Interactivity and Non-Interactivity on Tabletops

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ABSTRACT
In the growing field of tabletop computing research, there has been an understandable focus on interactive aspects of tabletop use, in terms of technology, design, and behavioural analysis. In this paper, I highlight the importance of considering also non-interactive aspects of tabletop computing and the mutually dependent relationship between interactive and non-interactive. We illustrate aspects of this relationship using findings from a deployment of an interactive tabletop in a public setting. The findings highlight how consequences of interaction can impact on non-interactive behaviours and intentions and how non-interactive actions can constrain interactive behaviours on the tabletop. In doing this we aim to raise more awareness of the relationship between interactivity and non-interactivity within tabletop computing research.

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Tabletops, interactivity, non-interactivity

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design.

INTRODUCTION

Over the years we have seen a growing body of research into tabletop computing. Unsurprisingly, this research has focused pretty much exclusively on issues of interactivity with tabletops, from different sensing mechanisms, interaction mechanisms, application design and social studies of use [e.g. [3], [4], [6], [8], [9]]. This research has provided important insights into the design and use of interactive tabletops and surfaces. However, in taking this focus, little explicit attention has been given over to understanding the role of *non-interactivity* in interactive tabletops. For our purposes, we use *interactivity* to refer to occasions where contact with the table surface results in a system response.

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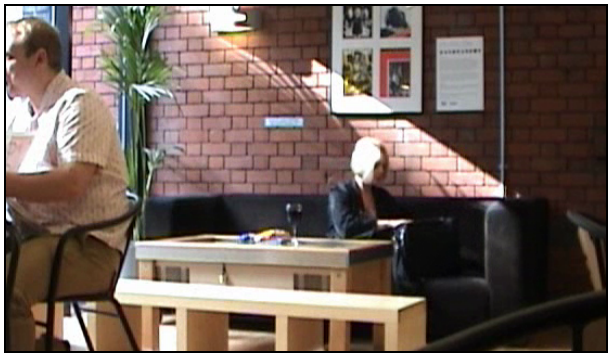
Conversely, *non-interactive* use refers to contact with the table surface with no resulting system response. Our concern here is not simply with non-interactive use of tabletops but with the relationship between interactivity and non-interactivity – that is, how tables can be comprised of interactive and non-interactive elements; how interactive consequences constrain non-interactive intentions; and how non-interactive elements shape ways interactivity is managed.

The relationship between these two dimensions is both dynamic and complex. Sometimes it is clearly delineated through design (e.g. a rim around a table) but at other times the relationship is fluid - something negotiated by actors in the accomplishment of social action. As Crabtree argues, this accomplishment and organisation of social action relies upon the spatial and material arrangement of artefacts [2]. In any particular setting and with any particular technology, these arrangements comprise both interactive and non-interactive elements and a relationship between them. In any particular engagement with an interactive table, people will move fluidly between interactive and non-interactive intentions and actions with a continual negotiation of the regions and boundaries where interactivity and non-interactivity should occur. In this respect we can draw some parallels with Palen and Dourish's [7] discussion of how people continuously negotiate the boundaries of public and private dissemination of information within the context of particular social circumstances. Also informative here is the work of Bellotti et al [1] on sensing systems where ambiguities exist between intentional and non-intentional interactions and where there is a need to continuously negotiate the boundaries between them.

The intention in this paper is to start reflecting on the relationship between interactivity and non-interactivity in tabletop computing and raise its profile as a significant area for further research. To do this we present selected findings from a field study of an interactive table deployed in a café bar. The aim here is not to present a full analysis of the study, nor to evaluate the successes and failures of the deployment. Rather the fieldwork is used as a resource to draw out elements pertaining to the particular relationship between tabletop interactivity and non-interactivity.

STUDY AND SETTING

The study was set in the café/bar of the Watershed Media Centre in Bristol, UK. The Watershed offers various amenities including an arts cinema, photographic dark rooms, conference and training facilities and various exhibition rooms. In this respect people find themselves in the Watershed for a variety of different purposes. The café bar is there to serve these people using the amenities but is also well established as a venue in its own right with people visiting there who are not explicitly using the amenities. While there, people undertake a myriad of different activities beyond simply eating or drinking. They read, work on laptops, have work meetings, chat with friends, hold mobile phone conversations, surf the Internet, relax, or simply just soak up the atmosphere while waiting for friends. People mainly visit and sit round the tables in small groups but there are a significant proportion of solo visitors (or people waiting for friends to arrive), in particular during the quieter periods of the day more conducive to relaxed solo activities such as reading.



