Curiosity Objects: Using Curiosity to Overcome Interaction Blindness

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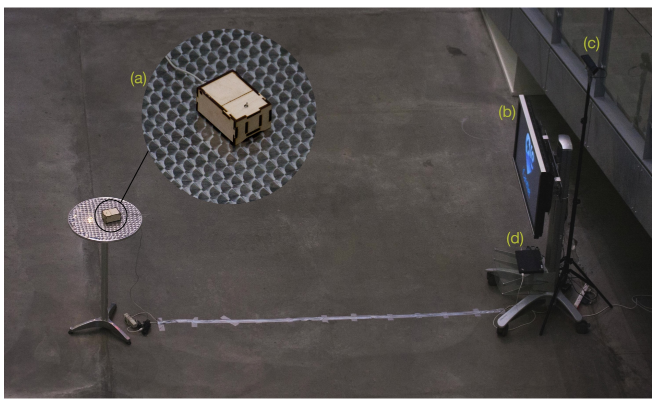

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Abstract
Although there has been a widespread proliferation of large interactive public displays, studies have demonstrated that many of these interactive displays suffer from *interaction blindness*, which is the inability of passers-by to recognize and explore the interactive capabilities of those surfaces. In this position paper, we put forward the notion of *curiosity objects*, curiosity-provoking artifacts designed according to five fundamental principles of curiosity. Curiosity objects exploit the curiosity of passers-by to unveil the interactive capabilities of public displays thereby overcoming interaction blindness. Our initial experiment confirmed the interaction blindness problem and demonstrates that introducing a curiosity object into a public space containing an interactive display (i) significantly increases the interactivity with the display and (ii) invokes changes in movement in the spaces surrounding the interactive display.

Author Keywords
display blindness, interaction blindness, curiosity object, situated public displays

ACM Classification Keywords
H.5.2 [Information interfaces and presentation]: Input devices and strategies

Introduction

Public displays are increasingly introduced in urban spaces around the world to display *information* (e.g. in train stations or airports), *advertisement* (e.g. in shopping malls) or video and television [2]. With the more recent introduction of touch technology, the traditionally unidirectional communication of these public displays have been altered to a two-way communication that allows public interaction. Despite the ubiquitous deployment of these interactive displays, several longitudinal studies [5, 9] show that these types of urban displays suffer from two fundamental problems, *display-* and *interaction blindness*.

Display Blindness Because most large displays are placed in urban spaces specifically for advertisement and publicity purposes, they elicit *display blindness* [7]: passers-by choose to ignore or only quickly glance these display as the information on the display is perceived as unimportant or irrelevant [5].

Interaction Blindness Since most public screens look like non-interactive displays, the interactivity of the displays are often not visible to the user [9]. This problem is potentially even amplified in cases were public displays switch between publicity and interactive mode.

Explicit interaction invitations, e.g. a "touch me" message on the screen, have been used as an approach to overcome *interaction blindness*. This approach however suffers from two major drawbacks: first they require screen estate which is not feasible in many advertisement scenarios. Second, studies have shown that displaying invitations alone are simply ineffective [9] as the public keeps ignoring them. The integration of personal mobile devices, such as phones or tablets, into the public interaction is an other approach [4]. Their use however introduce one major drawback: they require *active interruption* of the user to overcome the blindness problem. Other approaches include context-aware systems using location tracking or gaze activation [6].

In this position paper, we put forward the notion of *curiosity objects*, curiosity-provoking artifacts designed according to five fundamental principles of curiosity and explore how curiosity objects can decrease the display/interaction blindness problem.

Curiosity as Motivator

Curiosity is one of the important driving factors of human behaviour as it is used as mechanism to make sense of the world [1]. It is stimulated by external conflicting stimuli such as complexity, novelty, and surprise and influences how people interact with physical objects. Summarized, perceptual curiosity is the attention and interest given to a novel perceptual stimulation that motivates sensory and visual inspection.

