How can *technology* support *creative activities*? This chapter presents our experiences in this field with the *TRI Setup*. We explore how *new media* can support designers in the *conceptual phase of design*. Many elements of the TRI Setup (or TRI) were included in the design of Cabinet presented later in this thesis.

The first part is based on a paper published in *CyberPsychology & Behavior*. It *describes* TRI as a whole and elaborates on the earliest applications of TRI with *Video Collages*.

Because TRI served us so well and still *influences* our work, the article is complemented with a *summary of experiences* with TRI over the last years, from several publications.

We take the perspective of *tool developers* with experience in *Virtual Reality*, *perceptual psychology* and *design practice*. In the first two sections we once again look at how designers *surround themselves* with *visual material* from the perspective of *tools* and *technology*. With TRI we have gained *valuable insights* in *expressive body-scaled interaction*, *sketchy use* of *new media* and the *use of light* as *design matter*.

This work was *initiated* by Pieter Jan Stappers in the 1998 *TWAIO course* and was developed in late 1999 in *collaboration* with *SARA*. At the moment of this writing, TRI is *still actively used* in the ID-StudioLab.

ABSTRACT

Product designers use imagery for inspiration in their creative design process (Athavankar, 1997). To support creativity designers apply many tools and techniques, often relying on their ability to be inspired by found and previously made visual material and to experience the atmosphere of the user environment. Computer tools and developments in Virtual Reality (VR) offer perspectives to support this kind of imagery and presence in the design process. But currently these possibilities come at too high a technological overhead and price to be usable in the design practice.

This chapter proposes an expressive and technically light-weight approach using the possibilities of VR and computer tools, by creating a sketchy environment, using a technique we call "Video Collages". Instead of relying on highly realistic or even "hyperreal" graphics, these video collages use lessons learned from theatre and cinema to get a sense of atmosphere across. Product designers can use these video collages to re-experience their observations in the environment in which a product is to be used, and to communicate this atmosphere to their colleagues and clients. For user-centred design, video collages can also provide an environmental context for concept testing with prospective user groups.

This chapter is largely based on: **Keller, A.I. & Stappers, P.J.** (2001) Using video collages in the design process to experience presence and atmosphere. *CyberPsychology & Behavior, Special issue on Presence, 4* (2), pp.215-223.

3.1 Introduction

To capture their imagination, designers currently use a variety of methods, such as sketches, collages and mock-up models (Kolli *et al.*, 1993). These methods allow the designer to create, organize and communicate rich visual media. As the interaction and complexity of products increase, designers also need more narrative tools to capture, organize and communicate the way products are used. For this, designers have started to use methods used in theatre and cinema, such as role-playing, scenarios and storyboards, in their design process (Verplank *et al.*, 1993).

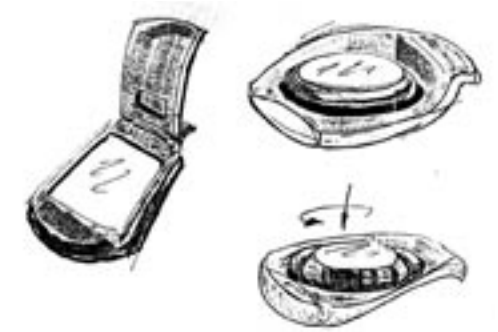
We believe that new tools and developments in VR offer possibilities to support and even extend the methods that designers use right now, if they offer good interaction, usability and aesthetics (Stappers & Hennessey, 1999). But current VR systems, though very impressive technologically and perceptually, do not sufficiently support the fluency and interactivity needed to inspire designers in their creative process. In particular, the technical overhead of creating applications, setting up the system and calibrating the system for the user (Krueger, 1995), keep these VR systems from being a suitable alternative to the traditional tools for inspiration (Stappers *et al.*, 1999). This situation is definitely improving, but still far from acceptable for conceptual design tools.

In our research we explore the possibilities of new inspirational tools by offering a possible solution and using it in a given design process. This chapter reports experience in constructing video collages to elicit the feeling of presence in a product's use context. *Presence* is a person's ability to experience a certain location or context. From the perspective of designers seeking presence, aspects of *atmosphere* are more important than any realistic or geographic location. This is similar to the use of the term *presence* in cinema or theatre (Naimark, 1997).

