
The Drift Table: Designing for Ludic Engagement

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Abstract

The Drift Table is an electronic coffee table that displays slowly moving aerial photography controlled by the distribution of weight on its surface. It was designed to investigate our ideas about how technologies for the home could support ludic activities—that is, activities motivated by curiosity, exploration, and reflection rather than externally-defined tasks. The many design choices we made, for example to block or disguise utilitarian functionality, helped to articulate our emerging understanding of ludic design. Observations of the Drift Table being used in volunteers' homes over several weeks gave greater insight into how playful exploration is practically achieved and the issues involved in designing for ludic engagement.

Categories and subject descriptors

H.5.1 [Information Interfaces and Presentation]:
Multimedia Information Systems---artificial,
augmented, and virtual realities

Keywords

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interaction design, multidisciplinary design /
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Industry/category

Home technology, electronic furniture, information
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Project/problem statement

Over the last several years, there has been increasing interest in designing digital technologies for the home. Motivated in part by the quest for new markets, and in part by the new forms for technology enabled by miniaturised components, advanced sensors, and wireless networking, the result has been a proliferation of new devices and systems for the domestic environment. These range from networked 'picture frames' [1] to internet enabled refrigerators [11], and include systems aimed at providing home automation [12], enabling family communication [9], and assisting the elderly to remain at home [13].

These systems represent worthy attempts to solve problems or support common domestic tasks. They share a utilitarian perspective on the home and technology's role within it that is a legacy of HCI's roots in the workplace. According to this perspective, people have things they want to do at home—e.g., cook dinner, adjust the heating, stay in touch with Grandmum—and technology's role is to help them accomplish these tasks more easily and efficiently.

Homo Ludens: People as Playful Creatures

The home is also a setting, however, for many activities that are less clearly utilitarian. People browse through books, pursue idle speculation, play word games with one another, and admire the garden. They engage in *ludic* activities, acting as 'Homo Ludens'—people as playful creatures [8]. Such activities are not a simple matter of entertainment, or wasting time. On the contrary, they can be a mechanism for developing new values and goals, for learning new things, and for achieving new understandings.

"All work and no play makes Jack a dull boy."
- folk saying

"Ritual grew up in sacred play; poetry was born in play and nourished on play; music and dancing were pure play. Wisdom and philosophy found expression in words and forms derived from religious contests. The rules of warfare, the conventions of noble living were built up on play-patterns. We have to conclude, therefore, that civilization is, in its earliest phases, played. It does not come from play like a babe detaching itself from the womb: it arises in and as play, and never leaves it."
- Huizinga, 1950, p. 173.

We believe that it is important to develop domestic technologies that reflect ludic as well as utilitarian values. From a commercial perspective, the popularity of books, music, games, decoration and artwork suggest that a potential demand exists for products that support curiosity, exploration and reflection. From a cultural perspective, supporting ludic pursuits may counterbalance tendencies for domestic technologies to portray the home as little more than a site for work, consumption, and relaxation [4].

In this paper, we discuss the Drift Table (see Figure 1) as a case study of designing for ludic activities in the home. The Drift Table is a coffee table with a small viewport showing a slowly changing aerial view of the British landscape. Shifting weights on the table changes its apparent height, direction and speed. With about a terabyte of photography of England and Wales available



Figure 1. The Drift Table.

for viewing, the table may be used to explore the countryside, travel to a friend's house, explore questions about geography, or simply to watch the world go by.

We describe the design, implementation, and use of the Drift Table here both to present this particular example of domestic technology and to show how the process of developing it served as a form of 'research through design', teaching us valuable lessons about supporting ludic activities. Although we briefly allude to our overall design process, and discuss issues of industrial and interaction design, our focus is on the *conceptual design* of the Drift Table. We describe three basic stages in our developing understanding of designing for ludic pursuits: our opening assumptions, the tactics that developed in and through detailed design decisions, and the changes in our understandings prompted by observing people live with the Drift Table over relatively extended periods.

Background/Project participants

The Drift Table was developed as part of an ongoing project on domestic technologies being pursued as part of the Equator IRC. The project evolved to reflect a convergence of influences from designers, social and computer scientists. Of the project participants, who are all authors of this paper, those from the Royal College of Art are interaction designers; the collaborator from KTH is an ethnographer, those from Lancaster University are computer scientists specialising in ubiquitous computing devices; and the partner from UCL is a computer scientist specialising in graphics and virtual environments. As we will show, the intensely interdisciplinary nature of this team was fundamental to the development of the Drift Table.

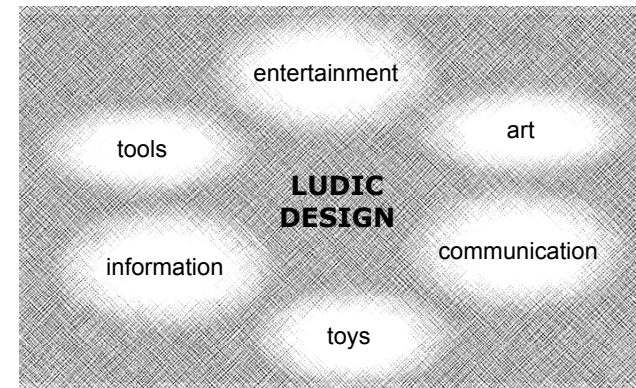


Figure 2: Ludic activities fit between familiar genres.

