Resilience in the face of innovation: Household trials with BubbleBoard

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Abstract: We present the results of a field trial in which a visual answer machine, the BubbleBoard, was deployed in five households. The aims of the trial were to create an improved answer machine, but also, and more interestingly, to encourage family members to appropriate it through the inclusion of open and playful design elements. Through making aspects of audio messages visible, BubbleBoard offered a number of improvements over existing answer machines. However, the new affordances associated with this were not appropriated by family members in the ways we had expected. We discuss possible reasons for this, and conclude that attempting to encourage appropriation through 'openness' in design may not be sufficient in the face of well-established social practices.

Keywords: social practices, home technology, appropriation.

1 Introduction

When we consider the impact of technologies in the 'real world', it is fair to say that Human-Computer Interaction's (HCI's) most far-reaching and consistent successes have been in the optimization of existing technologies. Iterative design, user testing and prototyping techniques have ensured that a great many products come to market having been evaluated with the aim of making them more 'user-friendly'. On more shaky ground, though, are claims that HCI has made significant inroads in the area of real innovation; in helping to produce products that form new categories, are disruptive of current practices, and radically alter the socio-technical landscape. Many such technologies are either the products of insightful designers and organisations, or have evolved as a result of the appropriation of familiar technologies. With regard to the latter, the example of text messaging (or SMS) is often cited, where unanticipated but sweeping changes in messaging practices developed on the back of conventional mobile phone use. For communication technologies such as this, appropriation is as much a social phenomenon as it is an adaptation of the technical features provided. Change is necessary at the level of the collective, with new conventions being recognised and adopted by a critical mass. This raises questions of how we can design for appropriation, and more interestingly, how we can encourage the development of new social practices.

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This paper presents a field study of a new communication device for the family; a visual answer machine called the 'BubbleBoard'. The research goals were twofold: on the one hand, BubbleBoard represented an attempt to solve some of the existing problems of home answer machines. On the other, we hoped that it would offer sufficiently different affordances to conventional machines that new uses would be discovered for it over time. Specifically, we hoped that by offering a new and improved version of voice messaging, BubbleBoard would in some sense to "slot in" to the home environment, while allowing different practices to evolve through its quick adoption. This approach has proved successful in the past for friendship groups, as exemplified by a study of Comeks, an MMS-based comic creator (Salovaara, 2007). Comeks was similar enough to SMS to incorporate existing communication practices, while simultaneously offering features that became resources for new types of expression. With BubbleBoard, we hoped to do something similar for families. As we will discuss, BubbleBoard was successful in achieving our first goal: it offered the families a playful, effective replacement technology and, in doing so, emphasised existing practices around voice messaging. However, it was largely a failure in terms of our second goal. Despite our expectations, BubbleBoard was not significantly appropriated by the families in our trial, and was not generally conceived of as anything but an answer machine. We examine the reasons why this might be, and consider what the implications are for the development of future innovative home technologies.

1.1 Related Work

The difficulties of using answer machines and voicemail have been well documented. Although speech is easy to produce and richly expressive (Chalfonte et al., 1991), listening back to voice messages is associated with problems of message scanning, extraction of important information, status tracking, and the creation of archives (Whittaker et al., 2000). A number of approaches have been adopted in attempting to overcome these. Early research explored the possibility of making answer machines more conversational in style, by encouraging the caller (Schmandt and Arons, 1985) or the recipient (Marx and Schmandt, 1996) to converse with the machine. In both cases messages were categorised, aiding browsing of received voicemails. While recent work has focused less on using conversation to address the problems associated with voicemail (although see Lakshmipathy et al., 2003), attempts to support search and browsing of messages continue. Research has focused on the detection of emotions such as urgency (Inanoglu and Caneel, 2005), and on the

use of information such as the number of messages left previously by the same caller (Ringel and Hirschberg, 2002), to aid automatic prioritisation.

Alternatively, by allowing the user to skip through and scan their messages, answer machines can support recipients in prioritising messages according to their own criteria. Early efforts assigned dedicated keys for navigating within a set of voicemails (Resnick and Virzi, 1992), while more recent approaches have focused on displaying messages visually. Jotmail (Whittaker et al., 2000) presents key aspects of the message in a web-based GUI, while SCANMail (Whittaker et al., 2002) generates a transcript of each message and displays them in a manner akin to email. More recently, Apple's iPhone presents voicemails visually. These visual displays offer strong support for message scanning, but not all designs of this type have tried to make information about the messages observable. Bishop's marble answer machine (Crampton Smith, 1995), using real marbles, simply displays the number of messages, although through its tangibility it offers creative approaches to status tracking and archiving.