The discussion here focuses on the concepts and early observations. We look at the role of video collages as an inspirational tool in the design process, but also at how the act of making these video collages can help the designer explore the design issues related to the user environment.

3.2 Inspiration & context

Imagine you are a designer being asked to design a new interactive device for consumers to be used in the kitchen. How would you take this description as a starting point for a meaningful product design? Aside from the technical issues, the designer needs to address the interaction, usability and aesthetics of the concept. A creative solution for this requires the designer to find inspiration for this assignment. This is the main focus of our research on tools and methods in the conceptual phase of design.



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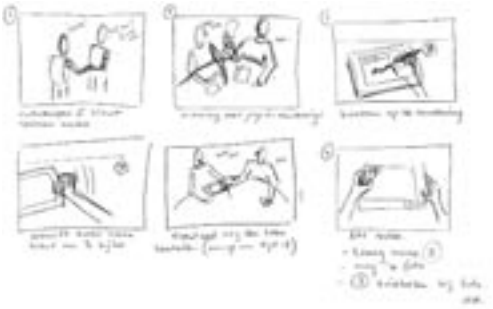

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1 Traditional ideation tools: sketch exploring different details

2 Traditional ideation tools: collage conveying atmosphere of leisure time

3 Traditional ideation tools: exploring handling in a foam mock-up

4 Theatre derived tools: storyboard for a sketching device

5 Theatre derived tools: designers role-playing a situation

The term User-Centred Design or UCD implies an emphasis on the human user – his perceptual, motor, and cognitive skills. A user-centred approach usually relies heavily on user participation and extensive user testing, to develop a product that best fits the user's need (Norman, 1988).

The conceptual phase of design (or ideation phase) is the initial phase where designers discuss and explore their ideas, using many different methods to visualize them (McKim, 1980). Observations of the designer's workspace show that some of these visualizations are pasted on the walls and periphery of the workspace to serve as a source of inspiration in the creative process (Kolli et al., 1993).

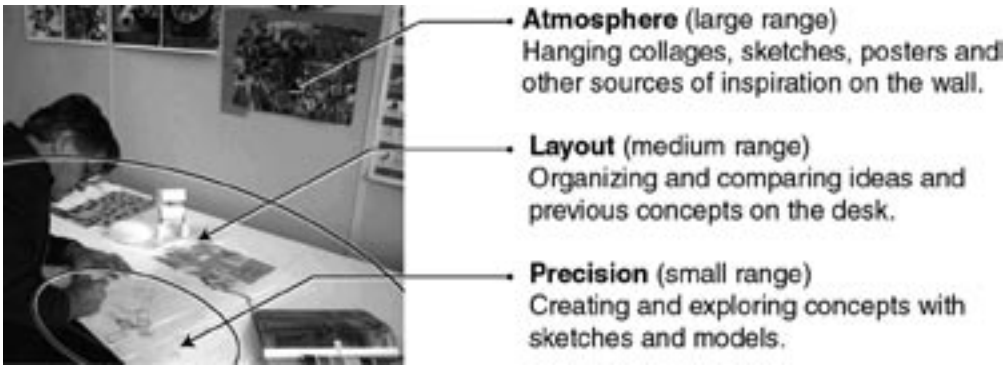
The traditional tools designers use for inspiration are shown in figures 1 to 3: sketches, collages and rough mock-up models. These tools and techniques are the most widely used by designers as they support imagery, associative thinking and imagination skills, without high technical overhead and with readily available materials such as pen, glue, clay, foam or paper.

Sketches are useful to create, explore and communicate shape and appearance of a design and are the most widely used tools for idea creation (Verstijnen, 1997). Collages are an intellectual and aesthetic exercise made out of found material to express an idea or feeling (Lynch, 1961). The collage offers the ability to deal with design precedents and precedent knowledge and to transfer abstract ideas and concepts into a visual language or atmosphere, hardly expressible in words (Tufte, 1997). Rough mock-ups, quickly made out of foam, clay or cardboard are often used in the conceptual phase to physically experience the scale, feeling and handling of a design.

In the past decade designers have started to borrow tools and methods from the field of theatre and cinema, such as role-playing, scenarios and storyboards, exemplified in figures 4 and 5, to explore and communicate dynamic and interactive aspects of their concepts. For example, role-playing and scenarios are ways for the designers to freely explore the whole context of a product and the role it can have in the life of a user (Burns *et al.*, 1994; Djajadiningrat *et al.*, 2000). Designers use storyboards to look more in detail at the dynamic use of a design and the possible user interactions.

