Beyond the Snapshot
From Speculation to Prototypes in Audiophotography

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ABSTRACT
In this paper we describe techniques used to move from a wide variety of speculative concepts to three working prototypes of potentially commercial audiophotography products. Stages in this trajectory included illustrated workbooks, video envisionments, form models and technical drawings, and ended with working prototypes using microprocessors to simulate standalone products. These methods were useful in communicating with our partners in a multidisciplinary collaboration. At each stage, however, we left many details of our designs purposefully unresolved, in order to encourage our own and our partners' imaginations as part of the design process.

Keywords
Audiophoto, design research, design methodology, prototypes.

1. INTRODUCTION
In this paper, we describe a recent project on audiophotography to illustrate our approach to focusing speculative design ideas into product prototypes. Audiophotography, in which short (~30 seconds) fragments of sound are captured with images, had been developed by researchers from Hewlett Packard [4, 5] as part of the company's ongoing interest and activity in digital photography. They sponsored us to open and extend their ideas as part of a collaboration with the Appliance Design Studio, a virtual organisation coordinated by Appliance Studio Ltd. [1] which spans ourselves, Hewlett Packard, and IDEO Product Development.

During the project, we used a variety of methods to explore and communicate our design ideas. A feature of all of them was that we kept decisions open as long as possible, purposefully underspecifying aspects of the designs to allow our partners and ourselves to imagine how they might be developed. This proved valuable in allowing us to nurture ideas, which, seemingly impractical at first, proved essential to our final designs.

Here we start by briefly describing a series of speculative concept proposals, developed before we joined the audiophoto project that set the tone of our approach. We then introduce the audiophoto project and illustrate our methods for exploring and defining our design concepts. Finally, we reflect on the value of using speculative prototypes in developing new possibilities for technology.

1.1 Speculative Design Proposals
Although the notion of information appliances has captured the imaginations of many, only a few tangible examples exist that allow us to imagine how this design space might eventually be populated. At the outset we decided to expand the space further by developing a series of conceptual proposals, which we presented in two workbooks shared with our partners [6]. A major role of these proposals was to highlight values that we felt needed to be addressed, in this case the cultural and social impact of such devices.

We adopted a technique for presenting our ideas in the workbooks that used collages to illustrate the ideas and narrative text to suggest their functionality (Figure 1-4). Juxtaposing found imagery allowed us to create designs that evoked alternative relationships between an object's form and functionality. By merging such disparate elements we could hint at these relationships without prematurely committing ourselves to fine details. Our intention was to ensure that people viewed and judged the ideas based on their functions and the new social and cultural roles they might offer rather than their appearance [see 7]. In addition, we wrote supporting narratives encouraging speculation about how these objects might be used. This enabled us to explore a set of values that we felt were important to incorporate in the development of new information appliances, suggesting playful devices that encourage curiosity and explore psychological and emotional content (an approach influenced by Dunne [3]).

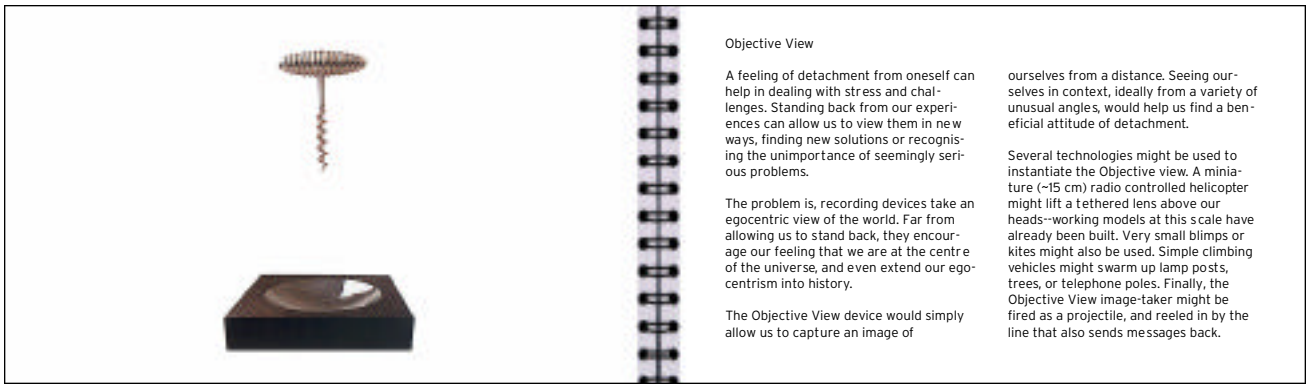


Figure 1. The Objective View speculated about cameras that could take pictures of oneself from a distance.