Based on this theoretical work, Tieben et al. [10] propose five properties: (i) novelty, (ii) complexity, (iii) uncertainty, (iv) conflict and (v) partial exposure, as fundamental principles to design for curiosity. Their description of the curiosity process is composed of different phases that are directly influenced by these principles. At first, humans encounter a curious situation driven by the novelty, uncertainty and conflict of that particular situation. After this initialization phase, they explore and discover the situation influenced by the complexity and exposure. The latter two thus determine the lasting effect of the exploration that resulted from the curiosity.

The importance of curiosity as an intrinsic motivation for interactive technology has also been recognized by Müller et al. [6]. Their design space analysis reveals that curiosity "belongs to the most important characteristics of intrinsically motivating environments" and describe how well crafted interaction can induce curiosity and motivate people to engage into interaction with large displays.

Inspired and motivated by this previous work, we propose the notion of a *curiosity object*, an object, informed by principles of Tieben et al. [10], that is used as a mediator between the public and interactive displays in an effort to remove the *display* and *interaction* blindness. Because of its curious character, it has a *honey pot effect* as it attracts people based on its natural properties and affordances. When people interact with the device, the curiosity object reveals the interactive possibilities of the displays, thereby removing the *display* and *interaction* blindness.

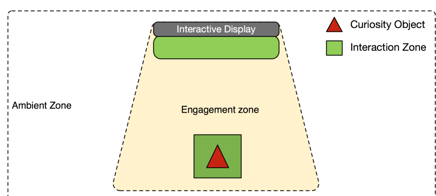

Figure 1: The positioning of the display and curiosity object creates four zones.

The positioning of both the public interactive display and curiosity object creates a number of zones (Figure 1) [8]. The primary interaction zone is directly in front of the interactive display allowing a person to physically touch the screen. The secondary interaction zone refers to the space surrounding the curiosity object. People in this space are able to touch and interact with the object. The engagement zone is the surrounding space in which people can observe the content of the display. Finally, the ambient zone refers to the physical space in which people are able to observe the displays presence but not its content.

Experimental Setup

To explore the effects of a curiosity object on the visibility of the interactive possibilities of an interactive display, we conducted a two-day experiment. The purpose of this exploratory experiment is twofold: (i) create a baseline that provides further evidence for the existence of the display/interaction blindness problem and (ii) explore the short-term effects of a curiosity object compared to this baseline.

In this paper we reconceptualize an artifact known as the "Worlds Most Useless machine" (WMU machine) to a *curiosity object*. The machine was invented by Claude Shannon and initially described by Arthur C. Clarke [3]. The machine is a small wooden casket, the size of cigar box, that only contains a switch at one side of the top plane, and a servo actuated arm, that remains hidden inside the device enclosure. Once a user toggles the switch, the machine actuates its arm, pushing the lid open, to restore the state of the switch to the off-position, effectively undoing the users action and rendering the machine useless. The "Worlds Most Useless machine" fulfils all five curiosity qualities.

Our system (front page figure) was deployed in two variants. First, the *baseline-variant* consists of a display and a Microsoft Kinect depth-sensor used to gather movement data. The second variant is the *curiosity* variant which extends the baseline-version with a curiosity object (in this case the "worlds most useless machine"). In both setups, the Microsoft Kinect is used to reset the experiment when there is no user within a 3 meter range.

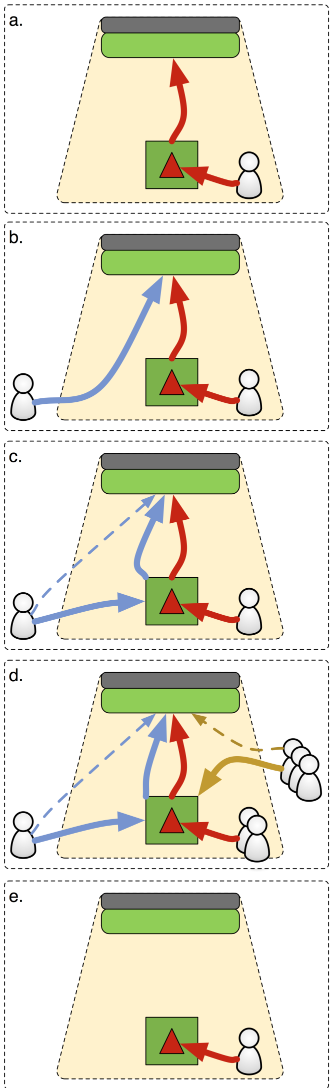

Figure 2: Different zone movements caused by the curiosity object.

