

SUPER STUDIO: CLARITY AND AMBIGUITY IN PROBES

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This paper describes how Super Studio, an annual design class given at Art Center College of Design in Pasadena, California, has used cultural probes not only to bring *clarity* to the research object, but also to shape a pre-design research space through leveraging several types of *ambiguity*. The research model strengthens the analysis and interpretation of data from probes, while fostering design projects that reflect the daily realities (and the desires) of the population studied. Further, it provides a specific means for reconfiguring data as design interventions through the exhibition format. As the paper's case study illustrates, the fluidity of the Super Studio research model is useful to the practice of designers as they assimilate the research into the design language and then apply it concretely.

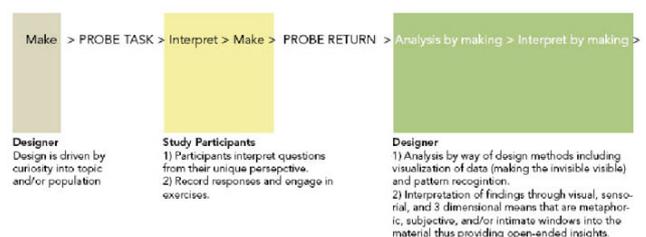
INTRODUCTION

Super Studio's pre-design research methodology is a case study in embracing both clarity and ambiguity to provide insight into the life experiences, points of view, and values of a specific demographic. Our methods provide a clear context for the design research phase and are scalable to include designers from other areas such as technology and product development, as well as researchers from the social sciences, anthropology, medicine and other disciplines.

Our distinct methodology has emerged from the Super Studio program, a year-long design research course at

the Art Center College of Design in Pasadena, California. Drawing upon an advanced, human-centered and reflexive approach to design innovation, our research utilizes the "probes" methodology in combination with in-person interviews, as these methods empower designers to use the qualities unique to design instead of relying on other disciplines.

The Pre-design research process begins by inviting participants to engage with a particular activity — a cultural probe — which could range from a highly directed to very interpretative exercise. We also engage participants in interviews that provide them the opportunity to explain their responses to the probes as well as answer a range of questions along a particular theme. The interviews contextualize the probes in participants' daily life experiences, which create a background of information from which to pull and add to the analysis. (Picture 1).



Picture 1. Designed-based analysis using both clarity and ambiguity.

Throughout the research process, we embrace both clarity and ambiguity, as we analyze, interpret and reconfigure probes to create a rich context for design that speaks authentically to the populations being researched. By the end of term 1 (14 weeks), the studio has been transformed into an exhibition tool—an open-ended environment for learning and inspiration—that consists of ambiguous and interpretative artifacts. This exhibition tool continues to inform the researchers as they enter the design research phase in the next 14 weeks.

Our projects in the Fall of 2006 focused on pre-design research to understand how families are preparing for a future that includes radical climate change. Graduate student researchers worked within the bounding terms “Biosphere Voices,” “Delight,” and “Interplay Between Identity and Place”. Through developing open-ended methods for analysis, we both strengthened our own practice and provided additional knowledge-building resources for a number of disciplines. By embracing the clarity model as well as leveraging ambiguity, the Super Studio group was able to create an environment for creating designs that reflect the daily realities (and the desires) of the population studied.

PROBES: SCYLLA OF CLARITY AND CHARYBDIS OF AMBIGUITY

Probes (or cultural probes) are self-reporting tools for gathering data to inform design. In essence, they are a sophisticated, playful version of diaries used in the human sciences for decades (see DeLongis et al. 1992). Much like probes sent to the outer space to do measurements, take photographs or collect samples of material and gases, we can send probes into communities or populations. Typically, this type of probes package has a disposable camera, a diary and postcards addressed to the researcher with questions on them. Probes are able to produce rich data in a relatively short time span, under circumstances in which other methods would be difficult to use.

The methods of probing can be roughly divided into three kinds of outcome: probes for information, for inspiration, or for interpretation and participation. Discussion has centered on various types of probes (Gaver et al. 1999, Cheverst et al. 2002), the probes process (Mattelmäki 2006), and the design ideas inspired by the probes (Gaver et al. 2002).

