Creating the Spectacle: Designing Interactional Trajectories through Spectator Interfaces

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An ethnographic study reveals how professional artists created a spectator interface for the interactive game Day of the Figurines, designing the size, shape, height and materials of two tabletop interfaces before carefully arranging them in a local setting. We also show how participants experienced this interface. We consider how the artists worked with a multi-scale notion of interactional trajectory that combined trajectories through individual displays, trajectories through a local ecology of displays, and trajectories through an entire experience. Our findings shed light on discussions within HCI concerning interaction with tangible and tabletop displays, spectator interfaces, ecologies of displays, and trajectories through cultural experiences.

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1. INTRODUCTION

As computers increasingly spread into public settings, ranging from cultural institutions such as museums, galleries, and exploratoria to more everyday settings such as cafes, bars, clubs, and also the city streets, so our interaction with them becomes an

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evermore public affair. These public interactions often assume characteristics of being a performance, either one that is deliberately staged as part of a theatrical event or installation [Crabtree 2004], or perhaps as part of the general "presentation of the self in everyday life" [Goffman 1959], as we see when mobile phone calls are performed for a local audience as well as a remote conversant. HCI researchers have therefore begun to question the ways in which our interactions with computers might be deliberately designed with spectators in mind: for example, through various tactics for revealing or hiding the manipulations of an interface alongside their subsequent effects, leading to interfaces that might be called expressive, secretive, magical or even suspenseful [Reeves 2005].

Museums and galleries have been among the earliest adopters of these "spectator interfaces"—that is, interfaces that address nearby spectators as well as their direct users—and previous ethnographic studies of interactive technologies in these settings have revealed how groups of visitors collaborate at the "exhibit face", sometimes showing how the use of conventional interface technologies can "undermine the collaboration of others" [Heath and vom Lehn 2002], while at others revealing how carefully designed installations can enable visitors to craft their interactions for the benefit of spectators who subsequently may become engaged themselves [Hindmarsh et al. 2002, 2005]. In turn, such observations are reflected in proposals for new technologies such as audio guides that allow eavesdropping on others' experiences [Grinter et al. 2002], mobile displays that support both sharing and spectating [Schnadelbach et al. 2006], and other novel approaches to distributed co-visiting [Brown et al. 2003].

A second common setting for early experimentation with spectator interfaces has been interactive theatrical performance, both within conventional theatres, but also increasingly taking place on the city streets. Ethnographic studies of interactive theatrical performances have highlighted the ways in which a combination of technologies, rituals, briefings and similar processes serve to frame participants' experiences, establishing the idea that a performance is taking place, introducing participants into it, and placing them in an appropriate role or state of mind [Benford et al. 2006]. Other studies have focused on the processes of orchestration, through which performers and operators collaborate to shape and maintain a participant's ongoing experience from behind the scenes [Koleva et al. 2001; Crabtree et al. 2004].

This article presents an ethnographic study of how professional artists created, and the public subsequently experienced, a spectator interface as part of an experience called Day of the Figurines. This was an interactive performance that toured for a month at a time to different cities throughout the world during which a bespoke spectator interface would be hosted in a gallery or similar venue in order to introduce participants to the work and provide an ongoing sense of how it was unfolding. The Day of the Figurines spectator interface is therefore interesting here because it combines elements of both performance and installation, combining both settings that have been investigated by earlier studies.

Although documentation in the arts and humanities literature often reveals the "craft" of the artist in designing and staging installations and performances (e.g., Rubidge and MacDonald 2004; Sheridan and Bryan-Kinns 2008], studies within HCI have tended to focus mostly on the visitor's experience. In contrast, our study contributes a detailed account, from an HCI perspective, of the rationale and craft of professional artists in designing a complex public installation, which then complements a description of how this was actually experienced by the public. In particular, we show how, by careful and detailed design of the physical form and situation of multiple displays within a local setting, the artists established a trajectory of interaction through an entire ecology of interfaces. Our findings shed new light on several contemporary themes within HCI: revealing the importance of asymmetry and physical form in tabletop

interfaces; showing how previously published strategies for designing spectator interfaces can be combined; highlighting the importance of carefully arranging diverse interfaces to create an harmonious ecology; and finally, affirming recent theories of trajectories through interfaces ecologies, while also showing that these need to be extended to better reflect multiple levels of scale. We begin with an overview of Day of the Figurines, before presenting our study, and then finally discussing our findings in the context to several fields of related work.

2. AN INTRODUCTION TO DAY OF THE FIGURINES

Day of the Figurines is an interactive experience that spans visual art, installation, performance, games and new media [Flintham et al. 2007].[1] It was "authored" by the professional arts group Blast Theory as part of a wider exploration of how arts-based research can explore the ways in which new technologies, particularly mobile devices, change how people interact with one another. Day of the Figurines takes the form of a text-messaging interactive adventure game for mobile phones in which hundreds of players at a time experience a day in the life of a fictional town. The town and its contents are rendered in text form and by exchanging SMS messages with the game server, and through this with each other, participants can control their "figurines", causing them to visit destinations, meet and chat with others, find and use objects, and undertake missions.

In keeping with the nature of SMS messaging, Day of the Figurines is a deliberately slow experience that unfolds gradually in the background of participants' daily lives. Each staging of the game takes place over 24 days, with each day consuming one hour in the life of the town. The game is driven by an underlying narrative that gradually moves from the mundane to the cataclysmic as events begin to unfold in the fictional town: pubs open, shops close, the car park gets deserted, a Scandinavian heavy metal band plays a gig at the Locarno nightclub that goes horribly wrong, an eclipse takes place, there is an explosion, a couple are found dead at the cemetery, and a platoon of soldiers takes over the town. These and other events raise dilemmas for participants, which they must resolve if they are to remain alive and healthy. Alternately, they may undertake missions to try to maintain their health in what is a steadily decaying society. The nature of text messaging within Day of the Figurines has been explored in previous work which focused on the temporal issues arising from participants' largely episodic engagement with its slowly unfolding narrative [Benford and Giannachi 2008]. In contrast, this article focuses on the design and use of a novel *spectator interface* as part of Day of the Figurines that is intended to reveal events within the fictional town to a watching audience of potential participants as they visit its hosting venue.

2.1. Introduction to the Day of the Figurines Spectator Interface

Day of the Figurines is a touring work that is hosted by a venue (a gallery, museum or festival) in each city that it visits. To take part, one must physically visit this venue to register for the game. In order to create a public spectacle at the venue, attract potential players, enable them to learn about the game, and support the practicalities of registration, the artists created a dedicated "spectator interface". This was centred on the use of tiny plastic figurines (Figure 1) that were chosen by participants to represent themselves within the game. This idea of engaging participants through small physical figurines that formed the basis of a spectator interface was evident in the initial concept for the game—hence its name. In other words, the spectator interface that we describe

[1]An accompanying video that provides an overview of Day of the Figurines, including its spectator interface, can be found at: http://www.youtube.com/watch?v=l6Gq1v7QgGU.

Fig. 1. The figurines (small human figures).

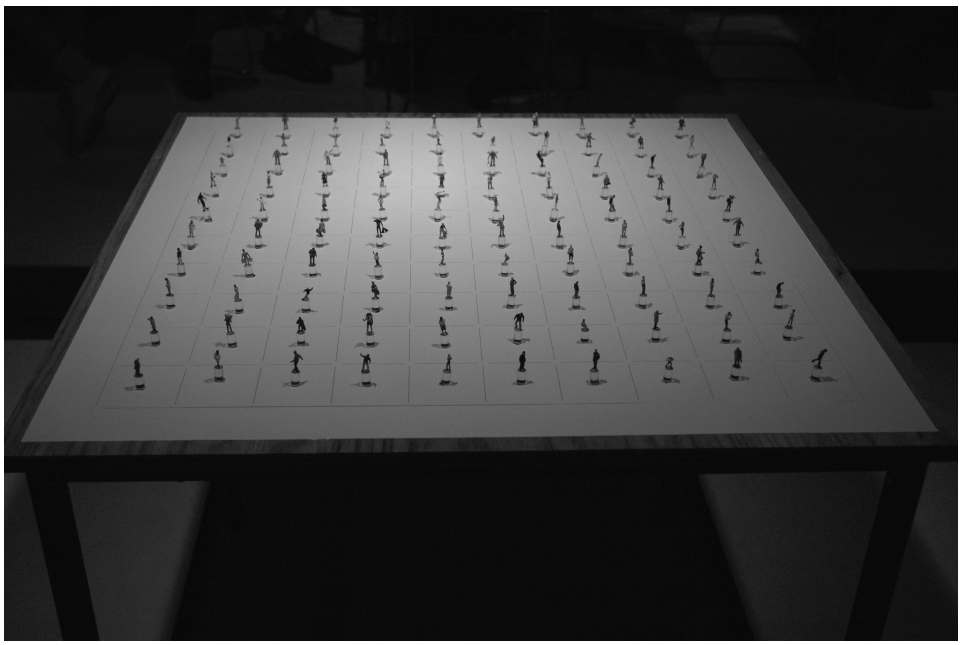

Fig. 2. The figurines table.

here was created from the outset to be an integral part of the experience, rather than being added on at a later date.

