Value Scenarios: A Technique for Envisioning Systemic Effects of New Technologies

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Abstract
In this paper we propose that there is a scarcity of methods which support critical, systemic, long-term thinking in current design practice, technology development and deployment. To address this need we introduce value scenarios, an extension of scenario-based design which can support envisioning the systemic effects of new technologies. We identify and describe five key elements of value scenarios: stakeholders, pervasiveness, time, systemic effects, and value implications. We provide two examples of value scenarios, which draw from our current work on urban simulation and human-robot interaction. We conclude with suggestions for how value scenarios might be used by others.

Keywords
Value Scenarios, scenario-based design, Value Sensitive Design, design noir, design method

ACM Classification Keywords
K 4.1 Computers and Society (Public Policy); K 4.2 Computers and Society (Social Issues)

Introduction

As millions of cell phones, personal computers, and other high tech devices become outdated, a range of organizations and government agencies are attempting to stanch the flow of toxic materials into the planet's waste streams. How might this daunting environmental crisis, tied to technological waste, have been avoided? More generally, how might we support envisioning the diverse effects of a new technology when it enters a societal milieu?

Our work is grounded in a theoretical view of technological appropriation, which is deeply interactional [7]. From this viewpoint, the influence that a new technology has on the world is not solely determined by the technology's design and the purposes behind it. Rather, shaped by its form and content, by individuals, and society at large, a technology can be appropriated in a multitude of ways. The consideration of technological appropriations, along with the new forms of social and cultural interactions that arise alongside them, should be part and parcel of technology development.

Toward this end we introduce value scenarios, an extension of scenario-based design [9] that supports envisioning the systemic effects of new technologies. Value scenarios build upon the narrative structure of traditional scenario-based design and combine the evocative work of design noir [7] with the value-oriented approach of Value Sensitive Design [8].

We begin by making the claim that systemic thinking could help designers and policy makers avoid introducing a technology which may well result in large environmental, psychological and ethical problems. We continue with an explicit recognition of the challenges of uncertainty, acknowledging that systemic thinking is difficult. Next we take what we believe are preliminary steps in identifying and defining key elements to be considered when developing value scenarios. To illustrate how these elements may play out, we provide examples of two value scenario projects motivated by technologies our lab is currently investigating: an urban simulation system and humanoid robots. We conclude by offering suggestions of the circumstances under which these scenarios might be used to strengthen design work and facilitate public debate about technology.

SYSTEMIC THINKING, AND DESIGNING UNDER UNCERTAINTY

Systemic interaction refers to those developments which either happen at large social scales or those that have large-scale effects that go beyond the initial locus of the interaction. Systemic effects are often emergent; they develop as increasingly more local interactions take place.

While value scenarios support the envisioning of systemic interactions, we do not claim to be predicting the future. It is not possible to consider all potential outcomes when a new technology enters a cultural and societal milieu. However, we are inspired by the line of thought put forward by Hannah Arendt who insisted that in the face of uncertainty we attempt *"nothing more than to think what we are doing"* [1]. Although the future is uncertain, value scenarios help us think about how the actions we take today will shape the conditions of our future.

VALUE SCENARIO FOUNDATIONS

Value scenarios extend Carroll and Rosson's powerful scenario-based design (SBD) approach [9]. Traditional SBD uses narrative descriptions of individuals interacting with a technology to stimulate and guide the design process. These engaging narratives are used to identify needs, anticipate usability problems, and facilitate communication among different groups involved in design and development.

A review of SBD literature reveals that a large majority of scenarios created using the traditional SBD methodology share two key characteristics. The scenarios typically focus on 1) describing the functionality of a technology under development, and 2) the immediate use of the technology by its intended user-groups [e.g., 2]. While traditional SBD scenarios describe these aspects of a technology quite effectively, taken together the two characteristics tend to lead the scenarios in a direction which has a number of limitations. First, traditional SBD-type scenarios tend to portray the technology being utilized in the manner the designers intended. Moreover the uses are primarily depicted in a positive light. Second, the scenarios focus almost exclusively on the direct stakeholders—the groups that will be in a direct contact with the technology. Third, traditional scenarios tend to have a short-term outlook, on the order of days or months. They do not engage issues of long-term, emergent use of the technology. Finally, traditional SBD scenarios seldom take on issues of pervasive use. The effects a particular technology is likely to have if it were to become pervasive in either a segment of society or in society at large are rarely considered.