While the playfulness of the marble answer machine makes it a viable, if somewhat radical, domestic technology, most of the above has focused on work-related voicemail. Research into answer machine use in the home has largely been performed in conjunction with explorations of general telephone practices. Lacohee and Anderson (2001) have discussed the importance of life rhythms in dealing with telephone calls; friends and family know when it is appropriate to phone, and machines are used to screen intrusive calls. Contrary to this, callers sometimes ring when they expect their call to go unanswered, with a view to leaving a message. These 'pseudo-maintenance calls' are made when someone simply wants to make contact.

Of course, the uptake of mobile phone technology since this research was undertaken has resulted in different approaches to messaging. However, recent research using technology probes (Hutchinson et al., 2003) indicates that a space for shared messaging within the home remains. The deployments of ASTRA (Romero et al., 2007), TxtBoard (O'Hara et al., 2005) and HomeNote (Sellen et al., 2006) have pointed to the benefits of person-to-place messaging. Similarly, Hermes@Home (Salis-Lagoudakis et al., 2006) and Keep in Touch (Langdale et al., 2006) have been used to support messaging between homes. Family members use these for micro-coordination, but they play an equally important role in emotional bonding, by enabling displays of, and demands for, affection.

2 The Design of BubbleBoard

As we outlined earlier, BubbleBoard was designed with two specific goals in mind. The first was the creation of an effective, compelling answer machine, which by resonating with an existing object could fit easily into the home. By creating a visual voicemail experience, we felt that we could provide a system better suited to family life. The second goal was to provoke new experiences. We felt that a visual messaging interface combined with flexible methods of organising messages should lead to new and unexpected uses for the device.

2.1 Designing a Better Answer Machine

Most modern voicemail systems provide very little information 'at a glance'. Information may be limited to a small, blinking LED, a distinctive dial tone on the phone line, or a small LCD display indicating the number of messages requiring attention. Our initial goal with BubbleBoard was, therefore, the design of a visual interface. Indeed, in some of our previous research (e.g. Sellen et al., 2006), family members have expressed the wish to see who has left voice messages. We reasoned that by displaying key information such as who left messages and when, how lengthy they were, and whether they had been listened to, family members would be

able to make quick decisions about how to deal with them. This should also do away with the need to navigate and listen to long sequences of voice messages.

We decided on the metaphor of bubbles for messages fairly early in the design. Although initially driven by the concept of voice bubbles, like those used in comics, we ended up using bubbles in water as a simple model around which we could focus our ideas. We felt that representing people as bubbles (which could be large or small, positioned on the board, and put down the drain) would foster a degree of playfulness. A touch screen was used to display these bubbles, allowing family members to interact with them using their fingers. This was built into a wooden frame alongside a whiteboard (Figure 1).

[Figure 1]

Information is provided at a glance in a number of ways. First, the identity of the caller is visible. Families can assign images to phone numbers, which are then displayed in the centre of the bubble when that caller leaves a message. Unknown callers are assigned one of a set of standard images, with the phone number displayed in the centre (Figure 2).

[Figure 2]

Second, family members can tell how old a message is by its position in the blue region of the display. When a caller leaves a message, it arrives through a pipe at the bottom-left (Figure 3a), accompanied by a 'new message' sound, and floats to the top-left of the screen. Bubbles are animated, bobbing gently to draw attention and sinking as they age, until they eventually settle at the bottom (Figure 3b). Additionally, each bubble has the time and day of its arrival displayed underneath it. Messages that have not been listened to are highlighted by a red ring that spins slowly around the bubble (Figure 2), distinguishing 'new' messages from those that have already been played. A final piece of information conveyed is message duration; larger bubbles indicate longer messages (Figure 2).

[Figure 3]

In addition to their visual properties, bubbles can be easily manipulated. Messages that are moved to the white region of the interface (see Figure 1) remain in a fixed position, allowing them to be positioned and grouped. This was referred to as the 'safe' area, because of the greater control afforded to the user. Bubbles are deleted by dragging them to the plughole. The message is sucked away, spinning, as a deletion tune plays.