Project dates and duration

The Equator IRC was formed in 2000, with work on the Domestic Experience initially involving a Probes study of households in the greater London area (see [5] for an early example of this approach) followed by the development of a wide range of open-ended concept proposals. The Drift Table was initially proposed in 2002, with focused work on its development as part of a suite of designs taking about eighteen months.

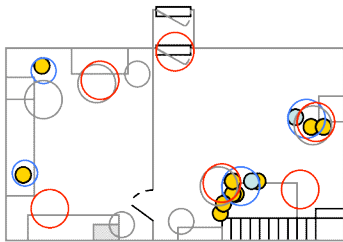
Challenge: Realising Ludic Design

The main challenge we faced in designing and developing the Drift Table was to instantiate our somewhat philosophical ideas about supporting ludic values in the form of an actual artefact. The lessons we learned along the way provide the underlying structure of this case study.

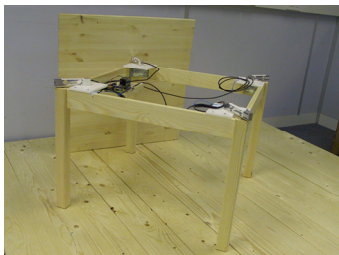
EQUATOR

is a six-year research collaboration between eight academic institutions in the UK, funded by the U.K.'s Engineering and Physical Sciences Research Council. It involves over 60 researchers, with a range of expertise that encompasses computer science, psychology, sociology, design and the arts.

Equator is pursuing research on how digital and physical realities can be interleaved in everyday life. We are pursuing a portfolio of projects ranging from urban games to digital care, and from museum visits to domestic technologies, as a way of exploring fundamental research challenges involving interaction, infrastructures and devices. See www.equator.ac.uk for more information.



Ethnographers in Equator had highlighted key sites in the flow of information through the home. Many of these involved surfaces such as tables or shelves.



Computer science partners found that by mounting load sensors under a tabletop they could track objects' movements.

Process summary: Multidisciplinary influences

Understanding how to create an interactive artefact that would support ludic engagement was the fundamental challenge of the project, but it was accompanied by a pragmatic need to balance the diverse interests and abilities of our multidisciplinary team. In this section, we discuss the design of the Drift Table in terms of the convergence of influences that led to this particular design.

Initial Design Assumptions

At the outset of the project we had only general intuitions about what designing for ludic rather than utilitarian activities might mean. One was that ludic designs should sit between several product genres (see Figure 2) without clearly belonging to any. Ludic pursuits may develop into more traditionally defined ones, but their self-definition and motivation is incompatible with the meanings and motivations implied by known genres. This perspective led to several assumptions about designing for ludic activities:

- **Promote curiosity, exploration and reflection.** Fundamental to the notion of ludic activities is an attitude of engagement in the exploration and production of meaning. Thus systems that promote ludic pursuits should provide resources for people to appropriate, rather than content for consumption or tools that structure the performance of defined tasks.
- **De-emphasise the pursuit of external goals.** Ludic activities are, by definition, non-utilitarian. If a system can easily be used to achieve practical tasks, this will distract from the possibilities it offers for more playful engagement.

- **Maintain openness and ambiguity.** If people are to find their own meaning for activities, or to pursue them without worrying about their meaning, designs should avoid clear narratives of use. Instead they should be open-ended or ambiguous in terms of their cultural interpretation and the meanings—including personal and ethical ones—people ascribe to them [4].

In sum, our opening position was that ludic design should not be 'for' anything, but instead offer a range of possible actions and meanings for people to explore. We wanted to design an artefact that would avoid privileging any particular task, but nonetheless be engaging and thought-provoking.

Technology and Empirical Impetus

Our ideas about designing for ludic activities informed the design *intention* of the Drift Table. The choice of a table as the basic *form* for the design was shaped by empirical and technical influences within the ongoing project. First, ethnographic investigations of people's routines at home had emphasised the role of surfaces (e.g. tables, shelves, notice boards) as key sites for mediated coordination of household activities [2]. Second, our colleagues from computer science, intrigued by design proposals that suggested weight sensing as an input mechanism, found that surfaces equipped with load-sensors could be used to track the location, movement, and even identity of multiple objects [14].

The ethnographic evidence pointing towards the importance of surfaces thus joined the technical possibility of using weight-sensing to monitor activities upon them. This prompted the design team to consider weight-sensing surfaces as the basis for ludic designs.

Probes are evocative materials designed to elicit inspirational responses. Examples of the twelve items we used:



A camera with requests for particular pictures.



Tags for noting house rules.