The tools and methods for inspiration mentioned above are not relying on realistic fidelity (Naimark, 1997; Stappers et al., 1999). Fluency, exploration and aesthetics are the more important aspects.

New tools and techniques for computer interaction and visualization can provide a more efficient and flexible way to create a sense of presence in the user environment. The technological advances allow us to create images with such a high level of detail and quality of shading, rendering and reflections that the quality is often referred to as *hyperreal*. However, these advanced VR systems lack the flexibility and ease of use that the designers appreciate



6 Three ranges in the designer's work environment

in their pictures, sketches and collages (Stappers & Hennessey, 1999). For example, a new concept sketch can be made in a matter of minutes, where a VR simulation can take months of programming.

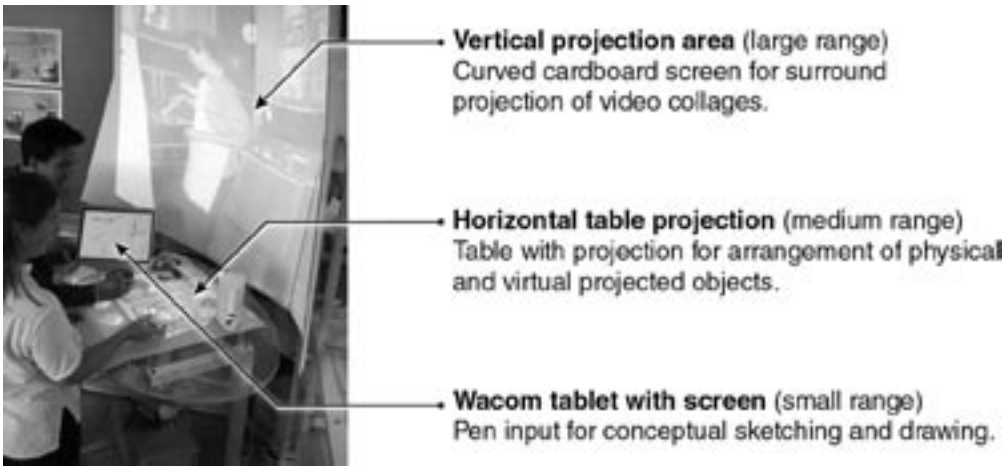
In general the advantages of the traditional tools such as sketches, paper collages and models can be found in the aspects of interaction, usability and aesthetics, i.e. they allow for fluent, direct and shared interaction. Their usability allows for improvisation and the materials used are readily available and they allow for expressive and suggestive aesthetics focusing the attention of the viewer.

Current VR tools fall short in these aspects, but when they are improved on, they can also offer advantages in simulated use and handling, easy change of environments and the application of rich media such as sound and animation.

Although the possibilities of such new tools are promising and have shown useful achievements, the latter usually come at a price that conflicts with the demands of our simple traditional tools. The key advantage that VR-related tools offer us in the conceptual phase of design is the ability to create an immersive sense of presence. We will show that this can also be achieved with less technical overhead.

3.3 Three Ranges of Interaction setup

With the experimental TRI Setup, *Three Ranges of Interaction,* we have tried to create a medium and an environment that allows the new possibilities offered in VR, while keeping as many of the advantages of traditional tools as possible. The TRI Setup is a body scaled interactive medium supporting the designer, exploring design concepts. The term *Three Ranges of Interaction* refers to three scales in which we interact with our environment: large, medium and small for respectively atmosphere, layout and precision.



7 Three scales applied in the TRI Setup

These ranges can be best illustrated by the way product designers interact with their work environment as exemplified in figure 6. For atmosphere, designers hang pictures, collages and sketches of the environment of use on the walls around them. For layout, sketches and models are laid out on desks to compare and organize possible solutions and use them in discussions and presentations. Finally, for precision the designer uses paper, pens and models to create detailed sketches.

TRI supports all the three ranges with an interactive setup that provides atmosphere (large range), virtual and physical organization and presentation (medium range) and computer supported sketching (small range). The combination of the three ranges allows for an atmosphere fit to the assignment where designers can collaboratively discuss, arrange and visualize ideas.