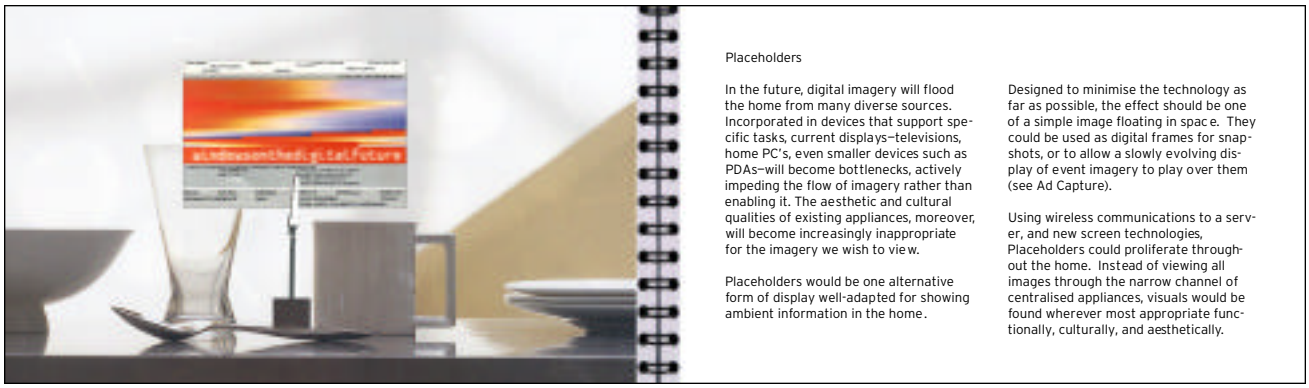


Figure 2. Placeholders suggested that images could be sent wirelessly to stand-alone displays around the home.

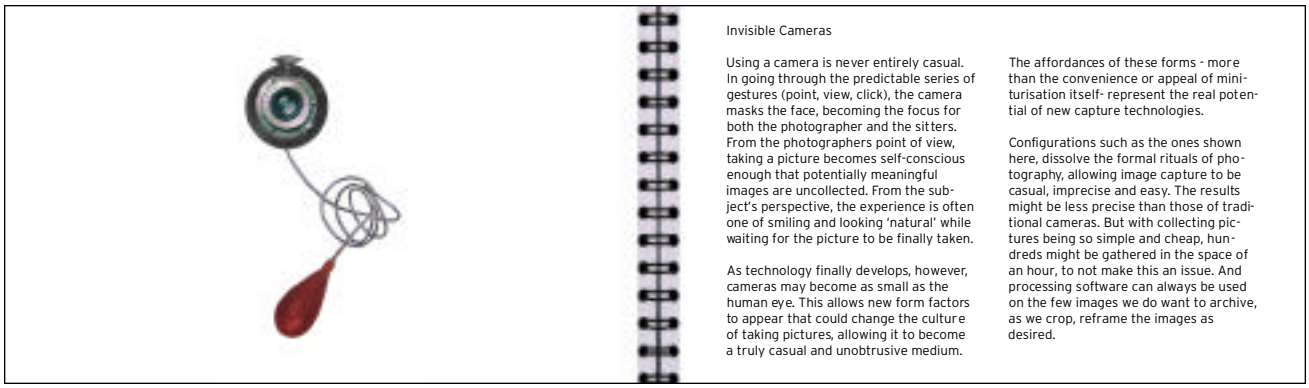


Figure 3. Invisible Cameras explored cameras to wearand use casually.

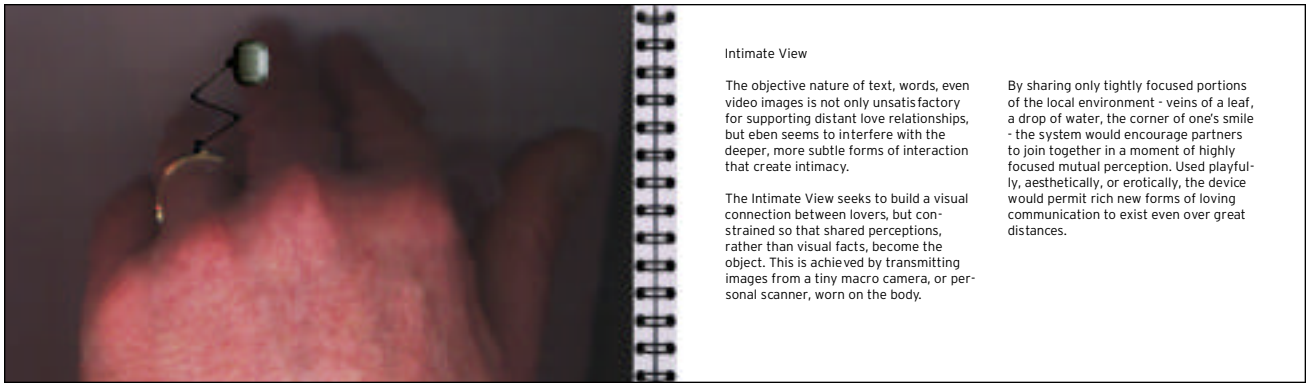


Figure 4. Intimate View Camera proposed sharing detailed images to create moments of shared focus between lovers.

1.2 Audiophotography

Wide ranges of possibilities, from household digital displays (Figure 2) to devices supporting psychological and spiritual insight, were explored in our initial proposals [6]. Several, however, used image capture to achieve their effects (Figure 1, 3 & 4). Recognising the overlap, our partners invited us to develop these proposals, and the values we were exploring, as part of an ongoing project on audiophotography.

The basic premise of audiophotography is that people may find value in capturing sound as well as images, a possibility afforded by new digital devices. Although several commercially available digital cameras can capture sound, this usually takes the form of short video clips. In contrast, David Frohlich and his colleagues from Hewlett Packard [5] found through consumer research that still images combined with sound were also appealing to users. In addition, several strategies had been explored for attaching sounds directly to photographs, for instance by using small memory chips [4]. With this as a starting point, we were invited to explore audiophotography as a medium to uncover new possibilities for its use.