Each participant chooses a figurine from a small *Figurines Table* (Figure 2), gives it a name and gender, registers it online at a public terminal, and has a human operator, an

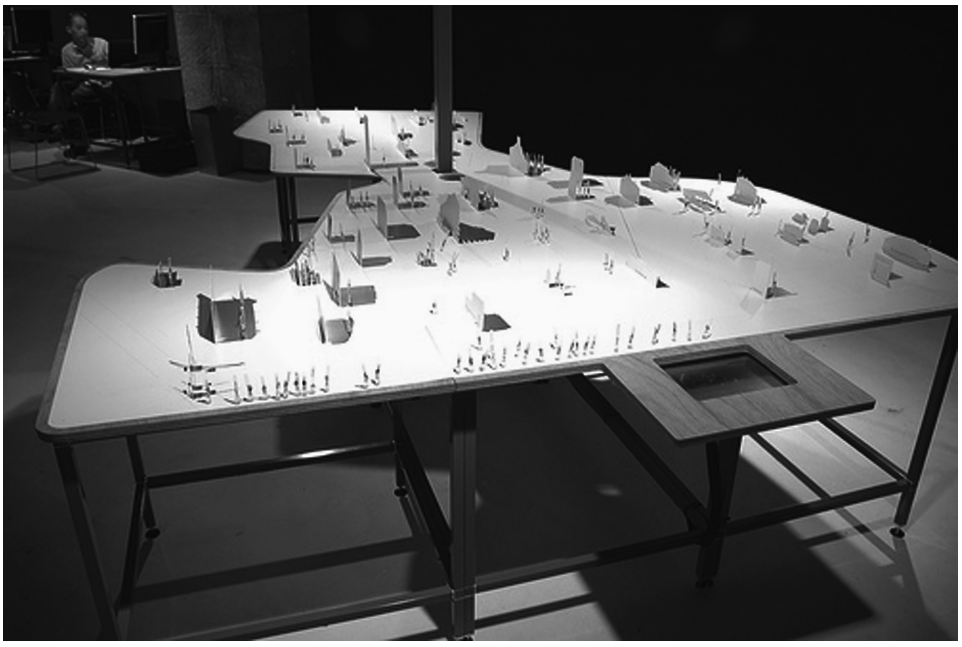

Fig. 3. The game board.

actor, check their registration details. The figurines were sourced from a company that manufactures detailed figures for model railways and offered a wide variety of forms from which to choose, ranging from the everyday to the more bizarre. The artists' concept was that their chosen figurine would provide an inspiring and yet relatively open opportunity for each participant to create a distinctive fictional persona within the game. The next step in registering for the game is to answer a series of six questions that give some background to this new persona, with the answers being entered into a web-based registration interface at a nearby terminal and stored for later use within the game.

—What is your figurine's name?
—Describe a special place from their childhood
—What kind of shoes are they wearing?
—Name someone they feel safe with
—What's their distinctive feature?
—How would he or she like to be remembered?

The operator gives the participant a small card (credit-card size) showing a map of the town, the names of the available destinations, and summarizing the available text commands, and then places their figurine at the edge of a second larger table, the *Game Board*, a 1:100 scale model of the fictional town (Figure 3). The game board is a specially constructed board whose surface is made out of metal from which the profiles and names of the various destinations within the town are cut out and lifted up to reveal them as silhouettes. At the same time the game software sends a welcome message to their mobile phone: for example, "Welcome to Day of the Figurines. It's 9.30 am and the weather is fine. The day has begun for <character-name>. Where should <he/she> go?" The game has now begun for this character and the participant can

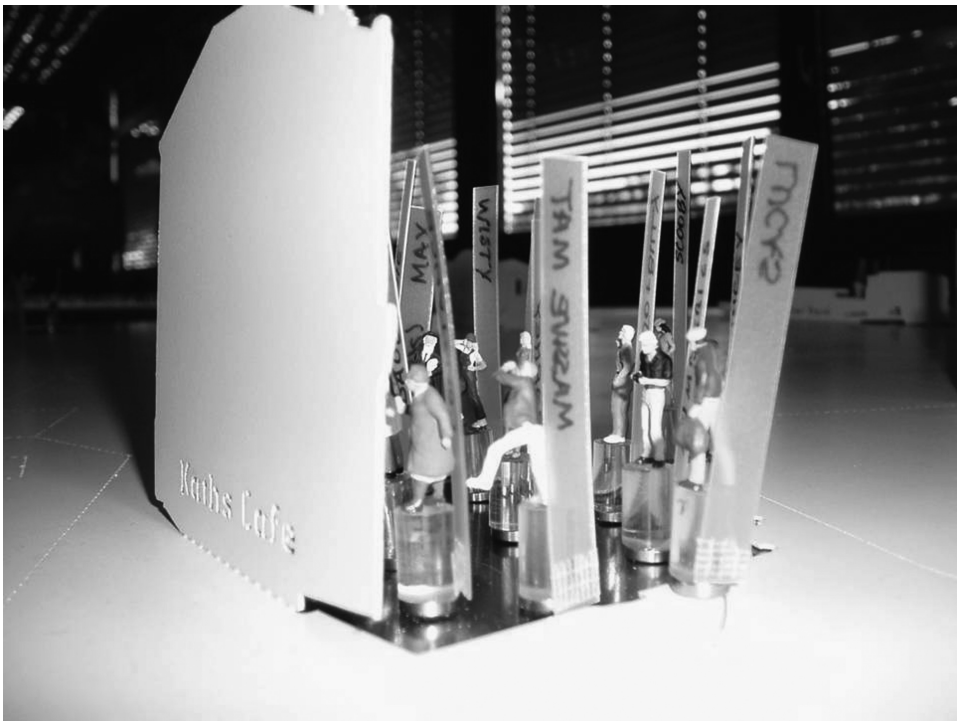

Fig. 4. The destination "Kath's Café" crowded with figurines.

begin to play by sending text commands from their phone ("go" to a destination, "say" something, "pick" up and object, "use" and object, and others).

Each hour of the ten hours a day for which the game is open the game operators (actors employed by the artists) stage a performance in which they manually update the Game Board, ritually moving the figurines across its surface from their previous positions to their new ones, and placing them within new destinations. There may be hundreds of figurines active within the game and so the destinations may become crowded (Figure 4) and the performance may take some considerable time, providing a significant spectacle for onlookers. To ease this burden and to further augment the spectacle, the performers who are moving the figurines are guided by a series of arrows that are generated by the game server and projected onto the surface of the Game Board from a projector below the table, via a hole in its surface and a mirror mounted above (Figure 5). It is also possible to simultaneously display all of the arrow augmentations to further enhance the spectacle (Figure 6). Finally, a small text display that is built into one end of the table (Figure 3, foreground) shows on an ongoing basis text messages that have recently been sent to and from the game.

3. STUDYING THE DESIGN AND USE OF THE SPECTATOR INTERFACE

At the time of writing, Day of the Figurines has toured to five cities worldwide, during which time it has been experienced by over 1000 people. Following initial tests at the Laban Centre in London in 2005 and the Sonar festival in Barcelona in 2006, the full work premiered in Berlin in September 2006 as part of the Trampoline Festival where it was experienced by 142 players. It subsequently toured to the National Museum of Singapore (146 players), followed by the Lighthouse in Brighton, UK (215 players), the

Fig. 5. Updating figurines' positions, guided by digital augmentations that are projected onto the board.

Fig. 6. Simultaneously displaying many augmentations.

Fierce Festival in Wolverhampton, UK (171 players), and then the Southbank Centre in London (331 players).

Previous studies of Day of the Figurines drew on exit questionnaires and system logs to understand players' general reactions to the game and also their patterns of

engagement with it via text messaging [Flintham et al. 2007; Benford and Giannachi 2008]. Inspection of system logs revealed an initial rush of players joining the game in the first few days, most likely due to advertising beforehand, but that this would be followed by a steady if smaller stream of further players joining throughout, right up to the end. Given its hosting at arts venues, the audience tended to consist of people who were interested in and experienced with new-media art, although some venues, most notably the Singapore National Museum, tended to attract a wider and younger audience with an interest in mobile phones and games [Flintham et al. 2007].