These three psychologically meaningful ranges are physically implemented in the TRI Setup, shown in figure 7. By physically dividing the three ranges in the setup, content can be developed separately for the three ranges. This simplifies the development of content, as the developer only has to tune and tweak one kind of interaction at the time, without influencing the other ranges at the same time. Argumentation of the design of the TRI Setup has been published online at DCNet (Keller *et al.*, 2000b). For the present discussion, it is important to note that the TRI Setup attempts to make a *sketchy* form of VR, sacrificing technical fidelity for conceptual usability. Like a pencil-sketch, TRI applications aim to give a quick, rough idea rather than a fully tuned, pretty picture.

Designers can use the TRI Setup for inspiration by generating presence in an immersive environment. With the traditional tools this is achieved by

8 Two stills from the kitchen environment video collage as presented on the vertical projection area

surrounding the walls of the desk with sketches, collages and storyboards. In contrast the large scale of the TRI Setup can serve as a rich and immersive environment, to experience the location or context of the design and its use. To create these rich environments we are exploring the use of video collages presented on the large range of the setup: a curved vertical projection area.

3.4 Video collages

Video collages are expressive combinations of image sequences, video, animations, music and sound to communicate an atmosphere, context or visual language. The goal of using these collages in the design process is to evoke a sense of presence in an inspiring environment related to the product to be designed. The video collages made on the TRI Setup have the same sketchy aesthetics as those in paper-and-pencil sketches, cardboard mock-ups and collages, allowing the designer to *fill in the gaps* and create his or her own interpretation of the atmosphere, which promotes active participation.

The goal of these collages is therefore not to aim for suspension of disbelief in a passive sense, but to use the *visceral eye* as described by Boorstin to help the designer who is actively wanting to participate in the simulated environment (Boorstin, 1995). In his book Boorstin explains that unframed images like IMAX and 3D images like the CAVE stand in the way of this visceral eye because they do not force the viewer to the center of interest. Instead of relying on picture-pretty images, Boorstin emphasizes the possibilities of narrative, pace, montage, sound and movement to create a compelling atmosphere. This is similar to how designers prefer to use sketches over photographs to focus the viewer's attention on the important aspects of a product design.

The video collages are made using simple 2D authoring tools such as Macromedia Director or through video editing techniques. This low-tech approach makes it easy for the designer to focus on the content and quality of the experience, without having to communicate these ideas to a programmer or developer.

As an example of a video collage and its use, think back to the example of the designer being asked to create a product to be used in a kitchen. A good way to start the design process is to observe a kitchen environment and to capture it in a video collage. For this example we created a video collage that conveys the atmosphere of cooking a meal in a kitchen environment. The video collage uses photographs of a woman in a kitchen environment (figure 8).

As shown in figure 8, the collage does not show a true representation of the actions in a kitchen but has the aesthetics resembling those in conventional sketches and collages. The composition of the kitchen background is created from different pictures placed together to match the visual field on the TRI Setup. This creates a somewhat distorted view on reality similar to the photographic collages of Hockney (Evans & Hockney, 2004). The composition allows the designer to fill in the gaps of reality and enrich the images with her own experiences (McCloud, 1994).

The different actions in the kitchen (such as cutting, baking, washing) are displayed as sequences of still photo inserts and recorded sound. The selection of the photo inserts highlights the actions, cutting out many irrelevant parts of reality such as the legs or head of the woman in the kitchen. In this way the kitchen stays completely clean and unchanged at all times with only a relevant change in the area of the woman's actions. This method of animation provides a clear focus of attention on the actions of the woman in the kitchen.

The use of stop motion allows the author of the video collage to balance the timing of the different actions in the kitchen. Sounds that accompany the actions serve as a continuous and ubiquitous reminder of the context even when the attention is not focused on the projection.

The sketchy aesthetics of the video collage encourages the same participation by the designers as conventional sketches and collages do. The use of stop motion exaggerates the actions of the user, so that it forces the viewer to the center of interest (Wurman, 1989). These forms of incompleteness, as compared to plain video, promote the designer's participation in the environment, i.e. sense of presence.

A regular video would be seen as a form of *entertainment* while it embodies some aspects of *environment,* it fails to provide a specific focus. Collages of still images, however, can contain close-ups of activities and actions of specific tools. Also, the collage sounds can be edited to promote design activities – not

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9 Experimental setup with design students sketching an MP3 player with a video collage as design input

10 Same experimental setup with a traditional collage as design input

just ambient sound as heard in a plain video. For the designer, a Video Collage of selected images and sounds is much more informational and focused toward the design problem at hand.