We began the project by formulating a series of questions that we deliberated during our brainstorming sessions. Because we were unaware of the exact technical specification of the audiophoto cameras, we were unaware of its functional capability, and thus its limitations. Having no limitations gave us the creative freedom to explore how we would ideally like to use this new medium. We began to question whether this medium could facilitate new forms for communication between people. How would such a system work? How would the images and sounds be displayed or heard? Would they be downloaded to the Internet or displayed on large electronic billboards in public spaces, where people could download, donate and share their images and sounds? Could sound be printed directly onto the printed image? If so, how would the sound be accessed? If a photograph were taken at the top of a hill what sound would be heard? Would it be worth recording? If not, could alternative sounds from different locations be juxtaposed to re-contextualise the image?

Our final design proposals emphasised the potential for casual and playful forms of photography. Currently, the action of taking a photo is seldom casual. Looking through a viewfinder, pointing the camera in the right direction and clicking the shutter release all take time and attention away from engagement with the event being captured. The result is that most of us are familiar with just missing the perfect photo opportunity. In addition, looking through the viewfinder tends to mask the face of the user, which in turn becomes the focus for the sitter. This creates an element of self-consciousness for both parties, and the result is a collection of often staged images, as the sitter tries to portray a natural pose.

Having already explored several novel and poetic uses for image capture in our workbooks, we were further inspired by Lomo cameras [8]. The Lomo Action Sampler is an inexpensive camera which takes four images in quick succession to give the impression of capturing sequential movement. The combination of its price, its appearance, and its novel functionality encourage a new style of photography that is uncontrived and spontaneous. The manufacturers extended this further by recommending that the viewfinder should not be used at all. We appreciated the light-hearted manner of the Lomo camera as it allowed the object and the process of taking a photograph to be more experimental and playful (Figure 5).

Figure 5. Examples of images taken with a Lomo Camera.

One of the features of digital photography, we realized, is that users may take hundreds of images without the extra cost of developing and processing film. Moreover, miniaturised internal components could allow digital cameras to become much smaller, allowing us to experiment with several new form factors. These forms were not chosen for their aesthetics, but for the new affordances they could offer users. In order to allow users to try these various new configurations without having to buy multiple cameras, we proposed that the camera lens itself, along with the circuit boards and the batteries, could become separate components that operate with new add-on extensions.

Most of the concepts we developed were aimed at trying to obtain an alternative perspective on our existing world. We altered the action of capturing images and sounds by omitting a viewfinder and trying various add-on extensions for the camera. For example, we explored the idea of changing the perspective of the camera by placing it on a small remote-control toy car (figure 6), and tested the results as we roamed around galleries, parks and streets. We mounted the camera on the end of an aerial (figure 7) and walked around trying to imagine what pictures we could take if the idea existed as a product. We

Figure 6. Stills taken from one of the video scenarios. A camera is mounted on top of a remote control car and begins to offer an alternative perspective on the world.

found ourselves exploring the inside of bushes, investigating inaccessible areas under floorboards, around corners or amongst a group of squirrels. We also explored the possibility of cameras reacting to sound as well as recording sound, by sitting with a bunch of friends and taking photos when they laughed or talked loudly. Finally, we developed ideas from the earlier workbooks, such as the Objective View (Figure 1), and the Intimate View camera (Figure 4).

We soon realized that the camera was enabling and encouraging us to explore our existing environment in new ways. Digital photography means more than being able to download, manipulate, and distribute images: it could allow image capture to play many, and more poetic, roles in our lives. In the following stages of the project, then, we used a variety of prototyping techniques to explore and communicate these ideas further.

2. PROTOTYPING

Designers use different prototyping techniques to test specific design attributes and to solve problems that may occur as the design is being developed. Appearance models are used to test the form and aesthetics of a product, storyboards and video scenarios are used to explain the role of the product and 'touch and feel' prototypes are used to test interactive qualities without requiring focus on details of technical implementation (c.f.5).

Throughout the development of the audiophoto project we adopted and used a variety of these techniques. We used prototyping not only to refine and communicate our ideas, however, but as a means of stimulating and generating further ideas.

2.1 Video scenarios

Video scenarios, as a technique, are widely used in research centres and the computer and consumer electronics industry. It is a method that enables designers to create and communicate a mode of use for complex interactive products and systems.

For example, the project 'Vision of the Future' by Philips used video scenarios as a technique for explaining numerous speculative design ideas for products of the future [9]. The videos were informative and provided a quick and accessible means