In this article, we concern ourselves with the issues to emerge from an ethnographic study of the spectator interface described previously, focusing on both the work of the artists in designing and installing it as well as how the public participants experienced it during a performance. For this, we paid more than 10 site visits to various venues where the work was deployed, most notably in Berlin, Singapore, and Wolverhampton, to document action prior to, at the start of, during and at the end of the performance. We made video recordings and conducted informal unstructured interviews with participants, operators, and the artists whenever we could about events happening on site, which we also videoed (we collected some 20 hours video in total). This included a "walk-through" interview with the artists during the installation of the spectator interface prior to the premiere in Berlin in which they articulated the rationale behind the detailed design of each component of the spectator interface and their detailed choices and concerns when installing and arranging it.

In keeping with the tradition of ethnomethodological analysis, we then sought to describe the events we had recorded in order to tease out their "naturally accountable" features [Garfinkel 1967]; that is, the things that participants, operators and authors busied themselves with, talked to one another about, and were otherwise visibly and interactionally occupied by. Thus, we are concerned to make visible what Garfinkel calls "the vulgar work of the streets". "Vulgar" is not to be understood in a pejorative sense, but etymologically as referring to things commonly or ordinarily done. What Garfinkel is interested in is the ordinary work of a setting, and more specifically, with the ordinary competences that people routinely and methodically exercise to concert or orchestrate their activities. Following Suchman, the competencies we are interested in here are those implicated in "making the technology work" [Suchman 1987].

We now present the key issues to emerge from the study in the following two parts. The first focuses on the work of the artists in designing and installing the spectator interface. The second focuses on the "work" of the public in using it.

4. DESIGNING AND INSTALLING THE SPECTATOR INTERFACE

As described above, physically, the Day of the Figurines spectator interface consists of a small white Figurines Table standing near a separate Game Board, a much larger scale model of the fictional town with a projector located below it. Computationally, the design of this interface is relatively simple, consisting of some simple augmentations that are projected onto the table once every hour, but then this is not what we mean in this case by "design of the interface"; or rather, there is a great deal more to its design than just the projected augmentations.

4.1. Rationality of Production

By "rationality of production", we refer to the artistic motivations and intent that shaped the construction of the spectator interface. As an artistic enterprise it will come as no surprise when we say that the rationality of production may be rather different from that at work in scientific or labor settings. However, the rationality of production takes us beyond considerations of Day of the Figurines as an artistic exploration to consider the specific motivations that shaped the actual design and construction of the

interface. We are not talking here then of what the experience is intended to be for example, an exploration of mobile communication that spans visual art, installation, performance, and new media work in games, but how its design is practically conceived of such that it might address artistic themes.

The first thing we note is that much of the experience over a month of play is essentially an imaginary one. The town where the action takes place is purely fictional. That fiction only exists as textual fragments received via SMS on a mobile phone interface, which as the authors put it is the "most hostile environment you can go to. No picture. No sound. No font even. So the challenge is, can we create a world that will still be meaningful, and resonant, and immersive while using this very narrow information channel?" The artists explained that this sparseness of SMS gave Day of the Figurines its essential artistic quality in that the vision of the town, its characters and the events that take place there should reside almost entirely in the participants' imaginations. However, the artists also reported that they were concerned with how to initially frame the experience so as to fully engage these participants with the world, give them a sense of its scope and content, fire their imaginations, and create an emotional engagement with their characters that could be sustained for up to a month of play. And yet they also needed to do this in a way that did not make the world too visually concrete as this might overly constrain the imaginative space that should be opened up by the use of SMS, which had initially led them to reject a representation based upon rich computer graphics, for example some form of 3D virtual world. From the earliest stages of design, the use of physical figurines combined with a striking but sparse physical representation of the town in the form of an unusual and abstract table was chosen as a way to give new participants a powerful framing experience while leaving the nature of the subsequent game relatively open to interpretation.

The spectator interface is therefore an artistic solution to (1) the fictional character of the experience and (2) the severe limitations of the mobile phone interface. It serves to make an invisible fictional place visible and available to direct experience by giving it a tangible existence. As the authors describe the spectator interface, "you have a god's eye view of a town and all the people in it and where they are and where they're moving and you can see who's talking to who. So you're given this tremendous omniscience as a starting point and the idea is that gives you a powerful sort of visceral relationship to the work and to the town that makes you think, I'm going to have a go at this."

The visibility, the tangibility, of the spectator interface is explicitly designed to "frame" participants' experience at the outset. Registration could be done entirely online, no-one ever need step foot in a gallery, but that would undermine the artistic endeavor. The spectator interface is therefore a key *theatrical* device for framing the experience, and this is achieved through careful attention to the fine details of its construction.

4.2. Building the Spectator Interface

It is one thing to reason about the broad design of an interface, another to realize it in detail. When we look at the work involved in actually building the interface a number of concerns come to the fore that are distinctive to the artistic enterprise but which also have real salience to the further development of spectator interfaces in HCI. In the first instance the artists are occupied with creating something that is unique. Not necessarily something that is one of a kind—even painters create multiple versions on a theme (consider Picasso's Blue Period, e.g.)—but something that catches the eye at-a-glance. As the artists put it, "it's clearly about interest, about making something that invites you to consider and look at it" (see Figure 3).

Participants first arrive at the Figurines Table where they have to bend down to inspect the figurines closely or pick them for an even closer inspection. The figurines

Fig. 7. Inviting the spectator's gaze.

are detailed, unique and tangible. In a marked contrast to many projected interfaces, they are also very small, which requires considerable physical engagement to inspect them. They are also highly desirable (as we discuss further in this article), promoting a sense of ownership. The precisely regimented arrangement of the figurines on the Figurines Table is both eye-catching and significant in other ways too. While it is acceptable to touch and move the figurines, this regimentation suggests that this is clearly not to be undertaken lightly; they are not just spread around randomly or left lying down on their sides, which might imply a lack of value and little importance as to how they are to be handled. Instead, their careful arrangement suggests a need to handle them carefully.

Like the Figurines Table, the Game Board is also designed to attract one's gaze (Figure 7). Creating something that "invites you to look at it" involves a certain attention to physical detail. First, there is the shape of the board itself. It is not square or some other uniform shape but intentionally irregular. The irregularity attracts interest, invites you to consider what it is, and to take a closer look. Its surface, made from plain white painted metal from which the shapes are buildings are cut out in fine detail and folded upwards, is not white by accident or lack of imagination either but is intended, as the authors put it, "to highlight the figurines very dramatically". Then, there are the buildings to consider. They too are carefully designed to attract the spectator's attention: "So the idea is that the detail in the table, in the buildings, is enough to give people a powerful sense of what kind of building it is. So some of them have very intricate detail. The traffic island, for example, you've got the exact shape of the traffic sign, or the gasometer. We've gone through this very elaborate process for the cutting so that it's a very defined thing and it invites your gaze. Others are more abstract. Like Trafalgar Square, it's a more simple silhouette. Nevertheless, there should still be enough detail here to pull people in and make them feel that they can imagine what they're looking at."

The cut-out and raised-up buildings are also very carefully oriented so that, when lit by theatrical lighting, shadows fall in the same direction to clearly define the front and back of the interface. This is echoed in the irregular shape of the Game Board itself, which has a central "opening point" at the front (on the left of Figure 3), providing a privileged viewpoint from which spectators can obtain a panoramic view of the town. The physical definition of front and back is not intended to confine the spectator to the front of the interface, but rather to create different perspectives on it. In the artists' own words, it is intended to create "a privileged sense of going around the back" and of seeing "figurines inside the buildings, inside the silhouettes, inside the shadows". The irregular design of the Game Board and arrangement of buildings to display front and back is no whim then, but is carefully planned out articulate different points of engagement with the spectator interface then.

The height of both tables is important too. While the design of the buildings and placement of figurines invite a spectator's gaze, this spectator is obliged to crouch down or squat on haunches to get a closer look, an action that is highly visible to others nearby. The artists described that the height of the table deliberately "encourages" the spectator to take a closer look and see the interface from yet another perspective that immerses them more deeply in the town. There are boundaries however, and the edge of the interface is clearly delineated by a wooden beading that not only circumscribes the interface but also demarcates the boundary between the gallery space and the artwork (see Figure 3). This boundary delineates the spectacle and further focuses the spectators' gaze.