2.2 Designing for Appropriation

The second goal was to see whether new uses and practices could be engendered around BubbleBoard, driven, in part, by elements of its design. 'Openness' is often described as one means of eliciting appropriation; Salovaara (2007) has emphasised its importance as a means of encouraging the user to actively interpret functionality, and Sengers and Gaver (2006) have highlighted it as a valuable tool in allowing multiple interpretations of a system to emerge. It should be noted that here, openness refers to the interpretation of *what something can be used for* rather than *how* a device should be used. While usability is specified, potential uses for the object are not. Salovaara suggests that openness may be particularly worthwhile when designing for complex environments such as the home, where artefacts gain significance by being incorporated into the routines of everyday life. With BubbleBoard, we felt that the inclusion of aspects of openness in its design might encourage the development of new social practices. We also hoped that experimentation would be encouraged by its different affordances, and through playful design elements, as will be described below.

New affordances through visibility: By displaying aspects of audio visually and by representing messages in space, we anticipated that new uses for voice messaging might emerge. In particular, visible characteristics of messages would be available to the whole family, potentially inspiring new collaborative patterns of use. Additionally, the board offers a space for family members to mark their 'visual' presence within the home. Previous research has revealed practices in which householders leave messages celebrating their own identity (Sellen et al., 2006), and householders might do something similar with BubbleBoard by leaving longer or more frequent messages, thus monopolising the space on the board. As another more functional example of changing practices, we expected that the visual presence of bubbles might lead to increased use of the board for reminders, both for oneself and for others. Again, we have seen similar practices of 'messaging to place' in previous research (Sellen et al., 2006).

Openness: We also hoped that the provision of different spaces within the interface would make it open to different and potentially new types of use. In particular, the flexibility of the 'safe' area allows users to arrange messages as they please, and we expected to see it used for saving special or important messages. The physical whiteboard provided a further resource for local messaging. We hoped not only that the affordances of all three areas would be well understood, but that their juxtaposition would be taken advantage of. The most obvious example would be using the whiteboard to mark up messages in the safe area.

Playfulness: Finally, the use of playful graphics, the bubble metaphor itself, and the sound and animation effects as messages came in or were dragged down the plughole were intended to convey a sense of fun. We hoped that these aspects of the design would encourage play and experimentation, and would draw in householders who might not normally be interested in such a device, such as children. We were also interested in how the involvement of younger family members might be accommodated, and whether this would be perceived positively by their parents.

With these different features and affordances, we very much expected that new uses would emerge around BubbleBoard. Indeed, during a period of initial technical testing in our own homes, it came to be used in ways that were distinctly outside what one might call normal 'answer machine behaviour'. For example, in one family, BubbleBoard began to be used as a personal memory aid: the mother would call it directly to remind herself of things that needed to be done at home. Also common was use of the whiteboard to annotate messages and draw other people's attention to them. In another house, the son called BubbleBoard to record a particularly annoying song, allowing him to play it back to the rest of the family at will. Householders also began to explore how large they could make bubbles appear by leaving lengthy messages, and populated the screen using particular icons; in one case, a young family member adopted the icon of a fish and repeatedly called the BubbleBoard so as to create the effect of a virtual fishbowl. Some of these uses were unanticipated, and led us to conjecture that the board might be used in other unexpected ways over a longer field trial.

2.3 Technical Implementation

The implementation of the prototype relied upon existing phone services and wireless connectivity. Householders subscribed to a call divert service with their telecom provider for the duration of the trial, allowing them to forward calls that were received when the phone was 'busy' or 'unanswered'. These calls were diverted to an internet based voicemail system provided by X-On, which could also be called directly. Messages were transferred from the voicemail system to our server over FTP, and from there they were downloaded by an application on the BubbleBoard Tablet PC using a web service call. The Flash application underlying the interface then gleaned the messages, along with images to be displayed inside the bubbles, from a web server running locally on the Tablet PC. This managed the voicemail store, providing new messages and giving state information, such as the position of bubbles.