3.4.1 Viewing video collages for inspiration

We conducted a study to compare the effect of being exposed traditional collages and video collages in the design process. The goal of this study was to find out which part of the different types of collages the designers pick up in their design activity. The hypothesis was that designers pick up more form and color related aspects from the traditional collages and more contextual, interactive and usage aspects from the video collages.

Two groups of five design students were asked to sketch a concept for an MP3 player. One group used a video collage showing the use environment, possible users and form details as inspiration (figure 9). The other group relied on a traditional collage providing similar information (figure 10). Both collages were presented on the TRI Setup. After a short written instruction they were given 30 minutes to sketch out their concept design. After they completed their concept sketches they were interviewed as to the use of the collage, the experience of the environment and the elements of the collage that influenced their designs.

Though we used a small group, we found that all our subjects readily accepted the video collage as a useful way to communicate context and atmosphere. The group exposed to video collages focused more on usability and context of use in the design, whereas the group exposed to traditional collages focused more on detailed aspects of shape, colour and form.

We present here only the observation rather than a formal description of

the experiment, which was limited in scope. For instance, in this study the experimenting researchers, not the participating design students, created the collages. In the conceptual phase of design the act of making collages, sketches, models etc. is at least as important (if not more) than the end result itself. Therefore we are actively studying the creation process itself as well.

3.4.2 Creating video collages for inspiration

To experience the possibilities that the TRI Setup has to offer in creating an atmosphere, several video collages of different user contexts have been made by 12 design students. In this aesthetic exercise they focused on the cinematic aspects of the video collage, influencing the atmospheric experience: narrative, framing, timing, transitions, sound, perspective and lighting. Moreover the students explored the usefulness of creating video collages in the conceptual phase of the design process.

All the video collages were made in a relatively short time – varying from 4 to 12 hours – and required setting out a design goal, choosing an environment, observing the aspects of atmosphere, capturing these observations in sound and images and combining them in a video collage.

The 12 different video collages offer many different experiences: from being on a busy marketplace to a quiet beach, to sitting in the chair at the dentist's. The feedback given by the students on their video showed, that they found it important to set the goals on conveying an atmosphere opposed to just creating a pretty image or good sound. The students who took the longest time tweaking aspects of sound quality or image quality in itself were the least satisfied of their results, whereas the students that took more time trying out the complete experience and overall narrative achieved the most useful and aesthetically expressive results.

3.4.3 Using video collages for concept testing

The conceptual phase of design relies heavily on iterations, trying out different concepts and verifying them with the end users. Therefore almost all guidelines on user-centred design stress the importance to test ideas with users in the earliest possible phase (Nielsen, 1994). The problem with most of these informal tests is that it's hard to test a concept in the right atmospheric contexts.

With video collages on the TRI Setup it is possible to quickly and easily convey a sense of atmosphere as a backdrop for user testing. When the TRI Setup is used for this purpose. the video collage on the large range is for conveying the atmosphere and context of product use. In this way, we have used video collages on the TRI Setup in a series of interface design evaluations.

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11 Screen-based setup for testing handheld navigation interface

12 Alternative test setup using the TRI Setup

In one experiment an interface for a portable navigation aid running on a handheld computer was tested. The application is intended to be used while walking through a city. The interface design was simulated on a normal PC with a touchscreen, which made it impossible to test the concept in the field. The original solution was to provide a sense of context in another part of the same touchscreen (figure 11). As an alternative, we proposed using a video collage of the user environment projected, with the touchscreen tilted in a position that resembles the way a user holds a handheld computer (figure 12).

During the usability test our subjects were asked to navigate through the city by using arrow keys on the touchscreen with the navigation interface for reference. As the users navigated through the city the experimenter changed the backdrops according to the appropriate location. This could have been programmed, but for a short study, a Wizard of Oz technique, in which a human makes these decisions is often more efficient (Gould, 1988). After completing a task the users were asked to recollect some details of the projected environment. This way the experimenters could measure the amount of attention the user needs for operating the handheld computer (Wolf & Keyson, 2000).

Though the usability of video collages for usability testing itself was not the goal of this experiment, we were able to verify that our users readily accepted the projection as an environment. Even without an explanation of the background or purpose of the large screen projection, the users easily accepted the video collage as a means to illustrate the environment of the user context.