Resetting the experiment causes the WMU machine to reset the switch state if necessary.

In both variants the interactive touch screen runs in two modes: (i) poster mode, in which it would show advertisement-like information and (ii) interactive mode, in which users can draw picture using touch interaction. In the baseline the system switches from poster to interactive mode by touching the screen. Whereas in the curiosity variant, the display goes into interactive mode when a user actuates the WMU machine switch or touches the screen. In case a user toggles the WMU machine switch but does not touch the screen, the screen will go to poster mode after one minute.

We observed approximately 1600 participants (861 passer-bys on day 1 and 825 on day 2) pass by the display. During the baseline variant (day 1), not a single person interacted with the display whereas during the curiosity object variant (day 2) 41 interaction instances (activation of interactive mode was logged by the system) involving 81 people occurred. Figure 2 provides a overview of the types of interactions that were observed over the course of one day.

Discussion

Zone movement

There was an increase in interactivity in the system variant that contained the curiosity object. Many participants were attracted to the curiosity object and tried to interact with it. In total 81 people interacted individually or in a group with the setup resulting in 78 sketches. Analysis of the video recordings in relation to the aforementioned zones showed 5 distinct patterns (Figure 2) in which people interacted with both the curiosity object and the interactive display.

76% of the participants that were attracted by the curiosity object (secondary interaction) also moved to the screen to create a sketch (primary interaction). This movement from the curiosity object to the primary screen is one of the main observations that confirms the ability of the curiosity object to (partially) remove the display and interaction blindness. However, in 24% of the cases, participants would interact only with the curiosity object, ignoring the interactive display. These were primarily passers-by that simply flipped the switch without waiting for a response or people who simply did not find the screen interesting enough. A side effect of people interacting with the main display (after using the curiosity object) is that some passers-by noticed the emerging or ongoing interaction, and are directly attracted by the display without even noticing the curiosity object. This shows that the curiosity level of the object is balanced enough to start the exposure of the interactivity of the display but not to suck up the attention of the main interaction actors and passers-by. The primary interaction thus produces social effects that draws other people to the display.

The interactive display and curiosity object is devised to reset after interaction actors walk away from the screen. The curiosity object shows a visual cue of reset (in this case, the automatic reset of the toggle switch) which can be noticed by passers-by. We observed several instances where the visual reset of the curiosity object would draw attention of people who would then again start interaction with the setup as mentioned in the first two patterns. During one instance, the social effect described in pattern b and c (Figure 2) snowballed into a large group that would form around the curiosity object and the interactive screen (Figure 2 e) . During this instance, the social effect was amplified because of the presence of a crowd.

Curiosity

Although the device is know in certain engineering and computer science circles, it is very *novel* for most common people. The placement of a wooden box in the middle of a public space draws attention simply because of the illogical relation between the box and the environment. The shape of the box and the affordance of the switch exhibits a certain degree of complexity, but not so much that the machine would be puzzling. However, people can interpret the function of the device in many different ways, which leads to exploration to expose its functionality. The level of complexity and novelty thus arouses exploration. The shape and the switch it contains result in uncertainty as the result of actuating the switch is not clear beforehand. The action of flipping the switch might be surprising and because of uncertainty, doubt and predictive behaviour is shown.

One of the key features of a curiosity object is the ability to introduce conflict. Because of the uncertainty and novelty, the device can violate the (sometimes false) expectations of the users while still exploiting the affordances. This allows the curiosity object to be connected to another device or object. In the case of the WMU, the expected result is that flipping the switch changes the state of the box, although it actually turns on the interactive mode of the screen. One of the fundamental properties of the curiosity object is the partial exposure of information to users. As users flip the switch additional information on the nature of the public space is presented to the user, who can then choose to react to this event.

Acknowledgements

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