A device for recording one's dreams upon awakening.

Five design proposals were produced around this idea, three of which were implemented as prototypes. The Drift Table is one of these prototypes.

The Appeal of Aerial Photography

The *content* of the Drift Table—the notion that it would give the impression of drifting over the landscape—had several roots.

Early in the project, we had distributed Domestic Probes (see [5]) to twenty households in the Greater London area. Several of the Probe returns—a picture of a man lying on his back, gazing into a fishtank, somebody writing that he 'pretends his room is a space ship', a painting of a tropical island—suggested the appeal of escaping the confines of the home in ones' imagination.

Using the illusion of height to provide an imaginary escape from the home has several precursors. For instance, the artist Ilya Kabakov [10] proposed a number of designs for creating 'utopias' in everyday life, several of which involve using height to change perspective. Particularly apposite is his proposal for 'A Room Taking Off in Flight', which proposes cutting into the floorboards of one's home to create a large hole. "In the presence of a bottomless pit," Kabakov writes, "the room which until now had seemed to be sturdy, will acquire qualities of the inside of a balloon or a rocket rushing upwards." Previous work from project members had also sought to exploit the psychological effects of height—for instance, through self-portraits taken from a great height, or very tall desks to encourage reflective work.

These conceptual influences were an important background for the Drift Table. The design was also

sparked by the publication of an 'aerial atlas' of England [7] at about the time that we were considering the ludic possibilities of weight-sensing tables. Indeed, the company that produced the book provided the data that made it possible to implement the piece.

Design details

An initial sketch of the Drift Table is shown in Figure 3. Evolving the design to the current version shown in Figure 1 involved many detailed decisions regarding functionality, technology and form, and presentation. These decisions and their rationale elaborate our starting assumptions about supporting ludic activities.

Restraining Functionality

The Drift Table was originally conceived as a table that would scroll aerial photography depending on the distribution of weight on the table. In the end, this remains its basic functionality. In the development process, however, we considered and rejected a number of candidate additions or changes. For instance, at various times we thought about allowing speedy transitions to desired locations; overlaying



Figure 3. The initial sketch of the Drift Table

maps and text onto the aerial display, and even allowing users to dial payphones in the area they could see. Many of these suggestions were motivated by an anxiety that the Drift Table, in being so simple, might also be uninteresting.

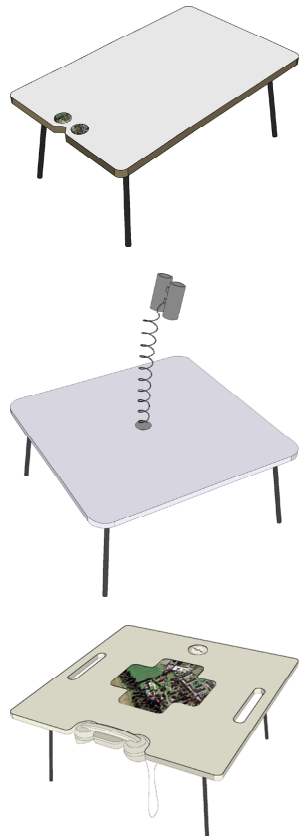
We resisted the temptation to add new functionality for several reasons. First, most attempts to make the table more interesting also implied creating a clearer narrative of use, which opposed our notions of open-ended design. Second, many of the proposed functions seemed too useful, liable to encourage a focus on task performance rather than creative exploration. Others seemed to require focused interaction, whereas we also wanted the table to afford occasional or peripheral engagement. Finally, many proposed functions would make the Drift Table 'seem like a computer'. People would be led to expect a complex set of interaction possibilities, to approach the Drift Table as a utilitarian design, and to focus on interacting with the Drift Table as a computational device. We resolved to keep the table simple and restrained, to encourage people to explore the situation it created rather than the mechanisms used to create it.

LOCATION AND ORIENTATION

We did decide to make three additions to the table's core functionality, however. Given the unfamiliarity of aerial imagery, we realised it would be easy to 'get lost' while using the table. Thus we included a small text display that showed the name of the place nearest to the Table's virtual location, allowing people to track their approximate whereabouts from memory or by checking a map. Second, we added a reset button to change the view to the table's default starting point (set to be directly over the user's home), allowing

people to start new journeys and to reorient themselves in case they got lost. Finally, we included an electronic compass to orient the aerial photography to the table's actual orientation, allowing people to map the table's apparent direction of travel to their understanding of landmarks' directions, and increasing the experience of setting off over the surrounding landscape.

These features appeared necessary and valuable, but we were still nervous lest they distract from the Drift Table's basic design. Thus we de-emphasised the reset button and location display by placing them on the side of the table, close to the power cable, to imply that they formed a kind of 'service panel' for the table that was peripheral to its functionality (see Figure 4). In addition, the reset button is a microswitch that requires a pointed implement to depress, implying that people should rarely feel the need to 'return home.'



A few of the alternative designs we considered.



Figure 4. Location display and reset button.