There are few descriptions, however, of how designers are to analyze the probes – and there is no consensus on the practical definition of “analysis” when in the domain of design. Existing proposals tend to eschew analysis, or liken analysis to qualitative diary-based research. Although these probe methodologies build on designers’ visual and spatial skills in data gathering, there is an opportunity for the analytic phase to be far more design-based.

There are several main approaches for analyzing the probes and using analysis to inform design.

1. The Clarity Model. The *clarity* model generally follows the classic requirements engineering model, in which ethnographic research leads to a series of conclusions that are then translated one by one into system requirements. In this approach, the aim for making sense of the probes is clarity: any results from the field must be translated into a few main concepts, with their interrelationships spelled out as clearly as possible. Taking the study outcomes and expressing them in writing reach this clarity. As such definitive statements, lists or bulleted items are the form clarity is often given, creating an expectation of clarity as being.

In Cheverst et al.’s study, for example, a group of researchers mapped communication problems in a community care clinic, and based on their interpretations, they suggested various ways of introducing a SMS Public Asynchronous Messenger (SPAM) into parts of the communication system used in the clinic. Cheverst describes the group's use of probes in the clarity model represented by a linear hierarchical simplicity.

as a way of *informing design* by deploying probes as instruments for eliciting information from the members of user groups that are difficult to research by other means. (Cheverst et al. 2002: 24).

2. Embracing ambiguity. Other researchers have chosen to embrace ambiguity as an integral part of the design method. Building on situationist art theory, Gaver et al. (2004) have defended “the mysterious and elusive qualities of the uncommented returns” of probes. For example, in their view, probes do not reveal an “objective” view on the situation, but dramatize the difficulties of communicating with strangers. In another place, they tell that ambiguity in probes sparks insightful and valuable dialog with volunteers as well as helps volunteers see their own world in a new way. (Gaver et al. 2004: 55). In this approach, ambiguity becomes a key resource that makes probes inspiring. The ambiguity of not knowing the exact reasoning behind the probe returns becomes a key resource used as a source of inspiration. Gaver writes:

[Probes] create relationships with our volunteers that are a little like designing for friends: We know them well, but that doesn’t mean we know exactly what we should make for them. Nonetheless, their familiarity serves as a reminder of the actualities for which we are designing, and allows us to imagine our proposed systems in real homes. (Gaver et al. 2004: 56)

3. Interpretation and Participation. A third strategy builds on inductive reasoning and is interpretive in nature (Mattelmäki 2006). First, probe returns are analyzed into a few main categories that are then related to each other. After that, the possible design process becomes a separate step with its own logic. In this approach researchers, who then return to the participants for feedback, analyze probe materials. The results are then used in workshops with the product development team. Workshops begin by spelling out the results of analysis. Analysis provides the starting point for these workshops in which probe returns are used to inspire product innovation. Due to the way in which the process is organized, researchers' analysis becomes a key element for understanding the probes.

User-centered design is intended to understand who the users are, what they do, and what kinds of attitudes and properties they have. User-centered design in general, and the design of user experience in particular, apply methods that measure, describe and interpret the users and their experiences as objectively as possible on the one hand, and methods leaving room for the designer's subjective interpretations and insights on the other... Probes are initially subjective, aiming at design through understanding the individual. (Mattelmäki 2006: 61)

4. From Clarity to Ambiguity. Building upon our own experiences with these three approaches, we set out by addressing the notion of ambiguity (Gaver 2004), and thought about ways to analyze probe returns while maintaining ambiguity, strategically for a number of crucial reasons. First, we recognize the risk for designers when relying solely on the clarity model. Designers may jump too quickly to unwarranted conclusions from data or focus solely on the results of the analysis without building empathy for the participants. This empathy, and the process of addressing ambiguity are, rather, critical components to a designer's understanding of the data, and the subject. At times, the results of examining ambiguity can ultimately be richer than a privileged, definitive statement.