3 Method

With the experience of our internal trial in hand, we felt it important to evaluate BubbleBoard with a range of families to see how new practices surrounding it might evolve. The device was deployed in five households. Although this may seem a small number, the emphasis was to observe changing patterns of use in the longer term and to achieve depth of understanding for any one family.

3.1 Families

Families were selected on the basis that they had children living at home and an existing answer machine or voicemail service. The rationale was to target busy families where we could examine the roles and practices of both children and adults. We also sought to have some variation in the ages of children because we were interested in how younger children as well as teenagers would engage with BubbleBoard. As a final selection criterion, families needed broadband internet access.

Household A consisted of two working parents, their 14-year old daughter and 17-year old son, plus two lodgers. The son used his mobile fairly heavily for texts, phone calls, and instant messaging. The parents and daughter relied more on the landline, with the father often phoning home during the day.
Household B consisted of two parents, a father who worked full-time and a mother who worked part-time, and two teenage sons. The elder son (aged 19) was at university when the study began, but returned mid-trial. The younger son was 17. The father had a strong interest in technology and was a practicing radio amateur, while the mother seemed to lack confidence in approaching new devices.
Household C consisted of two working parents with a nine-year old daughter and a seven-year old son. Routines (especially the mother's) revolved around the children. The phone was used most by the mother to make arrangements and by the daughter to talk to her friends.
Household D consisted of two parents with a five-year old son and a three-year old daughter. The father worked long hours and was often away on business while the mother cared for the children and did volunteer work. Landline and mobile phones were used daily for micro-coordination.
Household E consisted of a single mother, who worked full-time, and her eight-year old daughter. The mother's parents and sister lived nearby and her father in particular often let himself into her house during the day to help with childcare and various jobs.

In *Households A* and *B* the parents and all of the teenage children owned mobile phones; in *Households C*, *D* and *E* only the parents owned mobile phones.

3.2 Procedure

The study had two phases: a pre-BubbleBoard period of about 10 days and a deployment period of at least a month. The purpose of the pre-trial period was to get a sense of the families' general messaging practices. The phase began with interviews on usage of the telephone and answer machine as well as other means of communication such as mobiles, instant messenger, email, paper note-taking and whiteboard use. Families were then asked to log their answer machine use for 10 days using a simple paper diary, and were provided with digital cameras to photograph their existing note-writing practices.

Following this, a BubbleBoard was installed in each house in a room chosen by the family. In *Households C, D* and *E* it was placed in the kitchen, in *Household A* the dining room, and in *Household B* the hallway. The latter two areas were chosen because they were considered to be busy 'thoroughfares' within the home, and in *Household B* because the phone was also located there. At installation it was emphasised that as well as serving as an answer machine, BubbleBoard could receive direct voice messages via its phone number, and

could therefore be used to play back audio messages sent directly to the home. Nothing else was suggested about the ways in which it might be used.

BubbleBoard was left in place for at least a month (and closer to two months in *Households B* and *D*). Interactions with the board and voicemails were automatically logged during this period, and interviews were scheduled on a weekly basis. Families continued to use the cameras to take photos of the ways in which they used the whiteboard, and some were also loaned a camcorder. The weekly visits were audio recorded and also often video recorded.

At the interviews, the messages that had been received during the previous week were played back to provoke discussion. For each message, the sender and intended recipient were identified, the ways in which the bubble was dealt with (e.g. saved, deleted, annotated on the whiteboard) were considered, and the behaviours that its arrival triggered were discussed. In the case of messages from family members, it was also ascertained whether the call was a direct message to the BubbleBoard or if it had been diverted because the call was not connected. Photos taken by the families of the whiteboard were also explored.

3.3 Analysis

Analysis of the data focused on how BubbleBoard fitted into the existing social practices of the families studied, whether it was appropriated, and whether it inspired new social conventions. Videos and transcripts of the interviews were examined to understand the types of message that were received and how the different spaces within BubbleBoard were used. This was supplemented by logs of interactions with the BubbleBoards and records of the voicemails received during the trial. Comparisons were made with the completed answer machine diaries to give an impression of the types of message received in both phases in the study.

The video footage proved particularly useful in grounding group analysis sessions, and was found to offer some of the advantages of 'design documentaries' (Raijmakers et al., 2006). In short, provocative juxtapositions resulted from the standard empirical methods used and the filming and choice of footage. The video selected for the analysis sessions also allowed researchers who did not visit the households to get a sense of the families, their routines and the ways in which they approached the technology.