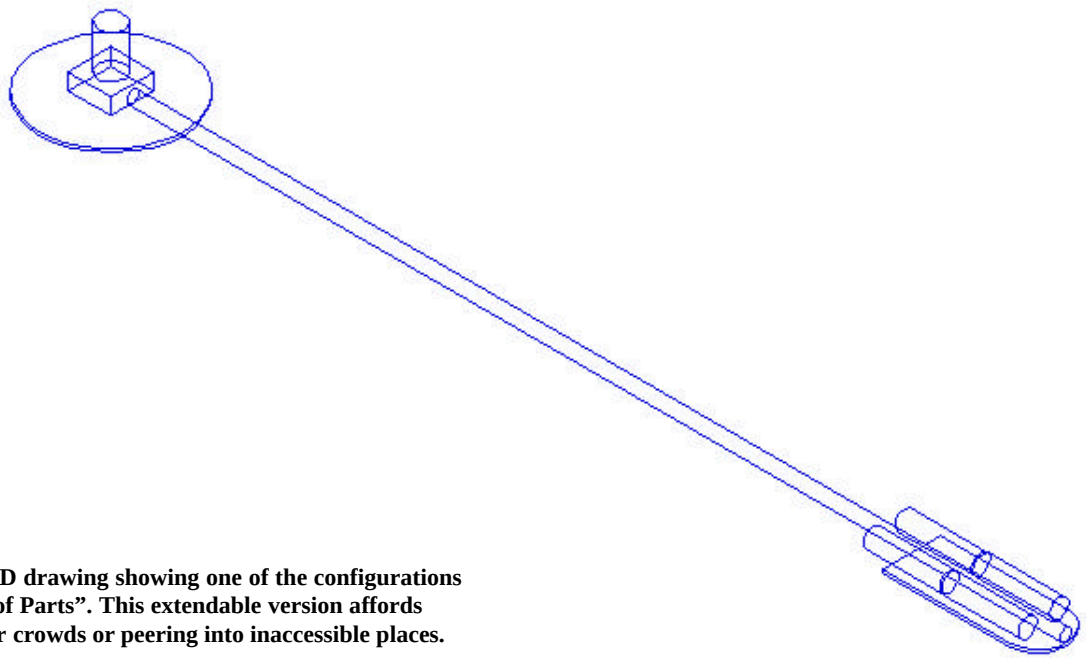
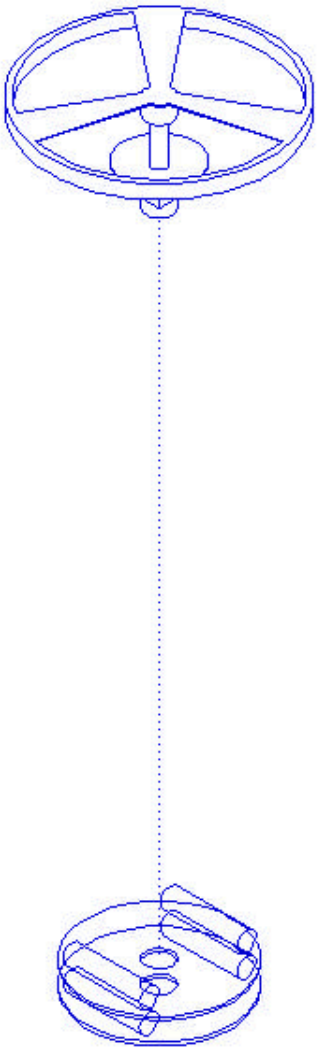


Figure 7. CAD drawing showing one of the configurations for the “Kit of Parts”. This extendable version affords reaching over crowds or peering into inaccessible places.

Figure 8. CAD drawing of an another add-on extention. A version of the Objective View Camera (see figure 1), it uses a hand-powered helicopter to allow images to be captured from high in the air.



for viewers to understand a product function, form and interactive qualities. These films, however, were used primarily as a presentation tool rather than a way of trying to expand the design space. The resolution and high cost of the films (involving actors, film sets, and film crews and computer animations) required ideas to be highly developed before filming could begin.

Rather than using video scenarios purely as a presentation tool, we tried to use them as a development tool, allowing our ideas to evolve and mutate freely during the process. We intended the films to be like animated sketches, taking a casual and unrehearsed approach. Such improvisation meant that we could explore the original concept further, without being forced to resolve issues prematurely [2]. We found that many of the possibilities of our ideas became clear only during the process of finding scenarios to video.

Scripted videos are often used to ‘spin’an idea, often suggesting that a product concept will make peoples’work easier, relationships closer and lives more fulfilling. We tried to avoid a strong narrative, in contrast, kept the potential use of the objects open for discussion and allowed viewers to express their own interpretations and misinterpretations. We used no dialogue in the videos, but instead relied on background noise and visual clues to set the context. We tried to allow the viewer to feel as if they were observing the scenario first-hand, rather than an enactment from a scripted story. Such features helped us to stimulate discussions that revealed ideas that were richer in content than the originals and stretched our imaginations in new directions.

2.2 Functional models

In conjunction with the filming of the videos, we built several functional models to describe the way each of the designs was to be used. The purpose of creating these models was to test not only the functionality of our concepts but also to use them as props in our video scenarios. The low grade of these models (made in white card) was intentional, and proved appropriate for the medium of video as it lends itself to creating an overall impression of a scene, rather than overemphasising any detail.

We intentionally used an "underdesigned," spare aesthetic design at this stage to avoid any bias towards a particular idea based on its appearance rather than its function. The dimensions of the models were based on given component specifica-

tions, such as the circuit board, camera optics and batteries, and reflected our idea for a "Kit of Parts", a system of add-on extensions for the basic camera module (Figure 7&8).

Throughout the process, we tried to capture just enough detail of the ideas to encourage our partners and ourselves to imagine living with the objects, whilst also leaving many aspects unspecified to encourage speculation rather than evaluation. In presenting the models, drawings, and videos to our partners as the design ideas progressed, we found they worked well in this regard, bringing out aspects of the designs that we wanted to promote, and leaving room for other possibilities to be raised.