Three of the scale models we made of alternative form designs.

FROM SCREEN TO VIEWPORT

A fairly major change from the original sketch design to the final prototype was in the treatment of the display screen. We disguised the fact that imagery is shown on a flat-panel display by using a 'viewport' rather than the entire table surface. This was done to avoid the display becoming too distracting in the home environment and to de-emphasise the table as a computer. Moreover, our design of the viewport allowed us to heighten the impression of looking through a porthole at a landscape far below.

In order to modify the appearance of the display, we mounted the screen about five centimetres beneath the table surface, into which we cut a relatively small aperture. This allows viewers to obtain new views as they move from side to side (like looking through a window) while ensuring that the edge of the screen is never visible. A Fresnel lens mounted in front of the screen increases the viewing angle of the imagery (otherwise limited by the display), adds to the illusion of depth, and creates intriguing distortions when viewed from the side (see Figure 5).

Treating the screen in this way means that the viewport is fairly small (10cm across). This was a deliberate choice as it allowed us to keep the experience of the Drift Table relatively intimate and undemanding.

Technology and Form

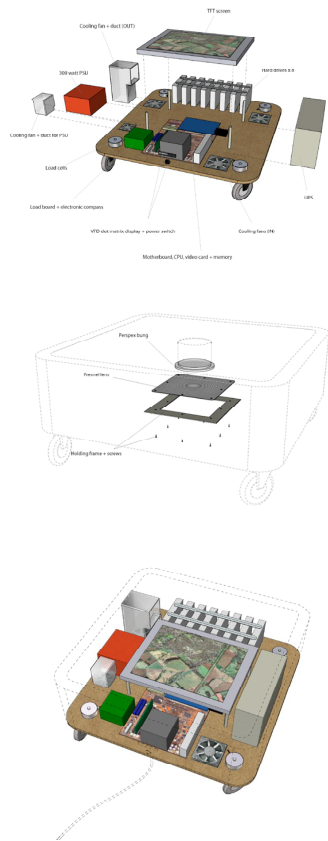
The functionality of the Drift Table was purposefully kept simple, but the technology required to achieve it is not trivial. The aerial imagery is stored on 8 100-Gig hard-drives that are read by a high-end PC motherboard equipped with a graphics card that drives



Figure 5: The viewport showing a street and building.

a 10" flat-screen display. The PC also sends and receives data to peripherals via a Smart-It, a self-contained unit that combines a microprocessor with a flexible range of IO units [6]. In the Drift Table, the Smart-It receives input from four load sensors upon which the Drift Table's cover rests, from the digital compass, and from the reset switch, and transfers text from the PC to the location display. The system is protected by a battery-driven emergency power supply that keeps the system running in case of a power cut (e.g. somebody unplugging the machine), shutting it down if power is interrupted for more than three minutes. Finally, the system is cooled by a series of five fans that circulate air.

Despite its technical complexity, we wanted the Drift Table to be compact and aesthetically simple. In the initial sketch proposal, the Drift Table was a modified dining table, but the relatively focused activities supported by such tables—eating, conversing,



Computer renderings helped us configure the technology.

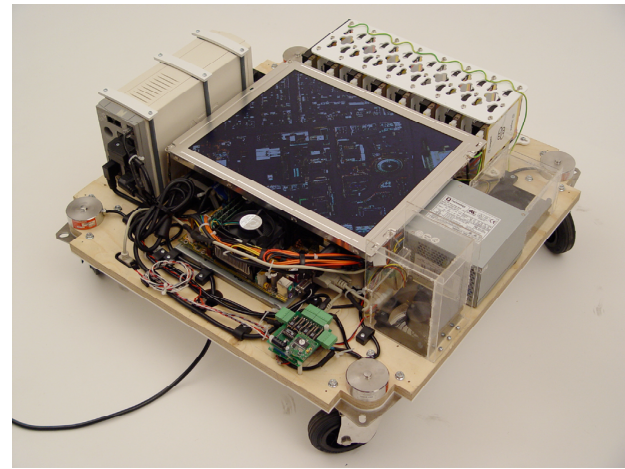


Figure 6: The Drift Table's internal technology

preparing food, etc.—seemed incompatible with more playful engagements. Designing the Drift Table to be a coffee table seemed more appropriate, as coffee tables are used for a wider range of less focused activities.

Combining technological complexity with compactness and a simple aesthetics was a challenging goal, however. In fact, we were tempted by, but ultimately rejected, the idea of wirelessly transmitting data to the Drift Table from a separate server. Although this would have allowed the table itself to be very compact, the addition of an external server would require accommodation in users' homes, and in emphasising the technology to them might distract from the Table's simple concept.

Instead, we incorporated all the technology within the relatively small (70 x 70 cm) table itself (see Figure 6). We also paid a great deal of attention to keeping the Table as quiet as possible, for instance by using

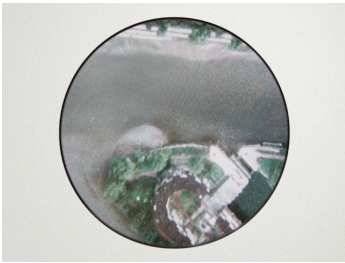
underpowered, low-noise fans. This was important both to de-emphasise the technical aspects of the Table and to avoid annoying people in their homes.