4 Findings

4.1 BubbleBoard as an Improved Answer Machine

4.1.1 Reflections of existing practices

As already mentioned, we hoped that BubbleBoard would fit easily into the home as a communication technology, both substituting and offering improvements over the answer machines that it replaced. In this sense, the prototype proved extremely successful, supporting both existing call patterns and established family roles. The messages that were received on the BubbleBoards were similar both in number and in type to those received on the families' existing answer machines (0.47 messages were received daily on average, compared with 0.53 messages on the pre-trial machines), and the ways in which they were dealt with reflected existing patterns of use. From the initial interviews it was clear that mothers tended to be responsible for listening to and deleting messages with the pre-trial machines, and this was mirrored in interactions with the BubbleBoards: for the majority of families it was the mother who would move messages to the safe area or put them down the plughole. In *Household D* the mother took sole responsibility for the device, saying of her husband, "He doesn't really bother with it, cos I take all the phone calls here and I tend to deal with

everything". Even in *Household B*, where the mother was seen by her family to be fairly incompetent when it came to technology, the responsibility of dealing with messages was not delegated to others.

4.1.2 Advantages associated with glanceability

There were also a number of ways in which BubbleBoard offered clear improvements over the households' usual answer machines. The visibility of messages and their at-a-glance properties resulted in an increased shared awareness of them. As the mother of *Household C* put it, "We come in the house straight in the kitchen and it's there to see". The fact that BubbleBoard enables shared listening also encouraged the involvement of family members who would not traditionally interact with messages. In another example from *Household C*, the mother described how "I didn't get to the phone in time so I just let it go, and then we all came and sat in here". On hearing the bubble arrive, her son "went and played it and we could all hear the message [from the adjacent room]". These factors had the notable effect of drawing in younger children; even the five-year old in *Household D* was said to interact with the bubbles and the children of *Household C* listened to messages unsupervised. Furthermore, in an isolated example of roles changing, the 14-year old daughter of *Household A* took over the role of organising messages from her mother.

The glanceability of the bubbles not only increased awareness of the existence of messages, but also supported family members in deciding whether or not to listen to them. Although in most cases family members simply played all recent messages, there were some cases where the decision was taken to ignore one. For example, the son of *Household A* chose not to listen to a particularly long message he could see was from his father, saying, "I looked at the number, and I looked at how big the bubble was, and I was like, 'No, I cannot be bothered'". The mother of *Household D* also took advantage of the information displayed to avoid replaying messages. She saved a number of bubbles representing calls that she needed to return, saying "I don't need to listen to the message again because I can see the number there".

Another consequence of making audio messages visible was that the arrival of messages became more salient. This was not so important when family members were in and simply missed a call (the ringing phone is a good indication that a message will be left), but became extremely useful when messages were left while the phone was busy. One example of this occurred when the mother of *Household A* was using the telephone while her son phoned home to request a pre-arranged lift; "As soon as I saw it [her son's bubble] pop up I knew it was him [..] so I quickly sort of shortened my call". In describing what would have happened with their previous voicemail service, the son said, "My mum would probably not have heard that message until she next used the phone [..] I could have been like stuck there".

4.1.3 Interpretations of the different spaces

The three spaces within BubbleBoard's interface were open to interpretation in terms of how they could be used, both in isolation and in combination with one another. In practice, this permitted a degree of flexibility to family members in organising their messages. As the mother of *Household C* said, "There's more sort of structure I suppose, play it, put it there, play it again [..], put it down the drain". The safe area in particular was used as a place where messages were demarcated as having been listened to, requiring action, or worth saving. While all of these activities are quite typical of what people do using conventional answer phones, BubbleBoard's different spaces were used to do them more effectively. Furthermore, the openness of the spaces permitted each family to develop their own conventions.

For example in *Household E,* messages that had been listened to were placed in the safe area for a short while, even if they required no further action, while in *Household D* the safe area was used by the mother to set ground rules for the children, thus managing the way that BubbleBoard encouraged them to interact with it;

"They know if it's on the white side they're not to touch it". For other families, the safe area was used for archiving messages that contained important information or that might need to be acted upon. For example, the mother of *Household C* saved a message that contained "a couple of email addresses that I want", and said "I've sort of left it on there thinking 'Hmm, shall I shan't I email him', so that will stay there until I get round to that". In this way the design offered each family their possibilities for carrying out their usual answer phone activities in new ways.