3. 'TOUCH & FEEL' PROTOTYPES

Not only does the design of an interactive object require consideration of its form and physical functions, but equally important is the design of the interactive experience itself. The way the user interacts with the object and how the object responds to the user is crucial. The most effective way to achieve this form of experience is to build a working experiential prototype. Small programmable microprocessors such as stamp chips enable designers, rather than engineers and programmers, to prototype the complete experience of using an interactive object (with the exception that the prototype is usually tethered to a computer). Their relatively small size also

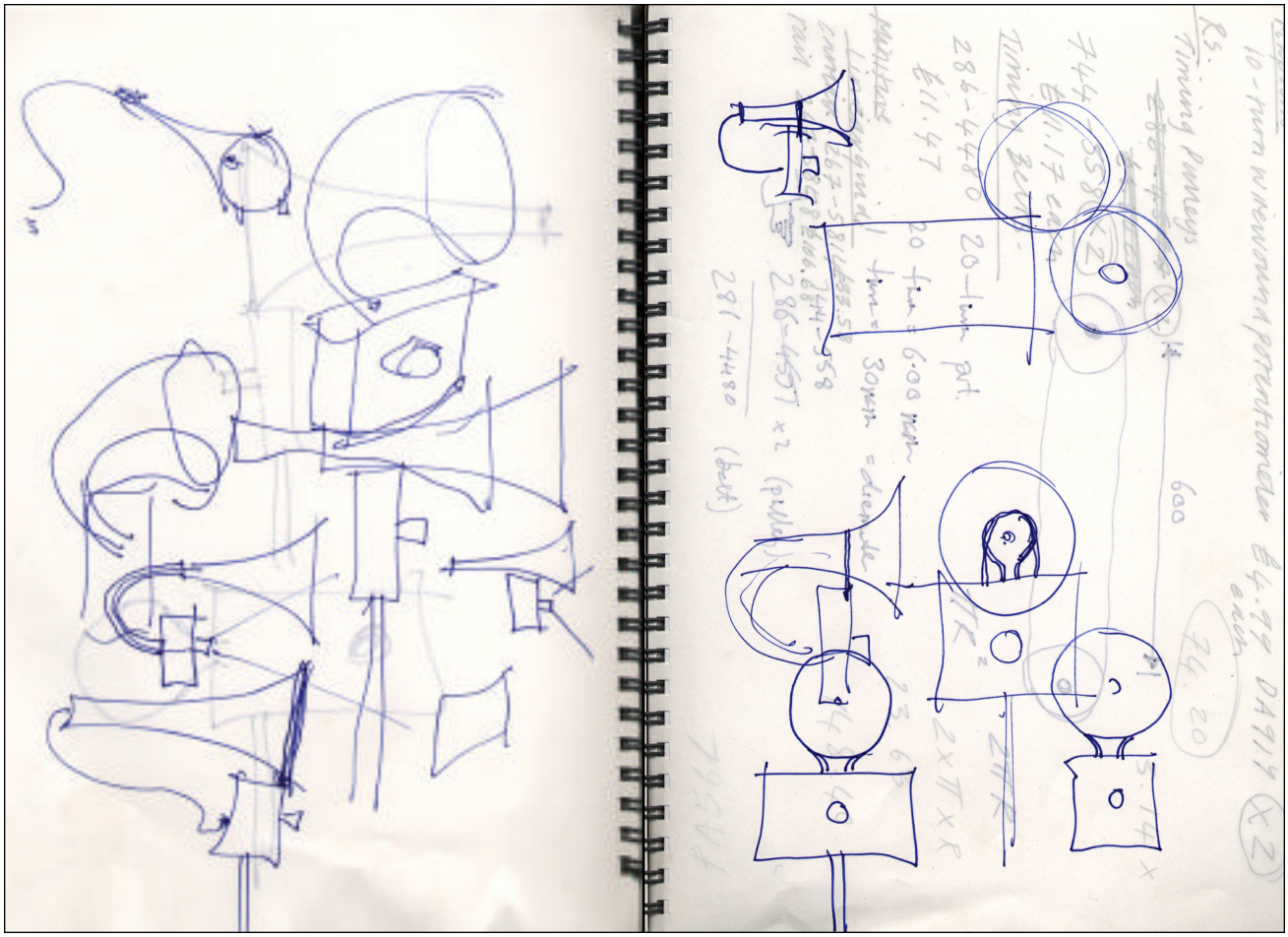
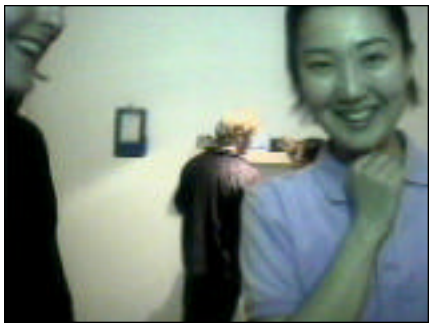


Figure 11. (above) Sketches of the Eavesdropper Camera showing the development of the form to indicate that the camera was listening, as well as watching, you. Figure 10. (below) Images taken by the Eavesdropper Camera at the Show.