The final built element of the spectacle is the augmentation of the Game Board (see Figures 5 and 6). Digital arrows with figurine names displayed alongside them mark out the route where figurines are to be moved from and to. The artists paid careful attention to the aesthetics of the augmentation: to the shape of the arrows, the color, and the font. The augmentation is about more than functionality, more than merely showing where figurines should be moved, and aims to create "a visceral emotional response" to the fiction as well. The augmentation gives it a life, a visible dynamic, which is intended to engage not only the spectators' gaze but their attention as well. That attention is further sustained by a small computer display that shows all the SMS messages coming into the game that is found when the table is circumnavigated.

4.3. Situating the Spectator Interface

Framing visitors' interactions with the spectator interface also occupies the work of situating it in physical space. The interface is not simply set down in a venue. Its installation involves considerable work. In addition to practical concerns revolving around whether or not the installation space is big enough, and the practicalities of getting the interface on-site, the work of installation is occupied by some rather distinctive concerns that impact directly upon a spectator's experience.

The first of these concerns the positioning of the spectator interface. Like any artwork or even more mundane objects, it cannot just be placed anywhere. As noted above, the Game Board has a clear front and a back. Thus, it has to be situated in physical space such that it can display its orientation, that is, with the front facing the entrance. The layout of physical space may affect positioning in other ways. Positioning of the interface at one venue was affected by health and safety regulations, which meant that it could not be placed within 1.6 meters of a fire exit. The interface also needs be positioned with respect to the flow of people through the space. For example, in the same space, there was a walkway to the public toilets down which many people could be expected to travel. Consequently, the interface had to be turned from the preferred position, though the relationship between the entrance and the table still afforded a trajectory to its front. This positioning of the tables in just the right place, in just the

right relationship to the spectators' entrance to the space, is incredibly important to the artists. As an artwork in a gallery the spectator interface is not alone. Other things are going on throughout the building, things that may well vie for the spectator's attention. The relationship between the work's position and the entrance to the space defines the moment of first encounter and everything may turn upon it. As the artists observed: "We know in this space that every single person that comes in will see it from that door first. That's the point at which you've got to give them that thing of like 'Wow! What is that?' You know, pull them right down the room."

A great deal of further effort goes into arresting the spectator's attention, including carefully setting the lighting. One cannot just shine a spotlight on the interface and again this is a matter of balancing several concerns. In the first instance, it is vitally important to determine the correct color and level of lighting and this has to be done in each venue as color and light levels change from place to place. So the artists experiment with different lighting gels until just the right effect is obtained. What constitutes "just the right effect" is a balance between the colors chosen, the light level, the position of the lights, and the effect these all have on the spectator interface up close and at a distance.

The position of the lights impacts upon the degree of shadow that is cast on the interface and the "cleanliness" of the shadow of the text cast by the buildings. Too high or too low and you "lose" the cleanness of the text. The color might be too "cold", "dominate" the augmentation, "spill" over and around the interface onto the ground, or exhibit unpalatable "differences" when viewed from different parts of the room. Gels have to be mixed, levels changed, different physical perspectives adopted all with aim, as the artists described in their interview: "that as you come in the door you've got the maximum impact. What you want is the entire surface of the board pulsing with light. Of course, it's completely unrealistic because you have the augmentation and the level needs to right when you are actually at the table. So we're looking to try to find a balance of as much power as we can and as much pulling everyone's gaze towards the table as we're able without wiping out the augmentation and making it dazzling for people when they're around the table."

This work involved in situating the spectator interface is not incidental to interaction. It frames it. It shapes the spectator experience, extending it beyond the interface itself to reach out into the physical space and attract the spectator's gaze from afar. The lighting of the interface to "pull the gaze" and its positioning to enable the ready access and flow of people shapes the spectator's journey, leading them from passing doorways and walkways to the boundary of an imaginary experience whose dynamics unfold in very tangible ways before their very eyes.

5. USE OF THE SPECTATOR INTERFACE

The design of the spectator interface in Day of the Figurines is very much akin to the "plan in the machine". It speaks of intended use; but what of actual use? What does that consist of? Do participants' observed situated actions [Suchman 1987] resonate with the authors' motivations and intentions? We now consider the work that visibly went on around the spectator interface in the course of the experience.

5.1. Fostering Engagement

With all the care and attention to detail involved in designing and situating the interface so as to "catch the eye", it will come as little surprise to find that passers-by did notice the installation, that their attention was and is grabbed by it, and that many of them approach it to take a closer look. What initially catches the eye up close is the figurine table. Time after time, in place after place, potential players first attend to the figurines as they arrive at the installation. They bend down to look, pick figurines up,

Fig. 8. Inspecting and choosing figurines at the Figurines Table.

chat between themselves, and laugh about them (Figure 8). The figurines pique curiosity, recognizably so, providing the game's operators with the opportunity to approach them and "explain" what the figurines are all about. Attending to the figurines thus becomes an opportunity to invite players into the game and the Game Board is invoked by operators (pointed to and talked about in relation to the figurine table) as a means of articulating a potential experience that one might wish to engage in? If potential players are still interested following this opening gambit, the operators invite them to "choose a figurine".

Choosing a figurine is not simply a matter of picking one up. The act is invested with meaning and quite often negotiated between participants. Players arrive in pairs or groups (six in a group is not uncommon). Even where individual choices were made whether alone or within a pair or group, the players sought to find a figurine that they had some affinity with, one that was "cool", or "different", or "interesting", etc. Thus, players would move around the table, point out figurines to one another as they moved, discuss the relevant merits of different selections, pick them up to take a much closer look, turn them around in their fingers and discuss their perceived merits in fine detail. It was also common for players to take photographs of their figurines, transforming the moment of choosing into a performative act (see Figure 8). The tangibility of the figurines was an essential ingredient in choosing a figurine.

The tangible character of the figurines also permeates the work of registration, as participants make the transition from potential to actual player of the game. In order to become a player, participants must give the figurine they have chosen an identity. They do so by answering the six questions listed earlier, the answers to which are used to shape subsequent game-play. It is in the course of formulating answers to these

questions that the tangible properties of the figurine come into play again, as in the following for example.

Operator. Think about her (lifts figurine up). What do you think *she's* called?
Player 1. She looks like maybe she's come from Latin America.
Player 4. She's got a story behind her man. She killed her pimp.
Operator I'm liking that.
Player 6. Do you think she's going somewhere or coming from somewhere?
Player 2. She's going somewhere, definitely going somewhere. She's on her travels.
Player 6. Yeah.
Player 1. What about, she could be called Comfort.
Player 6. Comfort! (Group members laugh).
Player 6. She's not a fabric softener.

Even in situations where operators aren't involved in the formulation of answers, players draw on the physical characteristics of the figurines to develop concrete answers: they have black hair, they have no shoes, they are barefoot, on so on. Furthermore, players also draw on the experiences of those around them—others who have been through the registration process—who invoke the figurines as a means of instructing players how to formulate answers for themselves. It is not that the figurines provide direct answers to the questions, but rather that they provide a concrete trigger for the imagination, a tangible resource which may be drawn upon in methodical ways to address the topics to hand [Garfinkel 1967].

Players may either input their answers into the system themselves or write them on a card and have the operators enter them. Either way, they must wait for their figurine to actually be placed in the game by an operator. It is at this point that the Game Board re-enters the interactional situation. Operators invoke it this time to articulate *how* the game is played. They give the players two items: a small piece of card with text commands on one side and locations on the other, and a piece of A4 paper that describes the game's workings in detail. The operators offer a gloss on the content of these items rather than a detailed account—"because it's about you exploring and finding out and seeing what goes on"—and then turn players attention to the Game Board, as in the following for example.

Operator So, we're going to put Comfort on the edge of the town now. Have you got your mobile phone with you?
Player 2. I have.
Operator. Do you want to see if you've got your first message?
Player 2 All right (gets phone out of handbag).
Operator So it's six o'clock in the town.
Player 2 (Looking at phone) It's 6.07 Welcome to Day of the Figurines. Comfort has been dropped off at the edge of town. You are feeling OK. Where do you want to go? (Laughs).
Operator. What I suggest that you do now is that you actually go somewhere. So text—just to make sure that everything's working fine and that you're off—type in 'go' space and then choose somewhere (gestures at board) where you want to start off.
Player 2 (Working keypad on mobile phone).
Player 5 (Looking around Game Board) We'll start at the bus shelter.
Player 2. So I text 'go'—was it capitals?
Operator. No, 'go' space and then somewhere in the town you want to go to.
Player 2 Where do we want to go to?
Player 5 To the bus station.
Player 2 (Composing text message).

Fig. 9. Operators doing an artistic performance.

Evidently invoking the Game Board to instruct players in playing the game also consists of using it to *check* that players understand the basics of play before they leave the gallery and that the game is working (i.e., messages are being sent and received).