4.2 Appropriation and Changing Practices

The second goal for BubbleBoard was to encourage new practices, moving it on from its use solely as a 'better' answer machine. It was hoped that this would be achieved through an open and playful interface that offered new affordances.

4.2.1 New affordances through visibility

As reported above, there were a number of ways in which making messages visible offered improvements over conventional answer machines. However, while family members took advantage of these new affordances, they were rarely inspired by them to adopt new social practices. As already alluded to, there were no obvious ways in which calling patterns altered over the trial. There were also no instances of particular family members trying to populate the board with their messages, or occasions in which they experimented with leaving extra large messages to draw attention to themselves. In other words, there was no evidence that individuals used BubbleBoard as a way to remotely project their presence into the home. Nor was there any noticeable increase in the use of BubbleBoard as a way of functionally 'messaging to place'. Contrary to what we expected, BubbleBoard did not become a useful place for families to remotely make requests or leave reminders. When these behaviours were observed, they tended to echo practices that were established prior to the trial.

4.2.2 Openness

Similarly, we did not see any convincing evidence for different kinds of voicemail activities as a result of BubbleBoard's more open design. Other research (Sellen et al., 2006) has shown that a situated notice board was used primarily as a place for displays of affection or 'social touch' by families. On this basis, we wondered whether the safe area would provide a place for saving and drawing attention to messages that are considered special. However, there was only one example of a message being saved for sentimental reasons. Here, a message recorded by the father of *Household C* before leaving for a trip was kept in the safe area "until he comes home and we put it down the plughole". In contrast, when the father of *Household D* was away on business, a message that he left from his hotel was saved in case his wife "needed to ring" him. In this case the reasons were not sentimental, but practical. Householders did not seek to create messages to be saved out of sentiment, nor did they appear keen to save any that might be construed this way. Likewise, we saw no evidence for family members collecting and grouping their messages, or of using the spaces to save and playback different kinds of audio.

A final interesting point regards how rare it was for families to make use of the juxtaposition of BubbleBoard's physical and digital spaces. Here, for example, we fully expected families to use the whiteboard to mark up bubbles in the safe area. To our surprise there was only one instance of this in the whole trial. Here a builder had left a message for the father of *Household A*, which was marked up on the whiteboard as a way of drawing attention to it. When the builder called for a second time, another scribbled message served to expand and highlight the first (Figure 4).

[Figure 4]

What happened instead was that the whiteboard was treated as an independent entity, and ironically, one that was used for a range of purposes that we had expected to see emerge in the context of voice messaging. It served as a place for expressing presence (Figure 5a), enabled calls to action (Figure 5b), supported awareness (Figure 5c), and was used to leave reminders (Figure 5d, top). Additionally, the couple in *Household D* incorporated it into their practice of leaving each other affectionate notes (Figure 5d, bottom). The fact that voicemail was not used for these purposes may reflect the difference between the visual properties of bubbles and the visible content of text. It was instead the whiteboard that was appropriated as a resource for action by our families, albeit one that was used in a fairly predictable way.

[Figure 5]

4.2.3 Playfulness

As a final set of observations, we had expected that the playfulness of BubbleBoard's design would engender experimentation. There was evidence for appropriation here too, but it mainly occurred during the very early stages of the trial. When the BubbleBoards were first put in place, families often recorded amusing messages as a way of testing out the system. For example, the mother in *Household D* created a bubble containing the theme tune for Cartoon Network's Johnny Bravo, while the children in *Household C* created a funny joint message that they liked to play back (much to their mother's annoyance, who eventually deleted it). Messages of this type seemed to be related to the novelty of having a BubbleBoard, although other creative approaches to using the board were sustained for longer. Householders uploaded playful images to represent themselves (Figure 6), and two of our households indulged in a game whereby they tried to make the bubbles grow by repeatedly tapping them, purportedly to see if eventually they "might pop".