An exception to this characterization of scenario-based design is Blythe and Wright's recent work on pastiche scenarios [4]. Although engaging, the range of consideration of the future that pastiche scenarios make possible can be idiosyncratic and dependent on the fictional work used to develop the scenario.

Elements of Value Scenarios

Value scenarios draw upon five key elements to develop provocative sketches of the future: stakeholders, pervasiveness, time, systemic effects, and value implications.

Stakeholders: Following Value Sensitive Design, value scenarios help designers envision a range of effects of a pervasive technology, both on those who are in direct contact with a technology (direct stakeholders), and on those who might not be direct users, but whose lives are affected by various interactions around the technology (indirect stakeholders) [7].

Pervasiveness: A value scenario presents a vision in which a technology has become widespread, spanning various geographic regions, cultures, social classes, and other contexts (e.g. school, work, home, car).

Time: Rather than focus on short-term effects, value scenarios take into consideration what the world might look like five, ten, or twenty years after a technology has been deployed.

Systemic Effects: Value scenarios explore the multi-dimensional interactions among technology, psychology, society, culture, and the environment as use of the technology becomes pervasive over a period of years.

Value Implications: Finally, drawing on Value Sensitive Design [7] and aspects of design noir [6], value scenarios help envision not only positive effects of technology, but also its darker consequences. We suggest that a careful consideration of a diverse range of influences, including the negative, should be a key component of the design process.

ILLUSTRATIVE EXAMPLES

What do value scenarios look like? How do they compare to traditional SBD work? Below we offer two sets of examples from our lab's scenario work. The first example, SafetyNet, stems from our work with an open source, large-scale simulation system for urban planning [4]. The second example, Geminoid Jack, developed in response to a collaborative project with Advanced Telecommunications Research Institute's Intelligent Robotics and Communication Laboratory [8]. Two condensed traditional scenarios are provided in the margins to help the reader compare the two types of scenarios.

Traditional SBD Scenario
[2007] Sarah and her daughter Lireal recently moved to the city. Sarah found a full time job with decent pay and an apartment which accepts cats. The one worry she had left concerned 12-year-old Lireal walking home from school alone.

After hearing about SafetyNet on TV, Sarah purchased a subscription for Lireal's cellphone. Sarah used SafetyNet to map out the safest route to and from Lireal's school. Now the cellphone will emit a warning tone if Lireal gets too close to a neighborhood designated as questionable or dangerous.

SafetyNet

SafetyNet is a hypothetical, commercial software platform which leverages publicly available demographic and criminal data, mapping technology, and satellite-tracking capabilities to create maps for display on various mobile technologies (e.g., cell phones, blackberries, in-car navigational systems). These maps are used to alert urban travelers as they venture into potentially unpleasant or dangerous areas during their travels.

Value Scenario: Canbaro lives in a SafetyNet world, yet has never actually used the device. Her mother says SafetyNet keeps strangers out of the neighborhood. Yet, Canbaro has overheard her father complaining that since SafetyNet labels their neighborhood as poor and Somali, only poor Somalis move in. Neighbors joke that if a new car comes down the street, its SafetyNet must be busted. Canbaro's little brother is convinced that SafetyNet is a real net which encircles their neighborhood. Canbaro wonders whom the net is supposed to catch.

The 204th street gang has figured out the answer to Canbaro's question. They regularly use SafetyNet to locate the home of the "catch" d'jour. For years homebuyers have been using SafetyNet to find decent neighborhoods, filled with people like themselves. As a result, the city has become segregated into homogenous enclaves. Thus, whether they are seeking to revenge themselves on a Chinese person or someone of Mexican descent, the demographic information is just a few clicks away. SafetyNet is the ultimate profiling tool.

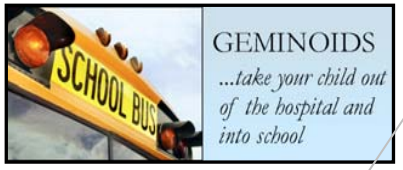
SafetyNet Discussion

The SafetyNet value scenario provides a vision of how the technology might influence the lives of both indirect (Canbaro) and direct stakeholders (home buyers and the street gang) as SafetyNet becomes pervasive. Canbaro hasn't used the technology, but her neighborhood has clearly been influenced by others' use of the technology. Values such as diversity and de-segregation appear to have been left behind as the technology enables people to easily avoid commuting through or living in areas of the city they find uncomfortable. Systemic interactions over time have created a city which has become segregated to a level previously unimagined. The gangs' appropriation of the

technology suggests nefarious activities that the "current" iteration of SafetyNet could easily support.