3.5 Conclusion

Computer tools can provide a sense of presence that is useful for the conceptual design process. To allow the designers to suspend their disbelief these tools will focus on easy ways to create a sense of the environment in an abstraction such as a video collage. These collages offer possibilities for abstraction and expression that designers have learned to appreciate in their pen and paper based ideation tools (sketches and collages). The TRI Setup provides the tools to create sketchy representations of a user environment in video collages. Although we have not completed rigorous experiments yet, we feel confident in the following observations.

The possibilities of dynamics, interactivity and the use of digitized sounds makes these virtual environments more engaging and flexible than the current conventional methods such as making conventional collages or filling the walls with sketches and photographs. Moreover these video collages form an important aspect of the conceptual design process as an aesthetic exercise. By using sketchy aesthetics, saving time on details, the designer can explore, visualize and communicate the user environment as an atmosphere.

Lessons learned from cinema and theatre can be used to lure the attention of the viewer to important aspects of the environment. This is similar to the way the sketchiness in drawings is used to emphasize important aspects of the product design. This approach assumes that if the viewers are prepared to fill in the gaps, they can immerse themselves in an environment by their own imagination and don't have to rely on the highly realistic, expensive and difficult to make three-dimensional graphic representations.

Designers can use these video collages for inspiration and verification. Inspiration can be promoted by creating a sense of presence in the environment in which the product will be used; verification is possible when testing conceptual designs on users in a simulation of the user environment.

3.6 Experiences with TRI 2000-2005

The previous sections were written in 2000, at the beginning of our explorations with the TRI Setup (or TRI). In the years after it, we integrated TRI in our working methods. Especially the large and medium range of the TRI Setup were further developed and explored by both researchers and students. These explorations were a persistent creative background activity in the ID-StudioLab.

The remainder of this chapter summarizes these experiences, taking material from different publications related to the TRI Setup (Keller *et al.*, 2000a, 2000b; Saakes, 2005; Stappers *et al.*, 2000; Umemoro *et al.*, 2003). We will first cover the principles that guided the design and then talk about the different applications of TRI divided into the different ranges.

3.6.1 Design Principles

The TRI Setup was designed with three main principles: *approachability*, *low threshold* and *body-scaled* interaction. To make it easy to approach the TRI Setup we placed the setup in the centre of our working environment, the ID-StudioLab, opposed to most advanced VR systems that are high-tech machines hidden in darkened rooms. By using bright video projectors we are able to work on the TRI Setup in normal lighting conditions. The *low threshold* was achieved by using 2D interaction instead of cumbersome 6DoF VR technology. Instead of all these advanced technologies, we use commercially available presentation software. Finally the TRI Setup supports *body-scaled interaction* divided in three ranges, each range tuned with its own display, content, input devices and software.

The TRI Setup was developed as a platform on which designers can create their own applications and solutions given these design principles. Therefore, to compare the TRI Setup with other augmented reality systems (Aliakseyeu, 2003) or input devices (Gribnau, 1999) based on features or abilities would not do it justice. Instead of offering technological abilities, the TRI Setup forces designers to think differently about how computer tools can be used in the design process.

3.6.2 Using TRI

In the last five years we have seen many applications appear on TRI. These applications started on the large range, such as the video collages and the others that will be discussed below. In the years after this we have seen a growth of applications of the medium range, specifically to support sketching and using the projection of textures on physical models. The small range interaction stays outside of the scope of this research project and will not be covered in this chapter.

In this section we will briefly discuss the applications of the TRI Setup of the large and medium range.

USING THE LARGE RANGE

The large range has developed itself into a shared library of images and music that is used by all members of the ID-StudioLab. Using a screensaver that randomly and smoothly displays the images stored on its directories we have been able to keep colleagues visual aware of each others project without formalizing this communication.