5.2. Supporting the Hourly Performance

The Game Board in particular has a strong performative character—it is not only used to invite potential players into the game or to instruct registered players how to play, it assumes a performative character in an artistic sense as well, articulating events in the town as they unfold. This became particularly apparent on an occasion when the augmentation broke down and the operators were obliged to move new players into the game manually. They could have left all new players on the edge of town until the augmentation was repaired but then people wouldn't "see the game as active and live". From the artists' point of view it was essential that people visiting the installation—potential and actual players alike—got a sense of an event unfolding before their eyes, something active and dynamic in which they might be or are already involved in.

This is in significant part achieved by moving figurines around the board every hour (Figure 9). The movement is usually done through the concerted efforts of a couple of operators who work together to move figurines from location to location, following the augmented arrows to do so. The absence of the arrows when the augmentation occasionally breaks down does not change the need to carry out the performance, and operators work more or less as usual, the difference being that they have to work out for themselves from reading logs of new players' text messages where to move the figurines.

There is performative value to the augmentation, however. It enhances and emphasizes the spectacle being performed before one's eyes. As one operator put it, "As soon as the augmentation system switched on, suddenly people would appear out of the gallery from other places and huddle round it because they were keen to watch the performance moment of the figurines being moved. It's not just a functional thing. It's the act of change taking place in the town, and that in itself kind of compels people to watch."

Fig. 10. Spectators working the Game Board.

5.3. Doing "Being a Spectator"

The heading is not merely a pun on Harvey Sack's *Doing 'Being Ordinary'* [Sacks 1992], it takes Sacks seriously. His point was and is that "being ordinary" doesn't just happen; it takes the constant doing of interactional work. So does "being a spectator". It is not only the artists who are visibly "doing a performance" but the players watching them in their capacity as spectators are doing one too. It is a performance that impacts upon the involvement of others in the game.

First, it is noticeable even at a glance (e.g., Figure 10) that spectators tend to follow the artists' intended design, being drawn to the Game Board as planned. There is more than spectators' interaction at the Game Board at work here, however. Again, at a glance, it is clear that spectators congregate around the Game Board (and the figurine table). Engaging with the interface is therefore an observable social phenomenon and one that attracts attention from passers-by as a direct product of its sociality.

Seeing people gathered around visibly looking at something makes that thing noteworthy and may well warrant further inspection for those who have the time or inclination. The congregation itself provides an account in its very assembly that says something akin to "look here, there is something of interest". Just what is of interest is yet to be determined by "bystanders"—those passers-by who have not yet become audience but whose attention has been grabbed by the congregation itself just as surely as the congregation's has been grabbed by the spectator interface. Thus, people mill around in the background, waiting for an opportunity to see for themselves what has occasioned such demonstrable interest and in turn, as they get chance to take a closer look, they perpetuate the social phenomenon and interaction with the game.

6. DESIGNING INTERACTIONAL TRAJECTORIES THROUGH ECOLOGIES

We now discuss our observations in relation to several contemporary and interrelated themes within HCI including the design of tangible and tabletop interfaces; emerging understandings of performance and spectatorship around public interfaces; the notion

of complex interface ecologies; and finally, recent discussions of interactional trajectories through such ecologies. We consider each of these topics in turn, gradually working outwards from the detailed physical design of the tables themselves, to the interactions that occur around them, and from there to their wider arrangement within the local setting so as to establish a clear trajectory into the experience of Day of the Figurines. For each topic, we show how our study both affirms but also extends previous work in the field.

6.1. Tangible and Tabletop Interfaces

Tangible and tabletop computing has emerged as a major theme within HCI over the past decade. Given the focus of this article, it is interesting to note that early visions of tangible computing were largely inspired by interactive artworks, such as Durrell Bishop's Marble Answering Machine, Natalie Jeremijenko's Live Wire, and Anthony Dunne and Fiona Raby's Fields and Thresholds [Ishii and Ullmer 1997]. Although tangible interfaces can take many forms, tabletop displays such as Diamond Touch [Shen et al. 2004] have proved especially popular, not least due their inherent support for cooperation and sharing [Apted et al. 2006], driving the development of commercial products such as such as Microsoft Surface.[2] In their introduction to a special issue of *IEEE Computer Graphics and Applications* on "Interacting with Digital Tabletops", Scott and Carpendale [2006] highlight the potential of tabletop displays to support collaboration, review key technical challenges in this area, but also remind us that the design of the physical table itself is one of these challenges. In the same special issue, Geller notes that tabletop interfaces are especially popular within museums and galleries and, based on a review of nine example systems, draws out some of the underlying reasons for this including: they naturally support "homier" social collaboration that reflects the group-oriented nature of visiting; visitors can easily approach them and engage from multiple angles; and the use of everyday objects for interacting, rather than mice or other electronic devices, may increase robustness and mitigate the problem of theft [Geller 2006].

The Day of the Figurines spectator interface clearly sits within this tradition, as it involves a tabletop interface being deployed within a gallery. However, there are some important differences too. First, and somewhat obviously, it is not a conventional tangible interface in the sense that the physical tokens (the figurines) are not being used as input devices, but rather are output devices that reveal underlying digital information (the movements of players across the town). Moreover, the figurines are moved by humans during an hourly performance rather than being moved automatically, making the interface relatively simple, at least technically, compared to many other tabletop interfaces that typically involve computer vision systems for tracking objects, and sometimes even actuation technologies for automatically moving them across the surface [Pangaro et al. 2002]. However, in spite of its relative technical simplicity, our study reveals that the Day of the Figurines spectator interface is quite sophisticated in terms of other aspects of its design, and so can offer us some interesting new insights.

First, while we would echo Geller's comments on the inherent sociality of tabletop interfaces, the characteristic of approaching from any angle requires further consideration. Although the gameboard can be approached from several angles, it is clearly designed and arranged to be initially be approached from one particular side, with subsequent approaches from other sides providing alternative, more detailed, views. In other words, the physical asymmetry of the table represents a deliberate attempt by the artists to provide alternative views and to establish a sequence of engagements over time. While some researchers have previously considered asymmetric interaction

[2]See: http://www.microsoft.com/surface.

in tabletop settings, their focus has been on distributed cooperation [Ashdown and Scott 2007], whereas we have highlighted the deliberate use of asymmetric views in co-located collaboration to encourage exploration, discovery, surprise and discussion. In this regard, the Day of the Figurines table is perhaps more like Architales, a bespoke tabletop interface that was designed to support interactive storytelling in a gallery and which embedded an interactive surface within a carefully designed physical frame featuring an asymmetric design, with steps leading up to one side of the table where interaction would take place, seats for nearby spectators on another side, and a couch where people could sit and reflect on their interactions on a third [Mazalek et al. 2009]. Both Architales and Day of the Figurines show how asymmetric physical designs can afford different views and modes of engagement, a feature of tabletop interfaces that has received relatively little attention to date.

Second, while discussions of tangible and tabletop interaction in HCI tend to gravitate towards novel forms of digital interaction (e.g., tracking objects and gestures) our study of an interface that operates successfully without any such interactions naturally emphasizes the importance of its physical form. To re-emphasise, the Figurines Table and the Game Board are not just any convenient tables, but rather are consciously designed in terms of their size, shape, height and materials to encourage particular viewing actions which are both immersive and visible to others. Similarly, the arrangement of these displays within a local setting is no casual accident, but rather involves the careful design of position, orientation, and lighting too as we discuss in this article. In other words, the design of tangible and tabletop interfaces may benefit from an understanding of "craft knowledge" that our artists brought to the physical design of their tables.

Third, while we also echo Geller's comments on the robustness of physical tokens, we note differences here too. In Day of the Figurines, each token represents a unique player, while their individuality and fine physical details are intended to foster an emotional attachment to the game. In short, the fine detail of the figurines is critical to the experience. Indeed, it may be that the tokens become more desirable as a result, hence many players wanted to have their photographs taken with them and the artists reported that several figurines were apparently stolen from the figurines board.