We developed a methodology that embraced the benefits of a clarity approach in the analytic phase, and ambiguity that ensures that analysis is not made into a directive for design too quickly. This approach can be effective in pushing clarity on a topic, but simultaneously maintaining a degree of open-

endedness to promote discussion, thinking, and inspiration.

We achieve this open-endedness by countering the authority of the text by integrating multiple means of expression (i.e. textual, imaging, pictographic) and using the elements of design (i.e. the use of juxtaposition, composition, typography, balance, sequence, form, line and color) to compose a communication that asks for the co-participation of the viewer in the analysis and synthesis of the findings. It is the use of these elements unique to the discipline of design that subvert typical expectations of clarity based on other means of expression (i.e. the written word).

This is a central issue when designers deal with communicating "research" to associative disciplines. The visual language is not always shared. With this unique vocabulary exists also a distinct set of considerations, interpretations and assessment vehicles.

SUPER STUDIO: A CASE STUDY ¹

In the first 14-week session of Super Studio for 2006-07, we were exploring how one generation is preparing the next for a future that includes radical climate change. Graduate researchers were assigned a specific population to investigate – families with teenage children in the Los Angeles area. They conducted secondary and primary research, including probes, to collect a rich body of material for analysis. The data were then explored for patterns and associations whereupon graduate researchers made interpretations of their findings to further explore the meaning of the data. The studio was effectively transformed into an open-ended environment for learning and inspiration that consists of ambiguous and interpretative artifacts, what we call the Super Studio exhibition.

Ten middle-income families—homeowners and apartment dwellers—in the Los Angeles area comprised the mix of 10 adults and 20 teenagers that were enlisted for the study. The study and probe designs were shaped by the bounding terms; "Biosphere Voices," "Delight," and "Interplay Between Identity and Place." Questions that helped to promote inquiry included: How can the biosphere's voices be "heard"? What will make people listen? What do we know about our local environs and how does it inform personal identity? If "our place" the planet is under stress what does it mean to us? These questions informed the development of a suite of probes that used textual, visual, and audio-based recording tactics.

THE CAREER OF A PROBE: THROUGH CLARITY TO AMBIGUITY

In the design-based analytic phase of Super Studio, we analyzed the probes through both *clarification* and *ambiguation*. In our analysis, we sought meaning through clarity, which entailed sorting, categorization, and diagrams. In *ambiguation*, several tactics were used to communicate the findings in visually engaging, highly interpretative, and simultaneously inspiring form to invite viewers to explore the opportunity spaces opened by the probe instead of having one handed down to them through analysis.



Picture 2. The Globe Probe designed and analyzed by Yee Chan and Serra Semi. Top to bottom: blank globe and newspaper; one globe as it came back from the field; photographs of all sides of one globe return; the magnetic wall prepared for the exhibition; globe sections adhered to magnet; final format used in analysis used globe sections that could be re-organized on the magnetic wall, the visitors' response to the globes written on the wall; globe created by visitors.

The Globes probe: This probe explored the ways in which people think about the future of the world and how they would like it to be, and the role of biosphere in people's consciousness. Participants were given glue, scissors, and the Sunday edition of the *New York Times* for making a collage on the globes.

Graduate researchers compared the teens' and the parents' globes and created one pool of images for teens, another for parents. Next, they identified the main themes in these image pools and created their own collages using these image pools. These data were placed two hemispheres, one for teens, another for parents.

Super Studio diverged from typical research, in which the next step would have been telling the viewers what the globes illustrate about the role of biosphere in the participants' lives and, by implication, in the lives of ordinary Angelinos. We took a different path that led towards more ambiguity. Instead of guiding the viewers towards clarity, the globes were processed into an interactive space and viewers were invited to explore design possibilities.