Geminoid Jack

The term geminoid has been coined by leading roboticist Hiroshi Ishiguro [8] to mean an android twin of a human "master". A current version of the geminoid is controlled via a motion capture system which tracks the master's movements and enables the remote controlled geminoid to mimic mouth and body movements while transmitting voice and audio signals.



Traditional SBD Scenario:
[2007] Jack is beyond excited. Today, through his geminoid Jack-G, he can truly contribute to a class debate through his voice, his hand gestures, and his facial expressions. By connecting to the geminoid's control system, Jack experiences real-time sights and sounds from the classroom. However, what is far more empowering is for Jack to actively participate in this environment. He can share his thoughts with classmates through Jack-G's voice and body language.

Value Scenario: [2011] Jack was born with severe combined immunodeficiency syndrome (SCIDS) and for 17 years he has been physically isolated in his sterile bedroom. His parents purchased a geminoid, Jack-G, four years ago so Jack could "attend" school. Today there are more geminoids in the school hallways, classrooms, and playing fields than humans. No longer used solely in specialized circumstances, geminoids have become massively popular for those who can afford them. Only poor kids and a few really ancient teachers attend school in "flesh mode" anymore. These geminoids are easy to distinguish because they are truly visions of humanoid perfection. No longer conceptualized as physical twins of their masters, geminoids are now created with blemish free skin, sculpted bodies, and fashionably styled hair.

Last month, after a strict regimen of cutting-edge meds, Jack was diagnosed SCIDS free. He could even go to school, but none of his healthy peers attend anymore. Moreover, his mother is against it. She says the world is changing and right now he is actually ahead of his peers because he is so adept at controlling Jack-G. If he stops using the controls on a daily basis, he may lose his advantage. As Jack looks in the mirror he suspects that she is also worried that his physical condition after years of sitting at Jack-G's controls instead of doing the exercises prescribed by his physical therapist. No sculpted perfect body here. Mom is probably right; most of his friends are spending entire days in their rooms, just like Jack. Even Jack's little brother, Joey, is getting pretty good with his geminoid. Actually Joey is becoming so used to engaging in geminoid play-dates from the comfort of his own room that he no longer likes to physically go to his best friend's house.

Geminoid Discussion

The value scenario takes a peek into a future society in which geminoids are ubiquitous. The pervasiveness of geminoids opens the imagination of the reader to a wide range of implications. The introduction of physically superior geminoids hints at appropriations that were not part of the original design motivation. The brief mention of indirect stakeholders (poor students and ancient teachers), those who do not directly own or operate a geminoid, also brings to mind issues of prejudice and inequity. Mention of physical atrophy alerts us to the effects of physical adaptation and stimulates consideration of the types of adaptations that are supported by the design.

We note that a strong negative tone is tangible in both value scenarios. A noir portrayal provides a counterbalance to the tendency of technologists to focus on the positive when considering their latest project.

CONCLUSION AND DESIGN IMPLICATIONS

As our examples begin to illustrate, through value scenarios, designers and policy makers can begin to imagine a wide range of influences for a proposed technology. The design team and/or policy makers are assisted in considering various appropriations which can be supported or constrained by system and policy implementations.

We have two suggestions for when value scenarios might be used. The first is during early strategic planning of technology development projects before time and money is invested. Secondly, value scenarios could be used as touchstones during policy-making discussions and the public discourse that surrounds them. We do not intend for the types of scenarios we describe in this paper to be used isolation, nor is the list of elements we provide exhaustive. Value scenarios do not predict the future; instead value scenarios leverage an extraordinary human capability, our ability to adjust our actions based on contemplation of the future. As Dubos wrote, "Indeed, man's propensity to imagine what does not yet exist, including what will never come to pass, is the aspect of his nature which most clearly differentiates him from animals. The more human he is, the more intensely do his anticipations of the future affect the character of his responses to the forces of the present"[5]. Given the far-reaching influences that technology has on our world, imagining possible futures is particularly important during technology development. Value scenarios provide a technique for moving in that direction.

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