6.2. Performing and Spectating

While Geller draws attention to the generally sociable nature of interaction around tabletop displays, others have further unpacked the details of social interaction around more general public displays, that is, various kinds of large display within open and potentially crowded settings. Previous research has revealed how people group around and engage with public displays, noting that the physical arrangement of surfaces relates to different forms of cooperation, for example, contrasting cooperation around vertical and horizontal surfaces [Rogers and Lindley 2004]. In studying interactions with and around the Opinionizer, a public display for posting comments that was deployed at a book launch and welcome party, Brignull and Rogers [2003] noted the "honeypot effect" in which the clustering of users around the display attract yet more users and concluded that public displays must be designed to facilitate users crossing the thresholds between different modes of participation, from peripheral to focal awareness of the display and then to active participation. A subsequent paper articulated two key concepts for understanding how such thresholds work: "entry points" that "invite and entice people into engagement" and "access points" that "enable users to join a group's activity, allowing perceptual and manipulative access and fluidy of sharing" [Hornecker et al. 2007]. Thus, entry points invite users in, while access points allow them to interact. They also discuss the use of "progressive lures" to gradually draw people into engagement. The Day of the Figurines spectator interface provides an example

of these ideas in action. Thus, we see clear entry points such as the careful designing of the initial view from the doorway, the god's-eye view afforded by standing in the central indent of the Game Board, and even the hourly spectacle of updating the board. We also see a series of access points such as physically engaging with the figurines at the Game Board, entering details into web terminals, and placing figurines on the edge of the board. The idea of progressive lures is also evident in the way in which players gradually pass through multiple tables, initially engaging with the attractive figurines before being asked to undertake the work of entering their registration details.

Beyond engaging players in this way, the Day of the Figurines spectator interface is clearly designed with aspects of explicit theatrical performance in mind. First, there are the hourly performances in which the ambient lighting is changed, additional projections are introduced onto the Game Board, and the professional operators perform the movement of figurines as others look on. The importance of lighting that emerged from our discussions with the artists reflects this theatrical purpose, mirroring previous studies of more performance-oriented interfaces such as Sheridan et al's performances with a tangible interface (an augmented version of the traditional Maori swinging Poi) at festivals where they reported needing to carefully match lighting to the colors of the tangible artefacts in order to increase the legibility of the experience for viewers [Sheridan and Bryan-Kinns 2008], and also Rubidge and MadDonald's sound installation in which coordinated lighting and coloured costumes also aimed to increase the legibility of actions and responses [Rubidge and MacDonald 2004].

Thus, our spectator interface lies at an interesting position between sometimes acting as a public interface in a gallery and sometimes providing a vehicle for more explicit performance. Put another way, the interface deliberately supports a variety of modes of participation and performance roles, as players arrive and engage and as operators step backwards and forwards between facilitating their interaction and overtly performing updates. This reflects previous discussions in the HCI literature around the framing of interactive performance in terms of different roles. In her Ph.D. dissertation, Sheridan [2006] wrote about the idea of the "performance frame" as the boundary that separates those who are aware that a performance is occurring and are able to interpret it, from that from those "unwitting" observers who are not. Subsequent work extended these concepts to identify various potential performance roles including performers, spectators and unwitting bystanders, and to explore how artists might ambiguously blur the performance frame so as to generate tension and/or excitement [Benford et al. 2006]. Of particular relevance here is Reeve's work on the spectator role, in which he introduced a taxonomy to classify spectator interfaces [Reeves et al. 2005] that involved comparing:

—the extent to which they hide, partially reveal, reveal or even amplify a user's manipulations of the interface (including their actions on it and their gestures around it);
—the extent to which, through both the physical and digital aspects of their design, they hide, partially reveal, reveal or amplify the consequent effects of these manipulations (including direct output and also the user's reaction to this) [Reeves et al. 2005].

By classifying a wide variety of public and situated interfaces, Reeves was able to populate his taxonomy and through this, identify four broad design strategies for spectator interfaces.

—*Secretive* in which both the user's manipulations of the interface and the effects of these tend to be hidden from spectators (e.g., a digital photo booth or kiosk).
—*Expressive* in which manipulations and effects are revealed or even amplified for spectators so that they can appreciate the users "virtuositi" with the interface (e.g.,

performance artists using sensors to support gestural interactions with musical interfaces).
—*Magical* in which manipulations and hidden but effects are revealed (e.g., Wizard of Oz interfaces or the use of computers to support stage magic [Marshall et al. 2010]).
—*Suspenseful* in which manipulations are revealed but their effects are hidden, thus the spectator is drawn to the interface and can learn how to interact by watching, but will not experience the "payoff" of the effects until it is their turn to interact.

This taxonomy of spectator interfaces is particularly useful for analyzing our findings in the present study and so we now devote some space to a more detailed exploration of these ideas. The artists behind Day of the Figurines clearly set out to create a spectator interface, one that would engage the attention of spectators and draw them into the game. We have documented how they achieved this by creating two different tabletop interfaces. What is interesting here is that the Figurines Table and the Game Broad employ different strategies for addressing spectators.

The small size of the figurines combined with their prominent position on the clearly lit Figurines Table demonstrates the *suspenseful* strategy in action. The act of inspecting the figurines (manipulations) is clearly revealed to spectators, and indeed quite deliberately amplified by the height of the table and its position and lighting as described earlier. On the other hand, the fine details of the figurines (the effects) are only revealed to someone who brings it to within inches of their face. Thus, by turning the act of inspecting the figurines, hunching over, crouching down, examining them in detail, and sharing them hand-to-hand into a notable public action, the Figurines Table clearly provokes interest among nearby spectators but retains the payoff (the close-up experience of a figurine) for those who are most directly engaged with it.

The Game Board oscillates between two different strategies according to its mode of use. Like the Figurines Table, it adopts the suspenseful strategy, requiring its users to crouch down to inspect the fine details of the destinations and the figurines that they contain, or to move around from front to back to experience distinctive views, or to move to and peer at the small display of scrolling text messages at its end (actions which are all highly visible but where the payoff is reserved until the user is at that particular viewpoint). However, on every hour the Game Board is switched into a performance mode when the expressive strategy comes to the fore. Now, performers manipulate the table in a systematic way in front of an audience and digital augmentations are used both to guide their work, but also to amplify and explain their actions for spectators. One important effect of the projected arrows is therefore to amplify the manipulations and effects that are taking place.

In summary, Reeves' idea of variously hiding or revealing manipulations and effects leading to secretive, expressive, magical and suspenseful interfaces, does appear to be relevant for explaining the design of the Day of the Figurines interface and in return, our study serves to confirm this approach to an extent. However, we are also in a position to extend this previous work. Whereas Reeves et al. [2005] tends to characterize a spectator interface as either tending towards being secretive, expressive, magical or suspenseful, our study shows that an overall spectator interface may in fact consist of several subinterfaces or components each of which adopts a different strategy and in which some may even switch strategies at different times, but where the components operate together to achieve an overall coherent effect.

6.3. Ecologies

This last point leads us to what is perhaps the most distinctive feature of the Day of the Figurines spectator interface, and hence of our study: that it actually consists of several different interfaces or components—the Figures Table, the Game Board, the

registration terminals and of course, the figurines themselves, that are deliberately designed and arranged within a local setting to achieve an overall framing of the game. What is striking from our study is not only the attention to detail that goes into the design of each component, but also their careful positioning, alignment and lighting within the wider setting in order to create the intended effect of framing, spectatorship, entry and access points, and progressive lures as described by previous authors. In other words, while previous work has already articulated important aspects of tangibility, social participation, framing and spectatorship that partially account for the design and experience of our spectator interface, the real story of our study lies in how the artists knit all of this together, which in turn, leads us towards needing a more holistic way of describing the "HCI" of the entire experience.

The starting point for this part of our discussion lies in the idea of "ecologies", which has been mooted by various researchers in different contexts. As early as 1999, Nardi proposed that we should think beyond designing individual interfaces to instead consider wider and evolving "information ecologies" that combine people, practices values and technologies within a local environment [Nardi 1999]. Huang et al. [2006] used the idea of "display ecologies" to analyze the evolution of use of a series of large displays in the NASA Mars Exploration Rover (MER) control room over the course of a year, while Crabtree and Rodden [2008] analyzed the operation of a mixed reality game that combined online players with those on the streets of a city in terms of "hybrid ecologies". Terrenghi and colleagues [2009] proposed a taxonomy of display ecologies that combine mobile and fixed displays at different levels of scale, from just a few centimeters up to many meters, predicting the kinds of social interactions that might emerge at each level of scale. In her study of sense making in museums, Bell [2002] introduced the idea of there being three especially significant aspects to "cultural ecologies": liminality (an experience set apart from everyday life), sociality (people attend in groups), and engagement (people may go to learn, but often in an engaging or entertaining way). Wakkary et al. [2005] drew on both Bell's and Nardi's notions of cultural and information ecologies when analyzing an ethnographic study of an "ambient intelligent museum guide" at the Canadian Nature Museum, confirming Bell's ecology in particular as validating many of its design goals. Finally, Fraser et al. [2003] describe a museum visiting experience in which groups a visitors explored the grounds of an ancient castle, gathering information such as drawings and rubbings on pieces of paper that we electronically tagged (using RFID) so that they could be used to interact with various public displays inside the museum in order to reveal further information.