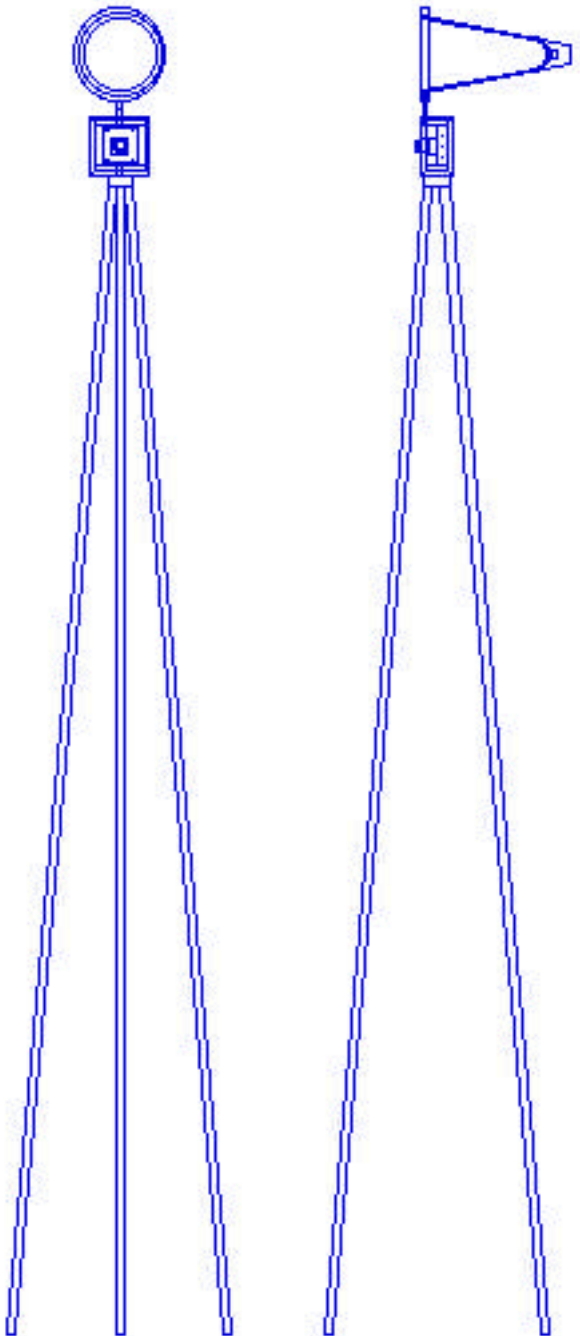


Figure 9. CAD drawing of Eavesdropper Camera.

allows chips to be embedded in the objects themselves, giving an opportunity to design the behaviour, form and aesthetics of the object.

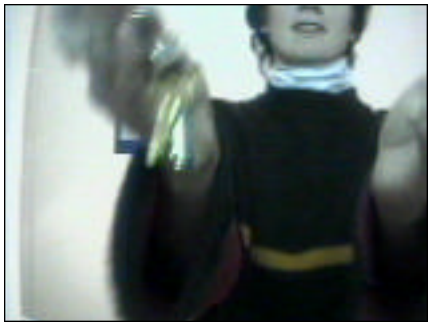
We developed a selection of the ideas explored in the video scenarios to create working prototypes. The selection involved balancing desire with practicality: while we believe that all our proposals are technically achievable, some (like the flying Objective View camera) were beyond our prototyping capabilities. In the end, we developed those ideas which we felt we could realistically implement using off-the-shelf technologies reconfigured in various ways, while still retaining the forms and functionality that we found compelling. This was a process of continual adjustment, as technological constraints appeared throughout the process which forced designs to be rethought.

In developing the prototypes, we began with CAD drawings for each idea, based on the earlier functional model dimensions and sketches. To avoid people viewing the objects as commercially available products we tried to keep the aesthetics of the objects understated. This was also to accentuate the experiential, rather than the aesthetic, qualities of the prototypes. Our intention was to encourage users to react to the functions of each object and experiment with the images and sounds that they might capture.

We presented the working prototypes as part of an exhibition at the Royal College of Art in November 1999. The show, titled "This Appliance Must Be Earthed", presented a wide variety of work from the Computer Related Design Research Studio over a period of 10 days. With many visitors from the general public, as well as students and staff at the Royal College of Art, it provided us with a means for getting feedback about our proposals. To help contextualise the work we played the earlier video scenarios showing how the ideas were formulated. Central to the exhibition, however, were the three prototypes which people could use.

3.1 Eavesdropper Camera

The Eavesdropper camera (Figure 9) was developed initially as a video scenario. We began to wonder whether an audio camera could not only record sound, but "listen" to sound as well. If so, the camera might become automatic, constantly listening for sounds loud enough to trigger it to capture an image. This would alter the process of taking a photo by giving an element of freedom to the person using the camera.


The Eavesdropper camera removes the photographer from the focus of the event, instead allowing the photographer and the sitter to trigger the shutter release at unexpected moments. We liked the idea that the camera would not only capture people unaware, but that sounds such as laughter or voices could trigger an image to be captured.

During the Show we collected over 3000 images, a result indicating how many people played with and used the Eavesdropper camera. The images (Figure 10) begin to demonstrate how people were indeed caught unaware, laughing and in some cases intentionally making sounds to trigger the shutter release.

3.2 Digital Shelf

The Digital Shelf, our second prototype, was a device for listening to audio postcards printed with images and sounds taken by an audiophoto camera. The sounds, each about 30 seconds long, were represented by barcodes on the reverse of each postcard (Figure 12). According to our scenario, these codes would direct the shelf to retrieve sounds over the Internet, while the cards would be printed either by an audiophoto bureau or at home using a special printer. The Digital Shelf concept was also influenced by one an earlier proposal, Placeholders (Figure 2) from the original workbook.