(a)

(b)

Figure 1. (a) the interactive table; (b) room where table was situated – table was to the left of the area in (b)

The interactive table was situated in a room in the café bar with a large sofa and wooden bench arranged for sitting at the table (see figure 1a). The rest of the room consisted of several small coffee tables each with 3-4 chairs arranged around them (see figure 1b). The interactive table consisted of a PC and horizontal touch screen display housed in a low coffee table format casing. The touch screen display was a 40-inch plasma with a screen resolution of 1280x768. A wooden rim of approximately 11 cm surrounded the screen on all sides. The touch screen was single touch only. The content on the display consisted of graphical links to a range of short films, interactive installations and games from *dShed* (www.dshed.net), the Watershed's online showcase of creative digital media.

The study was conducted over a two-week period. Observations were carried out on various days of the week and at different times of the day. After a period of observation, interviews were conducted with people who used the table with particular reference to notable behaviours that had been observed. Observations were also made of people sitting at the remaining non-interactive tables throughout the room.

Non-interactive and interactive tabletops

To set some context for discussion of interactivity and non-interactivty in tabletops, we begin with a look at the relationship between people and standard table surfaces in the room where contact is obviously without interactive consequence. Of significance here are the spatial dimensions of the tables which essentially position people at particular physical distances from each other and in particular postures with respect to others at the table. Physical distance, being related to zones of social distance, has bearing on how the table surfaces are used and touched under different social circumstances. Consider as an illustrative example, an episde where two young women were having a meeting at one of the coffee tables depicted in figure 1b. Arranged on the table among their drinks were separate copies of a document they were discussing. At different points during the conversation, the girls engaged with and touched the table surface in different ways. One girl rested her elbows on the table as she leant over the document to read it. The other girl then leant into the table with her arms touching the surface as a way of signalling her interest and attention. Throughout the conversation they leant in and out of the table in a carefully choreagraphed manner. How and where the surface was touched during the ongoing course of these encounters was bound up with the unfolding, in-the-moment social action, the relationship with the material arrangments of artefcats on the table and the relationship with table itself. The properties of surface touch, in terms of where and how, were something continuously negotiated by all parties. It was highly contingent and something done unknowingly without awareness. It was done with great social significance but importantly, as we discuss later, without interactive consequence. In other conversations we observed, there was similarly choreographed use and touch of the table surface but with different spatial properties that reflected the different social relationships, artefact configuration and unfolding conversational trajectories of the particular episodes.

The significance of this dynamic use and touch of the non-interactive surfaces becomes apparent when we place these

issues within the context of the interactive table where interactive and non-interactive intentions in relation to the horizontal surface come together. To aid the discussion we draw on a series of vignettes from our observations. Consider the following episode.

> A gentleman is sitting on the sofa at the corner of the interactive table. A woman is sitting to his right and two other women are sitting on the bench on the opposite side of the table. They are at the Watershed for a seminar on higher education. As a group, they have met before but are not closely acquainted. They are having a drink and engaged in conversation prior to the seminar. During the course of speaking, the gentleman demonstrates some nervous behaviour, stroking and tapping the table though still maintaining gaze with those he his speaking to. Then something inadvertently happens on the tabletop system in response to his tapping. He becomes aware of the system response, which consequently disrupts his ongoing management of the conversation and social action.

What we see in this vignette is how the surface was used and touched as a social response during an engagement with others. These touches were not intended as interactive but were social gestures in response to the ongoing conversational context – a nervous tapping on the surface. However, because the surface was interactive, these innocuous and subconscious social gestures acquired consequences beyond their intent. They brought these touch actions to the foreground making the man more aware of them and thereby adding social burden.

Consider now a second episode where the non-interactive intentions and actions impacted on subsequent interactive opportunities with the table.

> A woman arrives at the table. She is struggling to carry a large handbag, several packets of crisps and peanuts and a glass of red wine in both hands. She dumps them all down together on the glass surface of the interactive table, without initial concern for the arrangement of the objects. With her hands free she is able to then arrange things properly on the interactive surface as she settles down.

In this episode, as the women arrived at the table, its primary function for her was as a physical surface onto which an awkward-to-carry group of objects could be rested. At this point in her encounter, the interactive properties of the table were of secondary concern. In performing this activity, though, the non-interactive placement of objects then rendered the interactive properties of the table inaccessible. This was not simply through obscuring information on the table but rather that this particular touch screen technology did not gracefully deal with touch detection in the context of other objects on the table by averaging between multiple touch points. By doing these non-interactive actions at the beginning of her table encounter, further uses of its interactive properties were blocked.