We argue that Day of the Figurines provides a compelling example of ecology. It reflects Bell's notions of liminality, sociality and to some extent engagement for cultural ecologies, while also mixing people and practices with technology as noted by Nardi. In terms of Terrenghi's discussions of scale, we can see interactions that have been designed to work across a range of scales, from a few centimeters (when people are holding up and inspecting figurines and discussing them with heads bent together) to several meters as they gather around the table for the hourly performances. The use of the figurines to connect up the different displays in our spectator interface directly mirrors Fraser's use of electronically tagged paper to connect the various displays at the ancient castle, emphasizing the utility of portable tangible tokens in connecting up and reflecting a user's journey through different parts of an overall ecology.

Perhaps the one aspect of ecologies that is discussed in the literature that is not really present in Day of the Figurines is the sense of evolution, as new "species" of display are introduced and older ones die out or are repurposed. While we have seen that our spectator interface requires some adaptation to fit within the constraints of each local setting, the overwhelming sense is that its design is relatively fixed and is

intended to be rolled out in the same way at each new venue. Perhaps the most notable contribution of our study to this emerging literature on ecologies is to document in detail an example of how contrasting displays are carefully arranged to create an overall coherent effect. Thus, as we noted early, the Figurines and Game Table operate quite differently for participants and spectators, but are then arranged together as part of an overall journey through the experience. This notion of there being a designed journey through the ecology stands out particularly strongly in Day of the Figurines, bringing us to the final part of our discussion.

6.4. Trajectories

Our study reveals that the form of the different displays in Day of the Figurines and their assembly into a local ecology is not matter of chance, but rather is deliberately designed to take a use on a journey that gradually lures them, as Hornecker and Buur [2006] put it, into an ever deeper engagement with the experience. How this works can best be described using the terms of an emerging discussion within HCI of interactional trajectories.

Through their ethnographic studies of interactives in museums, vom Lehn and colleagues [2001] revealed how one participant's interactions might appear to shape those of others who, having observed them, would then follow them to take their turn. In one especially notable incident, they describe how a visitor inspected a bolt on the supporting structure of an exhibit (not something that was intended by the designers to be a focus for interaction) before moving on, which appeared to cause the next participant to investigate the very same bolt also without interacting in the intended way. While problematic in that case, this provides evidence of how interaction follows a trajectory in and through an interface. Other studies have also documented interactional trajectories; for example, a study of a touring artwork in which users controlled kaleidoscopic images through physical movements discussed how "common elements, which could be seen to occur in a similar order in each individual encounter" formed an overall "trajectory of interaction" (Costello et al. 2005], while Hindmarsh and colleagues [2002] also use the term, *international trajectory*, in their study of a gallery interface. Hornecker and Buur [2006] have sought to extend the scope of tangible interfaces beyond the coupling of digital data with physical artifacts to recognize that interaction with them is (1) embodied, (2) situated in physical space, and (3) the design and use of tangible interfaces is therefore bound by these factors. They suggest that interaction might be enhanced through the development of "methods of facilitation" to "structure" or "constrain" interaction. Their notion of constraint here refers in particular to the "set-up or configuration of space and objects" and includes such things as the placement, size, form, and location of tangible objects. These constraints "ease some activities and limit others, determining the *trajectories of action* or providing implicit suggestions" (emphasis added). Finally, as part of the development of an immersive artwork called "The Bystander Field", Loke at al carried out a series of studies of spatial behaviours in museums and galleries and used these to identify a series of different personas who would exhibit different patterns of movement and engagement which they then wrote down as spatial trajectories through the space of the interface using an extended version of the Laban dance notation (Loke et al. 2005].

Inspired by these notions of interactional trajectories around an interface, Benford and colleagues [2009] have introduced a conceptual framework for describing cultural experiences that involve complex hybrid ecologies in terms of extended trajectories of various kinds. The essence of their argument is that while the underlying ecologies are indeed complex, often combining and deliberately juxtaposing different settings and modes of interaction, they can be understood in terms of different kinds of trajectory

that express an overall sense of there being a coherent journey through the experience. The core concepts of this conceptual framework are the following.

—User experiences can be described in terms of three fundamental kinds of trajectory: *canonical trajectories* are created by authors to guide participants through an experience; *participant trajectories* describe each individual participant's personal journey through the experience and may diverge from and reconverge with canonical trajectories due to the respective "forces" or interactivity and orchestration; and *historic trajectories*, that select and then represent recorded participant trajectories in order to provide a retrospective view of what happened in an experience.
—These various trajectories pass though hybrid ecologies of space, time, roles and interfaces that define the underlying structure of an experience.
—While ideally continuous, the trajectories through an experience must in fact negotiate various key *transitions*, moments when the coherence of the user experience is at risk and to which authors or orchestrators therefore need to pay special attention. Significant transitions include: beginnings, endings, role transitions, handing over interfaces, managing access to limited physical resources, dealing with "seams" (e.g., lack of coverage, or accuracy in wireless sensing and communications) in the underlying technical infrastructure [Galani and Chalmers 2004], and episodic engagements with long-term experiences.
—The social fabric of the experience can be expressed by the ways in which different participants' trajectories are brought together or sometimes steered apart enabling them to pass between moments of collaboration and moments of isolation.

The original introduction of this framework in Benford et al. [2009] was illustrated with several user experiences, including Day of the Figurines, but focusing on the temporal issues surrounding episodic engagement during the text messaging part of the game after players had left the hosting venue. The present study enables us to extend this discussion to include the Day of the Figurines spectator interface.

The overall purpose of the spectator interface is to address the key transitional moment of "beginning the game"; it is a conscious response by the artists to the problem of framing an experience that will subsequently be delivered by the sparse medium of text messaging over the next thirty days. However, the journey through the spectator interface itself follows a complex canonical trajectory that has been carefully designed by the artists. We have constructed Figure 11 to show the overall form of the canonical trajectory through the Day of the Figurines spectator interface, which we propose consists of four key stages: *first contact* with the experience, *choosing a figurine*, *induction* into the experience, and the live *performance* of a turn. Figure 11 also summarizes the techniques that are employed at each stage to shape this overall trajectory.

Our study shows that individual participant trajectories do tend to follow this canonical trajectory and many players do successfully pass through the various stages to join the game. However, this is not always the case, as some people may arrive and choose never to join, including friends who are accompanying another potential player. Equally, some players may arrive during an hourly performance of a turn and watch this before registering, while others may register and then wait for the next performance. Thus, individual participant trajectories can diverge from this canonical trajectory to some extent, for example, experiencing its four stages in varying orders, but a process of orchestration in the form of being approached by local operators who invite them to join the game, is employed to steer them back towards it. The apparent need to photograph the experience might also be seen as creating a form of historic trajectory in terms of the ability to reflect on the experience and discuss it with others afterwards. In other words, the core ideas of canonical, participant and to some extent historic trajectories do appear to be present in the Day of the Figurines spectator interface.

