Using Science Fiction Prototypes to Envision the Future of NUI4D

Abstract
Designing appropriate technologies for the developing world can be challenging due to complex social, cultural, economic, and infrastructural barriers. We propose that science fiction prototyping can be used to generate design ideas in designing Natural User Interfaces (NUIs) for the developing world. We describe an approach for creating science fiction prototypes and share a short science fiction prototype exploring a potential NUI.

Author Keywords
NUI; natural user interfaces; NUI4D; ICTD; science fiction; scenarios; prototyping; development

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design

Introduction
The technological landscape of the developing world is changing rapidly. With technology becoming faster, smaller, and cheaper to produce, access to computing devices is increasing at a staggering pace. The exemplar of this is mobile phones, which is estimated to have 79% penetration in the developing world [5]. With phones reaching more hands, the space for designing natural user interfaces (NUIs) for this broad audience is immense but constrained by the challenges of the developing world. NUI designers need tools to help them envision and critically evaluate their designs in the complex, changing developing world context.

Science Fiction Prototypes (SFP) are a promising tool for designers to do just that. In this paper, we will examine the general features of a SFP and how they...
compare to other story-based prototyping techniques. Next, we outline the steps to create one. We outline some special considerations, derived from learnings in the field of Information and Communication Technologies for Development (ICTD), to think about when crafting a prototype. Finally, we conclude by present a short science fiction vignette and discuss its features.

**Natural User Interfaces**
When people talk about Natural User Interfaces (NUI), they are talking about a host of interfaces that could be based on alternatives ways of interacting with technology such as touch, voice, or gestures. The actual modality that the interface is embedded in is not the heart of what defines NUI. Rather, NUI is as open to definition as user experience or usability. In their book, Brave NUI World, Wigdor and Wixon emphasize that a NUI must behave like a “natural appendage” and must operate “in a way that is minimally intrusive and that makes it seem to the user as if she is ‘discovering’ the ways to interact with it. Additionally, the experience of using a NUI must feel natural to both expert and novice users[9].

Emphasizing the “naturalness” of NUIs – the ability for a user to interact or learn to interact with a device seamlessly – is especially promising for the developing world, where differences in literacy or access to technology could limit the adoption of more traditional interfaces based on designs from desktop computing and that often require training. What it means to be seamless and natural is contingent on both the user and the context in which it’s being used, putting pressure on designers to understand their audience.

**Science Fiction Prototyping**
Given both the newness of NUI and the relative unfamiliarity, or lack of access, that designers might have with regard to contexts in the developing world, a new design method needs to be considered. Science fiction prototyping (SFP) is a unique prototyping methodology that combines future casting and fiction as a way of allowing designers to see the greater reach of emerging and future technologies. Most prototyping is done with limited scope that only really addresses the technology. There is sometimes, as with “the day in the life” method, some real life contextualization, but it is usually limited and only addresses how people will interact with the technology as designed. In contrast to SFP, it does not address how the technology might be adapted by the user and used in unintended or novel ways. SFP offers a look at future technology that is still grounded in current abilities and possibilities, but also offers a look at how the technology might be used and accepted by people and society. In effect, it allows us to explore different – but plausible – futures.

Because a good SFP aims at plausibility, it has to be based on a solid understanding of what’s happening now and what trends are emerging. Thus, it can be important to inform an SFP with research used in the design process such as ethnographic observation, interviews, surveys, technology reports, and market trend data.

Being able to explore different futures is especially pertinent to designing for developing countries. In such contexts, rapid changes in politics, climate change, and economy quickly transform the environments for which we design. Being able to explore parallel futures can help refine a vision for implementing NUI.
**Storytelling as Prototype**

Various forms of storytelling have been used as a tool by design teams to guide the conceptualization of their products. For example, user scenarios are used to describe how a user is expected to interact with a technology and use it to meet their goals[2]. These, however, tend to have simple narratives restrained in both context, characters, and time-frame and focusing too much on the functionality of a technology. Other forms of scenarios, such as Value Scenarios and Pastiche Scenarios, have since been developed to explore more complex and nuanced aspects of technology use. Value Scenarios, for example, are written to reflect on the human values that are implicated by a technology for various stakeholders[7].

Pastiche Scenarios are a type of scenario that leverages literary elements from existing works of literature—such as writing style or well-known characters—to quickly immerse designers into the richness of a story. For example, Pastiche scenarios have been created using characters, like Agatha Christie’s detective Miss Marple, in exploring the use of a technology[1].

SFPs share many features with value scenarios and pastiches scenarios. Like value scenarios, SFPs can be used to explore values and how they relate to a technology. They can also be written in a literary style that is familiar and evocative for readers. Where SFP differs from these other scenarios is that the main focus of SFP is to generate a vision for a plausible future. It looks not at where we are now, but where we will be.

**Creating a Science Fiction Prototype**

Brian David Johnson outlines five steps for getting started in creating Science Fiction Prototypes[6]. As part of all the steps, Johnson reminds us that the SFP elements must be believable and logical.

*Step 1: Pick Your Science and Build Your World*
Select the technology or science you want to explore as well as consider the broader elements of the story, such as when and where the story will take place and who the characters will be.

*Step 2: The Scientific Inflection Point*
Envision the impact that you think the technology will have on the various elements in the story.

*Step 3: Ramifications of the Science on People*
Evaluate how the knock-on effects of the technology might cause societies and systems change in response to the technology in a lasting way. Consider both the negative and positive effects. Push these effects to the extreme to find new areas to explore, but pare them down in the story.

*Step 4: The Human Inflection Point*
Bring the story back to your characters and inspect in-depth how they are adapting to the technology.

*Step 5: What Did We Learn?*
Reflect on the lessons learned by creating the world as described in the previous four steps.