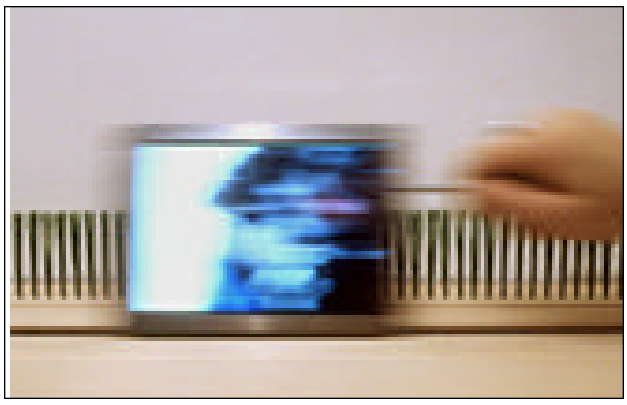
We proposed that the Digital Shelf would not only be able to play the sounds from each card, but store both the image and sound digitally. Rather like a digital photo album, the small postcard-sized screen would allow hundreds of different images and sounds to be displayed and played. Such a system would enable people to send or swap their audio postcards with friends or family, confident that the shelf had stored each audio postcard permanently.

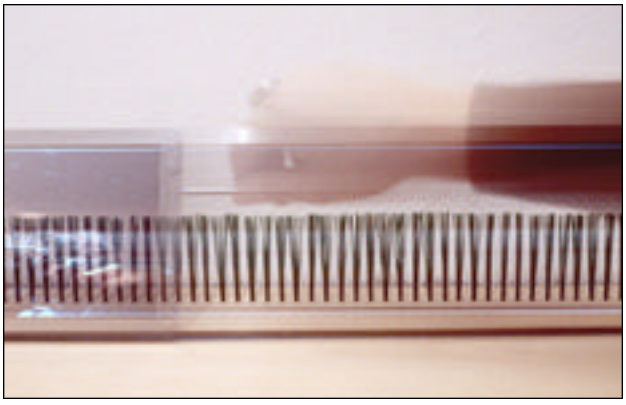
In our implementation, placing an audio postcard in a narrow slot in the shelf (Figure 13) would play the sound associated with the audio postcard. As the audio postcard sound played, both the sound and the image were digitally transferred to the shelf via an internal barcode scanner. A digital replica immediately appeared on the screen, confirming that the image and sound had been stored correctly. When the audio postcard was removed from the shelf, the sound being played stopped, leaving the digital copy remaining on the screen.

The action of sliding the screen along the length of the shelf allowed the listener to 'flip'through the audiophotos stored by the shelf (Figure 14). Stopping the screen at any point along its path caused the digital version of an audio postcard to appear on screen. After a few seconds, if the screen remained motionless, the sound associated with that particular image was

Figure 12. An example of an audio postcard. The sound clip is accessed via the barcode on the reverse of the card.

Figure 14. Sliding the screen along the shelf causes the screen to 'flip'through any previously stored cards.





heard. Each time a new audio postcard was digitally stored it appeared on the screen, no matter where the screen was positioned. As soon as the screen was moved the same digital image was then repositioned to a virtual location at one end of the shelf. This meant that every time a new image was stored, regardless of where the screen has been left along the shelf, it became the last in line to be seen.

We felt that it was important for the form of the shelf to make references to the aesthetics of the home and the way people display photographs and postcards on mantelpieces and shelves. The materials for the prototype, in this case beech wood, gave reference to a domestic environment, without being too explicit. The series of bristles running along the rear of the shelf were for the audio postcards to rest against when they were not in use. In order to make the audio postcards self contained we experimented with attaching a thin layer of piezo film directly onto the card to act as a speaker. After testing this concept as a prototype however, we realised that the quality of the sound produced through the piezo film was not loud enough, prompting us to reconsider the concept by placing the speakers in the shelf itself.

The concept behind the shelf was to encourage people to exchange audio postcards amongst themselves sharing particular and special moments collectively. This idea could extend to other applications, such as audio flyers for advertising a concert. In addition to a card showing an image of the event, a sound clip could accompany it, which would allow people to sample the music before making a commitment to attend the event. Many other uses for the audio postcards can be imagined, indicating the generality of the concept as a medium, which could work equally well in private, public and commercial spheres.

3.3 Intimate View Camera

The final prototype was the Intimate View camera, developed from one of the original workbooks (Figure 15). The proposal was for a camera that would take only small, tightly focused images that could be exchanged wirelessly between distant lovers. By sharing only a fragment of the environment, such as the veins of a leaf, a drop of water, or the corner of a smile, partners might join together in a moment of highly focused mutual perception.

We began the development of this concept by placing a small plastic magnifying lens directly in front of a digital camera and experimenting with the kinds of pictures we could take. Capturing details for their aesthetic qualities or the personal associations they had, we gathered a collection of images that convinced our partners of the potential of the idea (figure 16).

Figure 13. Placing a card in the shelf displays the same image on the small LCD screen and plays its sound simultaneously.

Figure 15. The Intimate View Camera prototype.