Controlling the Drift Table

To control the apparent motion and height of the Drift Table, users place weights upon its surface. The horizontal velocity is based on the difference in weights between the four corners, while apparent height is based on total weight (the weight of the table cover itself is discounted from these measurements). When weights are changed on the table, its velocity and depth gradually approach their new target values at a set percentage per frame. This overcomes jitter in the compass and load sensor readings. Moreover, it creates the impression that the table has inertia, and that users' actions are slow to influence its otherwise autonomous drifting motion.

Technical considerations place some constraints on how imagery can be displayed on the table. The maximum speed is limited by the underlying hardware's ability to load texture maps from disk into graphics card memory, while maximum and minimum height, achieved by under- and oversampling the imagery, is constrained by processing power and the aesthetic limitations of image magnification. In addition, the load-sensors have a maximum reported load of 50Kg, which led to our constraining the range of weights that would effect the table's speed and altitude.

The actual range of speeds and heights are set within the ranges offered by the design itself. The maximum speed is the equivalent of about 50 kph, and a minimum random drift of about 1 kph was introduced to prevent people from hovering easily for long periods



and to give variety to the table's movement when the weights are unchanged. The range of heights is about 500–1000 metres, close enough that details of the landscape may be inspected and high enough that a limited overview can be achieved. Finally, weight is mapped to velocity by an exponential function so that low weights can generate proportionally larger effects, while at high loads adding extra weight has little effect. This was intended to help people see progress being made relatively easily, while discouraging them from putting too much weight on the table.

Understanding Ludic Design through Practice

The many design decisions we made in creating the Drift Table can be seen as further articulating our beliefs about using technology to encourage ludic activities. Some of these tactics include:

- **Offer a range of possibilities for people to explore.** The Drift Table's aerial photography is a rich resource open to many kinds of interpretation—from speculation about land use in the UK to simple aesthetic appreciation. Using such a resource helped in designing the table to be an open-ended resource for people to appropriate.
- **Present the familiar as strange and the strange as familiar.** The Drift Table's aerial photography depicts a familiar landscape from an unfamiliar perspective and gives access to new views as well. We believed seeing one's surroundings would be relevant and motivating, while their unusual presentation would spur imaginative engagement and might lead to new insights.
- **Avoid the appearance of a computer.** Many of our design decisions were not only made to achieve the effects we wanted, but to avoid the result appearing as a computer. We presented minimal functionality and

de-emphasised task-oriented features to avoid giving the appearance of a multi-purpose machine that might be tinkered with for its own sake.

In sum, the Drift Table is designed to provide simple access to a rich range of information, presented to appear as a new sort of domestic furniture/appliance rather than a computer. Its appearance and control evokes the impression of drifting over the countryside, as if an opening had been created in the home's enclosure. But fundamental to the table's design is the fact that it isn't 'for' anything in particular but creates an evocative situation for people to explore.

Results

Inherent to the notion of a device that isn't 'for' anything is the crucial role of users in appropriating the situation it offers. In a very real sense, the design isn't complete until it has been used: until then, the design's



Figure 6: The Drift Table in S's flat.

openness undermines the ability to suggest scenarios of use with any confidence. Thus we are in an ongoing process of loaning the Drift Table to households (three at the time of writing) for relatively long periods and assessing their experiences through ethnographic observations, interviews, and self-reports.

In this paper, we describe the experience of one household that lived with the Drift Table for a six-week period (see Figure 6). Through a relatively detailed account of this example, we hope to point to phenomena we have found more generally while keeping coherence of presentation.

S, J, and W share an apartment in central London. S, the owner, is a musician who usually works in the flat during the day, evenings and nights being spent at another flat he shares with his girlfriend D. J and W, conversely, often return to the apartment during the evenings, after spending days away at work. With both sets of flatmates entertaining a steady stream of guests and collaborators, the table was used in this household by a number of people in a variety of circumstances.

Table Activities

We observed the flatmates engage with the table in a variety of ways. S described a number of his activities as 'sightseeing', and would steer the table to well-known locations that he expected to be noticeable from the air (e.g. Stonehenge, landmarks around London). The motivations for these trips were quite varied. For instance, one day S heard a news report that an area in Bournemouth was the third most valuable area of real-estate in the world, so he decided to navigate the table to take a look. He explained this to R, a drummer with whom he works extensively. Both found this news

funny, and exchanged jokes about English seaside resorts. Then they discussed more seriously the impact of property prices on the general economy as well as their own investments, while both set about getting the table on course from London to the south coast.