The large range is also used as an informal presentation display. Over the years many small presentations of student projects and visitors were shown on the large display of the TRI Setup. The curved screen often surprised presenters and audiences, forcing the presenters to rethink their mode of

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13 Screenshot of a shared collage of images on Iris on desktop

14 Same collage displayed on the large range of the TRI Setup

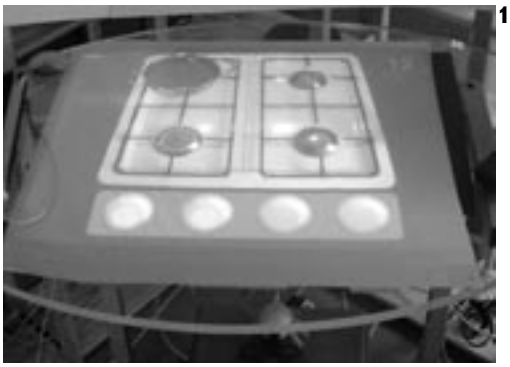
presentations. With its readily available large display, work can be presented without requiring a separate conference room with all its presentation etiquette associated with it (Tufte, 2003).

The ambient aspect of the large screen has been further explored in a research project to support visual communication in a closed community (Peeters & Stappers, 2005). For this project a software prototype was built called Iris. The Iris application[1] allows ID-StudioLab members to informally share images from their personal computers using screenshots in a shared collage (figure 13). The collages of the combined results of these messages are continuously presented on the large range of the TRI Setup (figure 14).

USING THE MEDIUM RANGE

The initial purpose of the medium range was for testing and organizing on a tabletop display. The first applications for TRI consisted of testing interfaces. In one explorative experiment we used TRI to test different arrangements of cooker knobs and compared the table projection with shadow detection (figure 15) to a setup with regular mouse input on a CRT computer screen. Though the shadow input was not optimized, we got positive feedback on the projection itself. Almost all users confronted with the projected image liked the realism of the projected image, especially when a Video Collage was shown of a kitchen environment. One user even told us this was the first computer interaction he could do *"without having to put his glasses on"*. This can be seen as a testimonial to the naturalness of the interface and gives hope for this and other augmented or tangible interfaces to break away from the stifling mouse-and-keyboard manifestation of computer interaction.

[1]On http://studiolab.io.tudelft.nl/peeters/iris/ more information on IRIS is available



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15 Medium range interaction used to test different arrangements of cooker knobs

16 Medium range used to explore different textures on a physical model. The table is transparent, so only the objects on the table are illuminated, not the table itself.

In the course of interacting with the medium range we found the overhead projection on the medium range to be a powerful tool for creative explorations. By projecting textures, interfaces and other images on foam models and physical products we can explore and enhance these models (figure 16). The distortion of the image on the shape can be used as a feature for explorations, finding new expressions by moving the shapes around. With this we can use light as a design material with interesting potential. In ongoing research, this so-called *"material light"* is being used to explore textures on foam models to define the material properties of such products (Saakes, 2005). In the course of its availability, many students have used the medium range to project their interactive interfaces on their physical models. This was used both for exploring different kinds of interactions and for presenting their work on video. With these augmented models they could use their hands and fingers to interact with the interface without requiring advanced video editing and 3D software.

In our later explorations of the medium range we used a camera on top of the TRI Setup looking onto the table to capture people's hands together with what was on the table. This was used in our sketching research to see if we could incorporate the hands and fingers more easily and expressively into design sketches. In a pilot experiment we asked design students to interact with a foam model using their hands on the table of the TRI Setup. This interaction was captured using the camera and projected on the same size and place on the table. Using A3 marker paper, students were asked to draw the hand and the model that were projected on the table and fill in the detailed design of the foam model (such as buttons, displays and materials).

We expected our participants to be helped by this projection to be able to better draw the hands and interaction. Contrary to our expectations, the projection didn't help improve the quality of the drawings, because our participants only drew outlines of the projected hands and didn't deconstruct the hands into their separate segments. Though this was first seen as a failure of the experiment, the experimental setup showed promise in incorporating the hands in the design process itself (Saakes & Keller, 2005).

Many of these findings on material light and projecting captured image in place were used in the development of Cabinet, which will be described in chapter 5.

Acknowledgements

The TRI setup was created in collaboration with the Academic Computing Services Amsterdam (SARA), who have shared their knowledge and experiences in the field of presence in their CAVE systems. Especially Jorrit Adriaanse of the Academic Computing Services Amsterdam has been a driving force in making the TRI Setup a reality. The TRI Setup is an integral part of the interior of the ID-StudioLab, a collaborative research workspace at the Delft faculty of Industrial Design Engineering.

Moreover the authors have benefited greatly from the ideas and discussions on the TRI Setup with the members of the ID-StudioLab.

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