[Figure 6]

In general though, entertainment was derived from existing practices, or from messages that were never intended to be funny. For example, a burp was sent to the BubbleBoard in *Household D* from an uncle, as part of a previously-established habit of sending joke messages, and in *Household A* much mirth was derived from a message from a confused grandfather; "My granddad didn't know what was happening, he was like 'Hello, who's speaking?!' [..] I loved it!". While the ease of replaying messages did support listening to them for amusement (this would have been "way too much work" with an answer machine), the design of BubbleBoard did not seem to encourage the development of playful new practices.

5 Lessons and Implications

If this had been a product development trial, much of the above could be taken as evidence of BubbleBoard's success as a visual answer machine. The families were drawn to BubbleBoard and strongly preferred it to their old devices; most expressed regret at seeing it go. We also gathered plenty of evidence to show the ways in which it offered greater flexibility in the interactions it afforded, how it drew in the family, and how its visual properties offered a more elegant way to manage voicemail in a family context.

But this was not a product development trial. It was a trial with distinct research goals, one of which was to explore BubbleBoard as a way of designing for appropriation. Contrary to this, the development of new social conventions was conspicuous in its absence. With a few exceptions, BubbleBoard was incorporated into our families' lives in some fairly unremarkable ways. It was unsuccessful in inspiring new answer machine behaviours, being managed largely by the people who had previously owned this role, and was messaged to as infrequently as conventional answer machines. Where, then, was the creativity we expected to see? Where

were the new emerging practices? It is, perhaps, in reflecting on these questions that the real implications of this research begin to emerge. Looking at why user-led innovation did not occur in this trial suggests many different possibilities, some relatively mundane, and some much more profound.

5.1 Questions of Methodology

There are, for example, questions to be asked around the method we adopted that have wider implications for the ways in which field trials are undertaken in the home. It could be that the expectations of the households were at issue here. The fact that we paid families to participate might have led them to take the use of the technology seriously, maybe overly so. Indeed, the households we engaged were quite diligent in being as helpful as possible, and in treating the equipment with more respect than we had in our early testing. Furthermore, we took the approach of simply introducing BubbleBoard as a 'visual answer machine'. By doing so we may have overly biased families' interpretations of it, or indicated, inadvertently, that there was a 'correct way' to use and think about it. Perhaps we would have seen more experimentation if we had provided provocative descriptions or scenarios of use.

Moreover, it is not clear that we left BubbleBoard with the families for long enough to see new practices evolve. Even where there were the inklings of something new, there appeared to be little motivation for making changes to habits that could not be sustained. The mother of *Household E*, for example, recognised that she could use BubbleBoard to message family members who let themselves into her house during the day: "I think what you could do, which would be quite creative, [would be] if my dad did come round he could almost see if that message was for him, so I could leave him a message: 'Do the washing Dad', or something like that". However, despite recognising these possibilities, she felt that this "would mean training" and, more troublesome, training her father, only to have the device taken away after the study. The need to not only approach the device in an imaginative way, but to also encourage others to change their practices, was perhaps too large an obstacle in this case.

5.2 Questions of Design

Turning from method to issues of design, it may be that we had failed to understand the nature of BubbleBoard's particular affordances. Specifically, it appears we did not pay enough consideration to the nature of voice as a medium, and how distinct it is from other channels of communication. For example, we expected that making some aspects of voice visual would open BubbleBoard up to many new possibilities for use. The basis for this rationale was in large part due to previous research that had looked at text-based messaging to and within the home (e.g. Sellen et al., 2006; O'Hara et al., 2005). A key difference, though, is that with text-based messaging the contents of the messages are open to inspection, and thus can be 'broadcast' at a glance. This is not the case with BubbleBoard, despite the fact that its design did make many other aspects of messages visually available. Indeed, for one of the rare instances of a message being created as a reminder, the resulting bubble was deleted and the content of the message written on, and therefore broadcast using, the whiteboard. On reflection, this may account for why BubbleBoard did not engender some of the practices seen with text-based devices.

Arguments might also be made about the entire design of the visual messaging system and whether it really was as 'open' as we had intended. The design – at a conceptual level, at least – may have been too similar to existing answering machines. In other words, despite our efforts to render audio recordings visually, the affordances simply weren't different enough to provoke new ways of seeing, interacting with and thinking about audio messages. This brings us back to prior arguments in the literature that explore ways in which to design for ambiguous or multiple interpretations. Gaver et al. (2003) have proposed that elements of ambiguity require users to actively engage in meaning-making processes, a suggestion that resonates with

arguments about how one needs to make technologies "strange" if one is to create opportunities to actively reflect on them and open up the design space (Bell et al., 2005).