The flatmates often navigated the table to places of personal significance. For instance, S would very commonly navigate the table to places associated with his friends or colleagues and, when encountering them later, reveal details to them about the places he had seen on the table. Flatmate J, on the occasion of a visit from his brother, navigated the table to their hometown of Harrogate, stopped over Betty's Teashop, a well-known local meeting place, and loaded the table to zoom in to great mutual amusement. The visit of S's brother led to a trip to Tockwith in the north of England, a place where they used to live.

It should be clear from these examples that the table can be used to inform matters that people are curious about while furnishing them with details which can be deployed in interaction with friends, relatives and colleagues. The table's role in these activities is not as a source of definitive information. It does not stand in lieu of a geographical information system that might, for example, help one to develop serious opinions about south coast property prices. Equally, one would not use the table to plan a car trip when a road map would serve better. Rather, its use is occasioned by curiosity about what places might look like, where those places are of interest for personal reasons or due to their participation in conversations with friends, relatives or colleagues. To use a phrase of Harvey Sacks, the table enables the uncovering of details that can serve as 'tickets for talk'.



We explained the table as we set it up in S's flat and gave him a manual explaining its operation, but avoided suggesting how he might use it.

Working the Table Collectively

Interaction with the table was a socially-oriented affair. S found things on the table that he could talk about with others, and engaged in trips provoked by what others said and did. Moreover, the table was often used collectively. J and W commonly formulated trips and set them in motion together, reporting to each other on the progress of a long trip if the other was away overnight. Regular times evolved when J and W would gather around the table, often with guests who were offered the chance to see their homes from the air.

The scale of the table and the fact that physical objects are used to control it make many features of its operation readily intelligible to onlookers. Moving objects to a given corner is easily interpretable as a navigational movement in a certain direction. Leaning over the table to gaze into its display is equally a clear public act. These features help people coordinate their use of the table to make shared trips. The physical-gestural nature of interactivity with the table also enables an experienced table-user to see at a glance that a novice has made less artful weight deployments. For example, a visitor from Canada who had heard much about the Drift Table started experimenting with it soon after arriving at the flat. S, who had been busy with other chores, found the table with objects spread around its surface. He could see at a glance that, not only had the table been disturbed, but that it has been done without, for him, clear purpose. 'What's all this about? [pointing to the arrangement of objects] It makes no sense.'

While the various residents of the flat and their guests were able to coordinate activities on the table and

make practical inferences about each others' conduct, we also observed instances where the small aperture design was problematic for synchronous collaboration. People have bumped heads while jointly looking in. It is not always easy for someone to manipulate weights to achieve desired views, while demonstrating those to others. Interestingly, then, the small aperture-like design involves a trade-off between its ability to engender curiosity on the part of individual viewers (peering in, trying to see what might be coming into view) and its use as a 'shared display'.

Working the Weights

Although the table has been calibrated to respond to weight in terms of an exponential function, complaints were made about the table moving too slowly with light weights. J, for example, initially explored the table's responsiveness to glasses of beer and magazines but found that these had little effect. Over time, however, members of the household learned to artfully select objects from the domestic environment so that a requisite variety of navigational effects could be achieved. A single heavy object might enable relatively swift movement, but S, J and W all preferred to work with the table using a family of variably weighted objects.

Consider S setting off to look at a friend's garden near Nottingham. At the beginning of the day, he places all of the weights on the table to bring about a northerly movement from a London starting location. After a morning of intensive work when he could not check the table's progress, he takes a break and inspects the text display. It shows Darlaston. S looks this up in a road atlas and finds that it is to the south and west of his friend's garden. Accordingly, the weights are shifted to



The small viewport sometimes made social use problematic.



Figure 7: Weighty objects used on the table

Some examples of the objects we observed in use:

- a wah-wah pedal
- a software user manual
- a small but thick antiquarian book
- a heavy ceramic candle holder
- a broken lava lamp
- rocks (in and out of containers)
- a guitar
- a loudspeaker (whose magnet intriguingly caused a slow rotation on the viewpoint)
- a statuette of a nun

the north-east corner of the table and S goes back to work. When he next takes a break, he sees that the display is still showing Darlaston. He goes out onto the balcony and brings in an ornamental metal container filled with stones, placing this between the aperture and the table's north-east corner: 'This should speed things up. This is the engine.' The lighter objects on the table are now rearranged around the metal container: 'And this is the steering.'

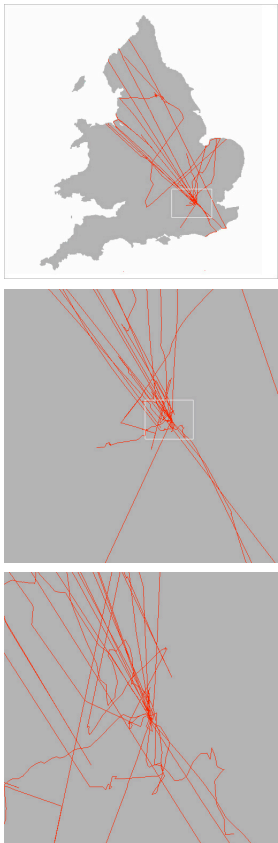
Selection of objects for use on the table is a practical matter, then, requiring some thought. Objects need to be moderately heavy (see Figure 7). It facilitates their careful positioning if they have a small footprint. If they are to be left on the table for long periods (e.g. if a long table journey is undertaken), they should not be regularly used and removed for other domestic purposes. While the table is responsive to moderate weights casually left behind as part of other domestic activities, we did not observe the table being used predominantly this way. Rather, a set of weights was

selected, a course embarked upon, and whatever else needed to be put on the table as part of transient domestic or working activities took its place amongst items which were there for navigational reasons.