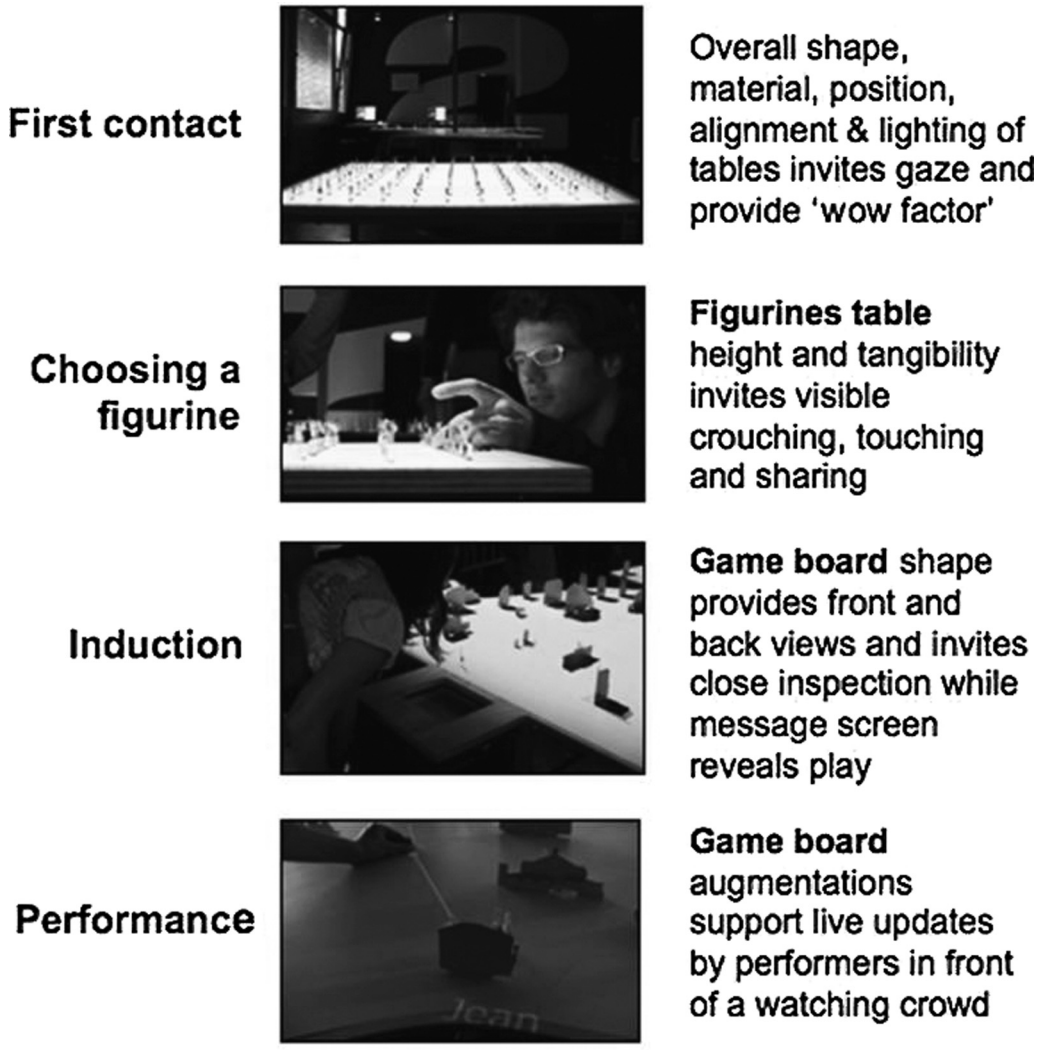

Fig. 11. The overall interactional trajectory of the Day of the Figurines spectator interface.

Our study reveals an example of how such trajectories can be designed to pass through hybrid structures of space, time, interfaces and roles. Participants do indeed follow trajectories that pass through several individual interfaces with different forms: the Figurines Table, the registration terminals, and the Game Board. There is a spatial aspect to this trajectory embodied in the careful arrangement of these interfaces within the space of the hosting venue to establish particular viewpoints and a likely progression from the entrance to the Game Board. At the same time, participants also follow a trajectory through different roles from being an "unwitting bystander" who is relatively unaware of what is taking place (e.g., someone who happens to be visiting the venue for another purpose), to being a spectator to others' interactions at the table, to being a player within the game. There is also a temporal aspect to the trajectory defined by the hourly schedule of the performance at the Game Board and its relation to the timing of the participants' arrival at and departure from the venue. Finally, there are

key transitions between four different stages of the canonical trajectory. For example, passing from the Figurines Table to the Game Board via the registration terminals, is a critical moment in the career of a participant through the interface and one at which the whole endeavor may be at risk. As a result, one of the key roles of the operators is to carefully shepherd individuals through this moment, orchestrating their smooth transition from being a spectator to being an active player.

Thus, the general concepts of canonical, participant and historic trajectories, orchestration, and transitions, do have a general utility for describing the results of our study. However, in turn, our study also sheds new light on these concepts, suggesting possible extensions of reinterpretations. Specifically, our study reveals the multi-scale nature of trajectories. We propose that the journey through the Day of the Figurines spectator interface needs to be considered at several distinct levels of scale that then have to fit together to form an integrated whole.

Trajectories through Individual Artifacts. The physical form of each individual component of the ecology of interfaces is carefully designed to shape interaction with and around it in terms of how participants approach it, interact with it and how these interactions are revealed to others. We have seen how physical shape, size, height, material and tangibility are carefully designed to encourage key physical actions.

Trajectories through Local Ecologies of Artifacts. Multiple components of the interface are carefully situated within a local setting so as to support a particular journey among them, encouraging participants to move between them in the desired way. The fine details of relative position, alignment and lighting are essential to establishing a trajectory at this level of scale. The ability to carry physical objects (the figurines) from one artifact to the next reinforces the idea of there being an overall trajectory through them.

Trajectories through an Overall Experience. The ecology of artifacts that is the Day of the Figurines spectator interface is of course just one part of the overall experience. Thus, the spectator interface forms the first part of a longer experience that eventually moves into other settings and uses other interfaces (e.g., a mobile phone). Again, portable objects may act as tokens to help maintain the overall trajectory, for example, the instruction card that participants in Day of the Figurines take away with them may remind them of the spectator interface later on.

Thus, while our study confirms the idea of there being interleaved canonical, participant and historic trajectories through complex hybrid structures, it also suggest that these need to be described and designed at multiple (at least three) levels of scale. We might potentially apply this notion of multiscale trajectories more widely. For example, the overall experience of a museum visit may involve trajectories through many local ecologies (buildings, sites or specific galleries), each of which may contain several local exhibits and displays. How might the trajectories of each exhibit and ecology and of the overall exhibition be designed to create a coherent visiting experience?

7. CONCLUSION AND KEY CONTRIBUTIONS

We have presented a study of how professional artists designed and deployed a novel spectator interface as a way of attracting players to, and engaging them in, a slow text messaging game. This spectator interface revolves around the use of physical figures to represent players; these are chosen from an initial Figurines Table, taken to a registration station where player details are entered, and from there taken to a large physical Game Board that represents the fictional town in which the game takes place. In an hourly performance, game operators manually update the positions of the figurines on the Game Board, guided by arrows that are projected onto the board as digital augmentations.

Our study of this somewhat unusual interface has shown that the physical forms and arrangements of these various components within a gallery space are no casual accident, but rather are very deliberately designed to promote the particular effect of capturing the participant's attention before leading them on a journey in which they choose a physical figurine and are subsequently introduced into the game. The distinctive details of shape, size, height and material details of the tables (and the figurines) are consciously chosen to afford particular viewpoints and demand publicly visible engagement. The physical arrangement and lighting of the tables is also carefully thought through to further emphasise these effects and reinforce the journey through the interface. Our study suggests that, by and large, these tactics are successful and that the interface does offer an engaging public spectacle that frames players' introductions to the game as intended. Thus, put simply, the primary finding of our study is that it is important to pay very careful attention to these fine physical details as well as to the digital elements (the media and underlying software) of such interfaces.

Taking a wider view, our study makes several distinctive contributions to several current themes within HCI.

Tangible and Tabletop HCI. Here we have highlighted the importance of the fine physical details of design, and especially the important role of asymmetry in establishing different viewpoints and hence modes of engagement. With a few exceptions, the role of asymmetry in tabletop interaction has not been widely considered. We have also documented the importance of attractive and detailed personalized tokens in promoting emotional engagement with the experience.

Performing and Spectating. Here we have given new examples of entry points and access points around public displays as well as ways of progressive luring people into engagement. We have also extended Reeves' work on spectator interfaces by showing how a complex interface can usefully combine several different strategies (expressive, secretive, magical and suspenseful) from his taxonomy.

Interface Ecologies. Our study lends weight and gives a further concrete example of various ideas of information, interface or cultural ecologies from the literature. What we emphasise here is the very precise and careful and detailed ways in which artists arrange and light different interfaces within a local setting (mirroring the attention that they paid to the physical design of each interface), and how they battle the constraints of the local setting in so doing, in order to create an appropriate ecology.

Trajectories. We have affirmed the idea of there being interactional trajectories through interfaces that emerged from previous studies of interaction within museums and galleries. We have also demonstrated how the extended trajectory concepts of canonical, participant and historical trajectories and transitions can help describe the journey through a complex interface ecology. At the same time, our study suggests that these concepts need to be applied in a more multi-scale way than they have so far in previous work.

Beyond these theoretical issues, our study represents a rare example of documenting professional artistic practice in designing a spectator interface. Many previous studies have focused on the user experience of interactive in museums and galleries but have said relatively little, at least in detail, about how and why artists created them. What is striking to us from our study is the very fine detail of craft with which the artists concern themselves in order to deliver a powerful experience. It can be all too easy to focus on the digital aspects of tangible, tabletop and spectator interfaces as these is where many of the complex technical research challenges lie. Hopefully, our study offers a reminder of the importance of designing the physical aspects of these technologies too along with an illustration of the fine details of the craft.

Finally, we find it intriguing that our discussion speaks to a wide range of literature within HCI. Consequently, we hope that a final contribution of our paper is to suggest

new synergies between these ideas, showing how previously separate concerns from tangible and tabletop computing, spectator interfaces, ecologies, and trajectories, may in fact be providing different or partial views onto the same underlying challenge. Put another way, in the same way that our artists needed to address a wide range of issues in creating a successful interface, so HCI researchers may need to achieve a more coherent integration across these different ideas in their future work?

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