5.3 BubbleBoard as a Lens on Family Life

It may be though, that the real lesson from this trial is not about the resiliency and familiarity of metaphors and design, but rather about the resiliency of family life in determining how technology is used. Unlike Comeks (Salovaara, 2007), which was able to support existing communication habits while also inspiring new ones, BubbleBoard was simply subsumed into the established practices of the participating homes. The social order of the households asserted itself so swiftly that it slipped into existing routines almost without thought.

Thus, while younger children enjoyed the playful aspects of listening to the messages and drawing on the whiteboard, the fathers and older teenagers were prone to slipping into old patterns, if not caricatured roles. One husband said of his wife's control of their BubbleBoard, "Well someone's got to look after it, I mean poor little BubbleBoard, it needs polishing", while another commented that messages are "normally for [my wife] anyway". This clearly has wider implications for the practicalities of messaging to place; as the mother in *Household C* said of her husband, "He's not reliable enough to pick up a message really". Furthermore, the teenagers appeared more concerned with their privacy and independence than actually using the device for messaging. Doing his best to assert his autonomy, the son in *Household A* readily told us, "I suppose to be completely honest I don't have much contact with my family [..] if I do anything, I do it myself". It was mothers, as we have said, who were thus left with much of the practical work of listening to and managing messages.

So, not only had we succeeded in slotting BubbleBoard in as a replacement to the answer machine, we had succeeded, too, in slotting it into the households' routines and social orderings. Revealing here is to reflect on what this suggests about family life more broadly and, in turn, what we can learn about how families orient themselves around technologies that are supposed to be adaptable and promote appropriation. Echoing past works from the likes of Tolmie et al. (2002), our trial provided us with an example *par excellence* of how a family's roles are practical achievements, worked on through routine practices. Even mundane chores like checking answer machine messages appear to have their part in the 'unremarkable work' families deploy to "communicate, organize, coordinate, etc." (p. 404, Tolmie et al., 2002). Seeing this through the introduction of BubbleBoard added an interesting dimension to these organising practices. We saw how this ordinary work can *sustain* a family's social order, in a fashion ensuring its resistance to the seemingly unfamiliar. In short, BubbleBoard's incorporation into established patterns and routines offered us an indication of how social forces shore up the social organisation of the family.

In our understanding of families, then, we have learnt something of how they are kept intact as socially organised entities. Social forces may well work against our attempts to introduce technologies that will disrupt existing patterns of use. This suggests that designing for openness, playfulness or even ambiguity may not be enough to promote innovative usage, especially where established practices are concerned. The Drift Table (Sengers and Gaver, 2006), so illustrative of Gaver's ideas on ambiguity, arguably had few if any established practices to contend with. Even SMS, while built on the back of a familiar technology, was novel enough to provoke new social conventions. These technologies *demand* some form of interpretation by their users from the outset, in a way that BubbleBoard simply did not.

6 Conclusion

While BubbleBoard offered a marked improvement over conventional answer machines, it did not provoke our families to appropriate its features in new and interesting ways. By sitting between clarity and ambiguity, we were unable to inspire family members to really think about the new uses that BubbleBoard could be put to, while at the same time failing to make clear what these were. BubbleBoard was playful and enjoyable, but it was not 'strange', and because of this it was easily assimilated into family life. In hindsight, it appears that we were not sufficiently mindful of what would be needed to disrupt the existing conventions surrounding family answer machine use. In short, replacing a device with well-established social practices demands careful attention regarding where, and also how, it might be provocative. In other ways though, the trial was a success. It led us to consider how we might design for appropriation in the future, and furthermore, it deepened our understanding of family life and the ways in which new communication devices find their place within the home.

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Figure captions:

Figure 1. The BubbleBoard device.

Figure 2. A short message that has not been listened to and a longer message from an unknown caller.

Figure 3. Bubbles arriving and settling at the bottom of the display.

Figure 4. Annotation of a bubble using the whiteboard.

Figure 5. Other uses of the whiteboard.

Figure 6. Images used to represent regular callers.