It is important to appreciate that, although the table was controlled functionally by moving weights, this was embedded within practices of reasoning about trip purpose (where 'let's just wander and see what happens' is still a kind of purpose), current location, and desired trajectory. Such reasoning was supported by much more than just the view through the table's viewport and involved more than just shifting weights. Sometimes it was enough for people to look at the view on the tabletop to see where they were or what progress had been made. But more commonly, gaining a fix on the view required checking the location display, finding the location in an atlas, and, through this, reasoning about the nature or significance of the image visible on the table in light of the purpose of the trip. Once all this had been done, the re-deployment of weights might be considered.

Accommodating the Table within Domestic and Working Routines

S, J, W, and their visitors accommodated the table to their domestic life in a variety of ways. J and W would quite commonly organise their activities on the table as part of an evening's domestic life. If they were going to the cinema, for example, the table might be set on course before going out and then its location checked on return. Particular journeys for the table might be selected as appropriate to the two to three hours that the table would have without supervision. Similarly, the table might be set to drift overnight with curiosity as to where it might have got to when the flatmates woke



Plots of all the journeys made by S's household. Progressive images zoom in on the Table's starting position over S's home in London. Users' detailed adjustments to the course are revealed by the closeup views.

up. S identified 'post-pub, pre-bed table-time' as a characteristic routine for the household. The drifting of the table appealed and the slow-paced responsiveness of the table to weight changes seemed just right to him as a late night activity and had, he claimed, provided a significant alternative to television viewing during this domestic leisure time slot.

S also folded interaction with the table into his working day, and told us that the table also replaced television as a background activity while he worked. The table was placed next to S's computer-based music set-up (see Figure 6). This enabled him to glance across at the image on the tabletop from time to time without interrupting his work. More extensive checking on the table's progress could take place as and when a break in S's work occurred. He might check on the progress of the table before and after an email session or while tuning his guitar. He might manipulate the weights in a more concentrated session during a lunch break. While the table was drifting all the time, it did not require attention all the time. Nothing disastrous would happen if a phone call took two hours rather than two minutes. An overshoot or a badly set course could be adjusted when time becomes available and this could be done as carefully or as casually as work time permitted. In short, engagement with the table was easy to accommodate into the other domestic and working activities that occupied S and his flatmates.

Appreciating the Table Aesthetically

The table was often an object of and for appreciation. That is, people routinely said whether they liked or didn't like it, compared it to other things they liked or didn't like, and discussed the grounds for their judgments. The table can be appreciated as an

ingenious piece of technology design. W and S liked it on these grounds, while, in contrast, D (S's girlfriend) was insistent that artefacts should never be enjoyed as technology alone. Admiring technological 'mechanism' was for her a criticisable male aesthetic. From time to time, the table was appraised as a designed-through domestic artefact. Some people liked the choice of materials and its rounded corners, though W thought the large wheels at its base 'took it down a peg or two'. Matters to do with appreciating the table as technology or as a designed artefact commonly occupied people in their early encounters with the table.

For some people, these initial encounters were decisive. D, for example, was unconvinced by S's attempts to engage her with the table and took it as a mere demonstration of technical possibility without the necessary aesthetic or political force to rouse her interest. Those who did engage with the table commonly expressed concerns about the speed with which the image moved and the restricted interaction offered by the table. For S, J and W, these matters were, from time to time, of critical importance in determining whether the table would be persevered with or not. For instance, J often wished that heavy domestic objects (a large pot plant say) would yield a considerable speed-up so that desired locations could be reached more quickly. This inability to go quickly to places turned out to be a decisive feature in J's appreciation of the table, his interest being exhausted at the end of the six weeks he had access to it.

S and W, however, used the table persistently throughout the period. Indeed, at the end, S, W and O (a friend of W visiting from Canada) could imagine buying a Drift Table, if such a thing were ever

"Initially, I thought fantastic, another hi-tech toy in town. Then I became annoyed after the first day by the porthole. I couldn't show it to people as it is too small. I found myself straining to see to the edge. But that's worn off now. I thought about having a switch for double speed. Now that's worn off too. You should take a look around on the way like on a train journey. One should accept it and use it as it is. Another thing I thought was that it would be great to have a keypad so as to type in a coordinate. Then I thought no, it's for drifting around. I like it for what it does. It's extremely sophisticated but without the arsing about. It has one use. It drifts. I like that understatedness about it. After a couple of days I was about to get bored with it because of its weaknesses but now those are strengths. From shiny new object, to where's the buttons, to this is what it does." - S

marketed. For these individuals, criticisms like J's came to be reappraised as constitutive aesthetic features of the table.