We introduced ambiguity to the probe through several means (Picture 2). The globes were made re-arrangeable by creating an exhibit in which the hemispheres were cut separate and glued on a magnetic plate that made it possible to move the hemispheres on the wall, which was painted with magnetic paint. The Exhibit encouraged re-arranging the globes: the hemispheres for any question were separated, and could be juxtaposed to the hemisphere from another question. The theory was that over the course of the exhibition, they might lose their original position, giving the exhibit a puzzle-like feel. Also, interactive materials were added, to encourage visitors to react to the exhibit: speech bubbles, thought bubbles, and pencils. Visitors were instructed to write to the wall and construct their own globes, allowing them an opportunity to react to the exhibition and to get an empathic understanding of what the participants faced when working with this probe.

METAPHORS: THE "DELIGHT" PROBE

"Delight" provides an understanding about how adults and teens perceive the term "delight" both as a general concept and when associated with nature. The probe was a simple, 3-part word exercise. Participants were given a list of over 200 words that consisted of nouns, adjectives, and verbs as well as space provided for writing in additional words. They were asked to circle all the words that they associated with the term "delight." When completed they were asked to circle, in a different color, all the words they associated with phrase "delight in nature." Then they were asked to select the most important word from each of the two categories.

The analysis was initially just lists of words by frequency. Seven categories relating to delight were

identified: concept, creation, feeling, sense, activity, object, and environment. When delight words were positioned onto a sketch of L.A.'s various environments, the categories were further divided into human or non-human, internal or external, and indoor or outdoor experiences. This representation gave an easy-to-read visual way of seeing two things: first, where Angelinos find delight (for example, the beaches vs. the family), and what role biosphere plays in delight.



Picture 3. The Delight Probe created and analyzed by Jinmi Choi. Top to bottom: word exercise around the term "delight"; analysis based on proximity of delight terms to the natural landscape; analysis based on metaphor student presentation; exhibition and detail of text and image relationship; reference to Hieronymus Bosch triptych,

The next task was finding a way to combine the findings of the content and the visual analysis. This was done by elaborating the visual map further using the metaphor of the Garden of Delights through the inspiration of the Hieronymus Bosch triptych, **The Garden of Earthly Delights** (c 1500). (Picture 3).

The diagram reveals that delight for both adults and teens is best when shared with someone and often involves the senses such as smell, tastes and touch.

Generational differences also emerge, showing adult delight encompasses the unexpected happening while teen delight focuses primarily around concrete daily objects. The interpretation of the probe's analysis provides both clarity and ambiguity as strategies to convey the study's quantitative findings as well as provide users with unexpected and associative experiences that mimic the serendipitous aspect of delight.

AURAL AMBIGUITY: THE "SOUND" PROBE

The Sound Probe attempts to map the sound environment around the home and participants' emotional reactions to it. The concept was to use the window as a conduit to hear the local soundscape, determine its origin, and capture differences between parent and teenage sound worlds. The Super Studio group also sought to learn how attuned people were to the variety sounds in nature and if they could identify specific sources as a way to understand the existing relationship between the participants and their surroundings.

A large sheet of transparent acetate was taped onto a window for three days, participants were asked to write or draw on the clear sheet the sounds they heard when looking out of the window. To make their entries discernable from one another, adults were instructed to use black markers, and teens red ones. The probe returns included ten sheets each with extensive entries.

The analysis started with calculations. The occurrences or frequency of a dog barking or car honking were tabulated per family member. The next step of analysis was to create a pictorial representation of the participants' reports by color mapping each sounds' source: white for nature, black for technology, and purple for the body. Haloing out from the dots are colors ranging from red to yellow to green that reflect the participants emotional reaction — disturbing to delightful to peaceful — to each particular sound. The frequency of sound is translated into the size of the halo.

Juxtaposing these sound constellations, satellite images for each participant's home were dropped into the background whereby providing a concrete understanding of the physical and emotional relationships between people and their audio environment. In addition to the maps, composite audio tracks that demonstrated the different soundscapes of adults and teens were provided for comparison. The diagram and tracks reinforced the findings that adults tend to record more sounds of technology while teens hear more self-referential and

nature sounds. (Picture 4).