**Crafting Science Fiction for the Developing World**

While there are no hard and fast guidelines for developing an SFP for the developing world, there are
several areas worth exploring that seem most relevant. However, when using it as a tool to explore design concepts, and their implications in the developing world, the following, non-exhaustive, list of themes might be helpful to represent when creating a science fiction prototype of NUI design concepts.

Unintentional Use
Because many users in the developing world have a different relationship to technology from those in the developed world, where many such technologies are created, developing world users might find opportunities for alternative uses that would not occur to developed world users. An example of unintentional use is the prevalent practice of beeping, where mobile phone users hang up before their calls are answered. These missed calls act as a message to the recipient to either call back or some other predetermined action. Since the call was not completed, the recipient can avoid having to pay for call charges[3].

What alternative uses for a NUI might there be? What might be an unintended use?

Pervasiveness
Pervasiveness has the potential to create new possibilities for how a technology is used. The growth of the use and availability of mobile phones, for example, has had profound impacts in the developing world. Some of the more remarkable adaptations, whose success increases as the ubiquity phones increases, include services such as crowd-sourced information for farmers [8] and low-cost mobile banking [4].

What direction does the story take if a NUI becomes widely prevalent? What tensions might arise?

Integration into Daily Life
Many technologies designed for the developing world fail to be effective because their design fails to take into account the challenges of every day life that might make it impractical to adopt, such as if the primary user is responsible for managing all the household chores and caring for the children or if they own only part of the technology experience. Other challenges might include unreliable power sources or network connectivity. Attending to these practical challenges in a SFP can provide ideas for alternative form factors or interactions with a technology.

What barriers need to be overcome for a NUI to adopted and integrated into daily life? What changes or adaptations need to be made for a NUI to become adoptable?

Social Structure
Social structures in many developing countries are stratified along dimensions such as wealth, education, and gender. As a result, the resulting impact that a technology can have in a given country can be uneven. The way that a technology is eventually distributed or adopted might mirror those stratifications, thus further enforcing them. Incorporating social issues into SFP might provide insight into potential negative consequences caused by a NUI, as well as inspiration ensuring more equitable access to a technology.

Which populations will have access to the technology? Which groups stand to benefit the most from the NUI? Which populations stand to suffer the most harm?
Where SFP Fits in the Design Process
Because of its exploratory nature and its written format, science fiction prototyping fits most naturally during the earlier, conceptual phases of design. It provides away to generate and reflect on many different design concepts in a low-cost way.

The Reminding Bracelet: A Vignette
The bag that Aaarti carried was heavy and filled with the things she needed get meals settled for the day. She was close to home now, but was so tired that she wanted to just sit down where she stood: the busy sidewalk in Bangalore near her flat. Being pregnant was more strain than she could have predicted. Her mother had told her as much, but Aaarti presumed it was nothing more than tales. She’s barely stepped foot into her home when her bracelet buzzed against her hot and irritated skin.

“I need to take my vitamins,” Aaarti said to her mother, who had moved in during the fourth month of her pregnancy.

“I’ll take the bags and get them for you,” she said.

Aaarti sat heavily on the cushion and looked at the bracelet. It was delicate looking and a beautiful color. Orange was her favorite color, so she chose the orange reminder bracelet when the midwife offered her the selection. Of course, Aaarti’s bracelet was simple, as she wasn’t rich. It was made of a rubbery material and only buzzed once a day to remind her to take her prenatal vitamins. Some women from richer families had bracelets like hers, but they were made of nice metals or had more things that the bracelets did. Some of the most expensive bracelets also measured heart rate and blood pressure, and then set that information to the midwife. Aaarti longed to be cared for like that.

“I wish my bracelet buzzed when it was time for my midwife appointments,” Aaarti said to her mother.

Her mother came out to her with the vitamins.

“Aarti, don’t complain. It is a nice thing to have at all. Some women still have nothing like this bracelet or the medicine to help with the pregnancy.”

She was right, of course, and Aaarti knew it, but she still envied the women with the nicer bracelets. She also envied the women who had their own phones to program their bracelets with. Her bracelet was connected to her husband’s phone, so she always had to go through him for the reminders.

“Maybe Arup will want to buy me a nicer one when we have our second child or get me my own phone,” Aaarti suggested.

“Don’t be greedy. One cell phone is enough for a family.”

“I’m not being greedy. He hates dealing with the reminders that are sent to his phone.”

Her mother shook her head and left. Aaarti took the vitamins and wondered about life after the baby was born. Could she keep her bracelet to remind her to do new things? Probably not, considering that her sister was trying to get pregnant and couldn’t afford the kind of midwife that had bracelets. Aaarti wanted to keep it, or maybe keep the symbol of being pregnant.
Discussion
We can see how even a short piece can surface themes and implications for a hypothetical NUI device.

This vignette incorporates the four themes discussed earlier by looking at one woman’s experience using a new technology that reminds her to use her prenatal vitamins.

Shaped in the form of a wristband, Aaarti is able to get her reminders in a way that is easy for her to incorporate and understand how to use (integration into daily life). Aaarti wonders if it could be used as a reminder for other things, such as to remind her for appointments for her midwife (unintentional use). While she is able to pick one in her color, she expresses envy at the other, richer women who can afford bracelets that look more like jewelry (social structure and pervasiveness). We also learn that part of her use of the device is tied to her households shared cell phone – which her husband holds – so she lacks some control in its use (social structures). Finally, at the end, she expresses her desire to keep the bracelet after her pregnancy as a memento (unintentional use).

Conclusion
The developing world presents a complex set of challenges that designers must account for and address. In this paper, we have looked at how science fiction prototyping can be a valuable part of that design process.

References