Many of those who encountered the table have considered possibilities for its redesign, but everyone has recognised that this would involve a considerable change of design intent: one would not drift if the table were hypersensitive to small weights or moved very quickly under large ones. For S, initial objections about the speed of movement (various shades of slow) and the uniformity of navigation control (various shiftings of weight) came to be seen as just that: initial objections that disappeared as he acquired an overall sense of the table's aesthetic identity the included an appreciation for its restricted interactive character.

Lessons for Ludic Design

Our observations of the Drift Table in use supported many of our intuitions about designing for ludic engagement. A number of the volunteers engaged with the table persistently over their relatively long periods of ownership, and were inventive in finding new activities and motivations to pursue. Perhaps most fundamentally, their experiences seem to justify our strategy of designing the Drift Table to provide a rich but unstructured resource without a clear narrative of use. People did indeed use the table to satisfy their curiosity and to wander, without feeling that it should be useful or utilitarian.

Observing the Drift Table in long-term use also uncovered new aspects of designing for ludic engagement. These can be summarized by the following lessons about ludic activities:

- **Support social engagement in ludic activities.** Using the Drift Table was engaging as a solitary pursuit, but people liked to gather round it, discussing their current view and how to reach new destinations. The small size of the viewport was frustrating in social situations, but other features of the table made it well suited for group use.
- **Allow the ludic to be interleaved with everyday utilitarian activities.** People often engaged with the Drift Table as an occasional break from their routine household activities. We had not explicitly anticipated this in the table's design, but its slow speed, the use of a persistent input (weight) and the sheer enormity of its data set combined to allow periodic use.
- **Don't expect ludic designs to leave everyday activities untouched.** The Drift Table was conceived as a kind of augmented coffee table, but its use was not a simple extension of coffee table use. This became clearest in the way that weighty objects were specifically selected and deployed on the table. We speculate that similar effects will be found generally for this sort of augmented artefact.
- **Don't seek to meet users' immediate desires.** In designing the Drift Table, we consciously restrained ourselves from adding features to support expectable demands (e.g. moving quickly to a particular location). Many people in fact voiced exactly the desires we had decided not to support. Over time, however, our decisions appeared justified as a noticeable subset of users accepted the table for what it was, and relinquished the desire to engage with it to achieve obvious tasks. For these individuals, the table worked to encourage the exploration of new activities and appreciations.

"I would describe it as a digital hot-air balloon that you travel in from the comfort of your own front room... All the technology in the Drift Table is within, as opposed to without. There are no buttons or keys to press, the only interaction I have really is to look through the lens or to place weights in the direction I want to go... If you want to do anything more than that you really should be looking at maybe buying a Playstation. This is what it does, and it does it really really well." - S

One of our initial assumptions was that ludic activities would not be organised around tasks but instead be more aimless and exploratory. Our observations, however, made clear that people routinely set themselves tasks in their engagement with the Drift Table. These tasks were internally motivated through their curiosity about the landscape, however, rather than defined by the desire to accomplish some utilitarian goal. They seemed to serve the role of rules in a self-defined game, directing behaviour and defining meaning. It seems clear that ludic engagement is not characterized by an absence of tasks. But the tasks that comprise ludic pursuits are motivated by aesthetic rather than utilitarian values, and pursued for pleasure rather than to fulfill external goals.

Conclusion: Design for Homo Ludens

We believe the Drift Table to be a successful example of designing for ludic pursuits. Moreover, we believe the process of designing and observing the table to have taught us a number of lessons about designing for open-ended, playful exploration.

It is possible to interpret the Drift Table as an example of calm or ubiquitous computing, a tangible interface, peripheral display, information appliance, or some other new genre of interface. It does, after all, embody many of the features that such visions encourage. But to see the Drift Table primarily in such terms would, we suggest, be a mistake. The Drift Table's form and interactivity are important to how it functions, but more important are the values that it supports, the role it plays in people's lives, and what it suggests about the intentions (or lack thereof) of interactive devices. Our concern is not to investigate new sorts of interaction for

their own sake, but to offer a new perspective on how technology might fit into our everyday lives.

The Drift Table is not an artwork. Nor is it a toy or a tool. It is not designed to provide information, entertainment, or communication. But the temptation to interpret the Drift Table in any or all of these ways is key to its understanding. Perhaps it is best thought of as a *pre-genre* artefact, designed to be easy to use, but difficult to interpret. In deliberately withholding a clear interpretation or narrative of use, we created the opportunity for people to find their own meanings and uses for it. By avoiding suggestions of what people *should* do with the Drift Table, we created a situation in which they could play around with what they *could* do. The curiosity, exploration and aesthetic appreciation that this entailed is at the root of ludic engagement.

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