Apparent in this episode is the multi faceted nature of the table surface and actor intentions within the context of the café environment. We have highlighted here the behaviour on arrival but of further significance here is how encounters such as these unfolded over time during the visit [5]. For example, other people arrived to join the woman at the table later on in the encounter and they too placed drinks and objects on the surface that inhibited interactive use. Similarly, bar staff brought plates of food to the table and placed them down on the surface. During a typical café episode, then, the points at which there was a clash between non-interactive intentions and interactive potential were many. More importantly, these points involved other parties. Any management of the boundaries between non-interactive and interactive use was something to be dealt with collaboratively within the context of other well-established social and behavioural schemata for café episodes.

In managing the boundaries between interactive and non-interactive intentions, we observed a number of notable behaviours. In the first instance, we saw some placement of bottles and glasses on the rim of the table to allow interaction with the content on the display. Important in this strategy is the clear delineation in the design of interactive and non-interactive properties of the table - the wooden rim being *understandably* non-interactive in these instances and thus affording placement of objects in the context of interactive intent. For some people though, the rim was too narrow and raised, leading to concerns about precarious placement of drinks at the table edge and the potential to spill onto the table and damage the technology. For these people, while there was clear delineation, the particular dimensions of the design created hindrances to such a strategy.

In other instances, the management of the boundaries between interactive and non-interactive was simply done through complete non-use of the table. We observed on several occasions people approaching the interactive table and sofa arrangement because it looked a comfortable place to sit. But on arriving at the table and seeing it was interactive, decided to sit somewhere else in the café.

> "I just went to look at it because it is a table that you could just sit around but then when I looked at it I thought 'Oh its something else' so I came away again – because we were just here to have food and I thought 'well I'm not going to sit there and have it' – well I would have done but I kind of thought it was something like that [slacker table] say and I wouldn't sit there because it is a feature as opposed to a normal table… I jut thought I don't want to eat here because someone else might want to come and look at it."

Of note here is this decision was driven by social concerns. Interactivity of the table made it a unique resource relative to the other non-interactive tables in the space. To use the table as a non-interactive surface would deprive others of interactive opportunity.

DISCUSSION

Our aim in this paper is to highlight the importance of considering interactive and non-interactive aspects of tabletop use and mutually dependent relationship between them. Through a series of vignettes and observations from

a deployment of an interactive tabletop in a public setting, we have presented several manifestations of the relationship between interactive and non-interactive components of table surface use. Interactive tables are both normal surfaces as well as interactive displays. Once the table was used as a display, this constrained how it was used as a normal surface. In our examples we saw how interactive consequences of touch created additional social burden when when non-interactive surface use was intended; an interactive *Midas Touch*, if you will. We also saw how non-interactive use of the table surface, such as through touch or artefact placement, can block potential interactive engagement with the surface.

In presenting this, our concerns here are not with the specifics of the particular interactive tabletop deployed in the field study. We recognise some of the specific issues discussed here may not be manifest in other multi touch interactive surfaces that deal more gracefully with the placement of objects. We recognise too that there may be design solutions for the difficulties highlighted. But this is not our point. The intent is to show the demonstrable relationship between the interactive and the non-interactive. In light of this, we would argue this relationship be given further consideration in the context of emerging interactive surface solutions.

As we have seen from the findings, this relationship between interactivity and non-interactivity is a complex and dynamic one that is continuously managed and evolved within the context of particular social settings. How we design to support fluid movement between interactive and non-interactive actions is an important question. While in our observations, there were times when a clear delineation between interactive and non-interactive elements was important (e.g. rim vs. touch screen), this is only a small piece of the design puzzle - the relationship goes beyond a simple static specification of interactive areas and non-interactive areas. This is because spatial arrangement of interactive vs. non-interactive touch was shaped by multiple and dynamic factors, including dimensions of the table surface (e.g. height, length, width, diameter), number of actors around the table, the relationship between them, particular topics of conversation and arrangement of artefacts on the table. With many of these factors continuously changing, the movement between interactive and non-interactive is ultimately a social accomplishment collaboratively achieved by a group of actors. In designing for this relationship then, it is important to go beyond the static delineation of interactive and non-interactive regions on the surface. Rather, the focus should be on supporting social mechanisms that enable and manage fluid transition between interactive and non-interactive.

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