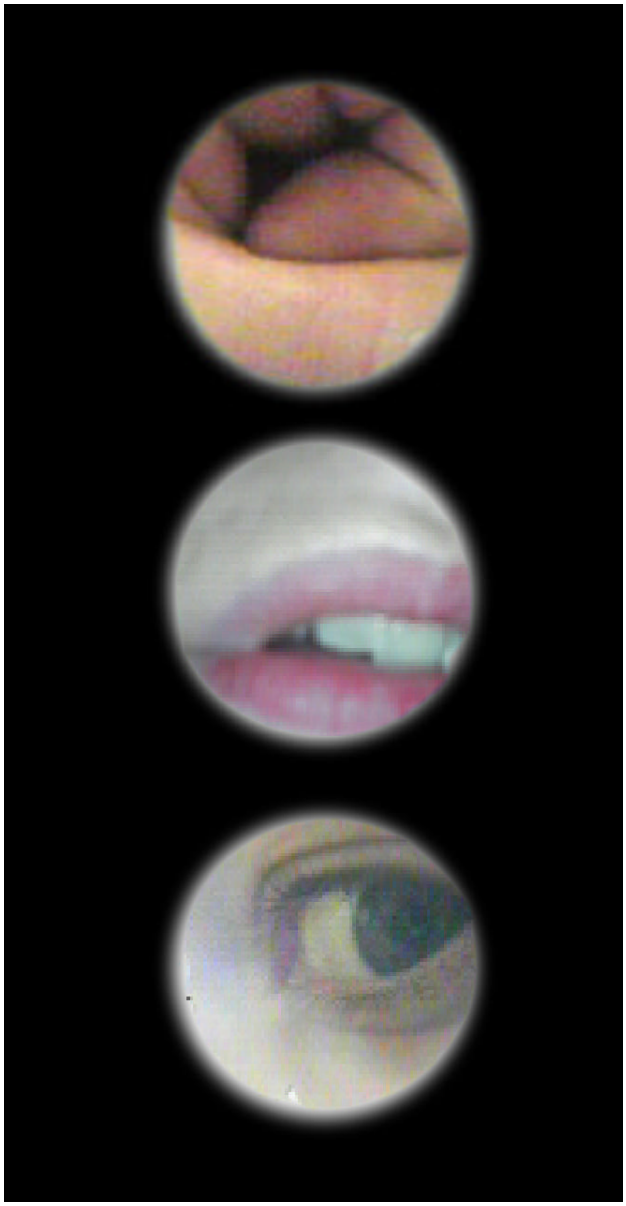


Figure 16. Images taken with the Intimate View Camera.

For the working prototype, we used a small video camera about the same size as a disposable cigarette lighter, housed in a translucent plastic casing. The camera had a macro lens mounted in front of it, so that it could only focus on objects within about 25mm of the end of the lens. Both to indicate this distance and to provide light, a fringe of fibre optics was mounted on the front, which glowed when the camera was moved.

We played on the visual language of a probe by formatting the images to be round, rather than the typical landscape or portrait formats. This helped in giving the images a softer and more intimate connotation, giving the results a distinctive identity. Within the exhibition, we displayed the images on a flat panel screen on the floor underneath the hanging camera. Images that had been taken during the course of the show slowly faded in and out when the device was not being used.

4. CONCLUSION

The experiential prototypes of the Eavesdropper Camera, the Digital Shelf, and the Intimate View camera were well received both by our partners and by the general public attending the exhibition. Thousands of images were captured as people played with the devices, exploring what they offered and finding new ways to use them. Although experiencing the prototypes in an exhibition context has clear differences from using them in everyday situations, the event provided a valuable opportunity to test the concepts, and the results encouraged us that they had potential viability as commercial products.

Beyond this, however, the process of exploring ideas through concept proposals, videos, form models, and prototypes taught us that digital photography could extend beyond replacing film cameras. Cameras that afford new uses and a nonchalant approach may offer new roles for image capture, offering unusual perceptions and insights and new forms of communication. In hindsight, this realisation, more than the specific prototypes we built, was the most significant result of this project.

The purpose of this paper has been to illustrate the tactics we used in to develop these new concepts for audiophotography. In particular, we have tried to indicate how we used these methods–most in common use within commercial and research establishments–in an improvisational and exploratory way. By approaching various kinds of prototyping with this attitude, the methods became a means for us to do research as well as to communicate with or convince our partners.

For each form of prototyping, some aspects of the designs were made concrete, while others were left intentionally unspecified. This balance allowed ourselves and our partners to test ideas about functionality, experience, and so forth, while preventing design decisions from becoming reified prematurely. The abstractness or ambiguity of the results, from prototypes to models and even to the final experience prototypes, allowed a continuous process of rethinking and refinement to continue through the course of the project.

It is interesting to note that the final results of this project—the three prototypes—were developed to a level where more traditional validation efforts could begin. One of the features of our process, in comparison to that used by many commercial and academic establishments interested in such technologies, is that we spend a relatively long period of time exploring ideas and roles for technology before implementing working prototypes. During this period, all of our research methods, from the workbooks to the videos, form-models, and so on, work in themselves as prototypes—not only in the technology sense, but in the effects and experiences that they offer.

From this point of view, it is important to appreciate the role of the original concept workbooks in the trajectory that resulted in the final prototypes. Developing speculative design proposals is useful in exploring new aesthetic, functional, and cultural possibilities for technology. Yet the results can appear idealistic or even frivolous, irrelevant to commercial realities. We hope to have illustrated here that such work is an important foundation in a process of design that considers cultural desire as well as technological and commercial feasibility.

5. ACKNOWLEDGMENTS

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