Picture 4. The Sound Probe was created and analyzed by Yu Ming Cho. Top to Bottom: Clear acetate on windows with participants' recording of sounds they heard; analysis by parent and teen recordings by type of sounds and frequency; room display of soundscapes in relationship to neighborhood; legend to read emotional quality of sounds; soundscapes of adult participants; detail of teen soundscape.

HOW DIARIES BECAME EMOTIONAL OBJECTS: THE DIARY PROBE

Diaries function as a complement to the probe suite by asking the participants to document their daily experiences. Specifically, the parent and teen participants were asked to identify where they were located; what they were eating/watching/doing; what they saw; what they heard; what they smelled; and what feeling they were experiencing within a single moment. These moments were documented eight times a day for three days. This documentation probe was designed to explore the relationships between the participant's emotions, place and the influence of the outside world within their interior built environments.

To process the large quantity of data, the pages of the diaries were posted to a wall to be viewed concurrently.

Associations were identified using frequency and immediately highlighted with a marker when they were discovered. The result of this developed a visual map of sorts. –A challenge arose, however, in that these outcomes were more quantitative and based singularly on frequency. This strategy of analysis was not allowing the comparison of the relationships between the emotions being expressed and the location in which they were being experienced. It was not feasible to see the totality of locations and range of emotions that were being experienced concurrently among all the participants.

In response, the next analysis approach looked to the language of design, first placing the location and emotions within a scalable measurement via abstract representation of the data. Several scales were developed that measured the intensity of the emotion being experienced while simultaneously allowing the viewer to see the locations in which each of these were being experienced.

There was a third dimension, however: time. How could the analysis of the intensity of emotion within a specific location over the course of time be enabled? Fortunately, this data set comparison enabled the exploration of relationships between the "sequence" of emotions and the places they were being experienced. (For example, after an intense emotional experience, would our participants retreat or cluster?) This analysis was also able to provide insight into the interconnectedness of parent and child and their respective emotional experiences. Exploring through the elements of sequence, location and time, allowed researchers the opportunity to reveal emotional transference and/or cause and effect.

Tangible 3-dimensional representations of the data were produced, wherein each emotional diary entry was represented in a scaled continuum that expressed intensity through frequency and the translation of their written documentation (i.e. the use of explanation points, enlarged or bold typography). The locations were placed into four quadrants that represented the four primary home locations identified in the diaries. These charted experiences were then laser-cut into a variety of materials ranging from wood to plastic and sequenced in order of time of entry, to create a single dimensional design graph that holistically expressed the emotional "experience" or "feelings" of the respondents. Some were manic, as expressed through the high and low angularities and the extreme fluctuation of the ridges in the objects shape. Some were consistent, as expressed

through a flat or gradual scale of emotional activity. This analysis method further provided the ability to combine the plates of the parents and child, revealing the effect of their emotional experiences on each other (Picture 5).

The outcomes of this analysis strategy were twofold: one relative to the data, identifying methods and strategies to parse the volume and breadth of data collected. The second outcome was insight into design as a vehicle with which to develop a strategy for viewing multiple dimensions of a data set while imparting an empathetic perspective by visually expressing the overall emotion experience of the participant community.



Picture 5. The Diary Probe created and analyzed by Justin Gier, Jonathan Jarvis, and Manuel Alcala. Top to Bottom: a diary return from participant, wall pin up of diaries; class analysis of the relationship between rooms in the house and intensity of emotion; charts of emotional states of participants in their homes in 2D and 3D.

INTERPRETATION: THE USES OF AMBIGUATION

The "Globes" and "Delight" probes illustrate several tactics developed to maintain ambiguity. In both

probes, the analysis followed more or less well-traveled paths. Thus, the initial stages of analysis of the Globes consisted of cleansing the data and of creating composites of several globes by age, while the "Garden of Delights" was originally analyzed through a content analysis.

However, the second part of the probes added the step of interpretation through creation, which by its nature reintroduces ambiguity or subjectivity. With Globes, the group built ambiguity into the exhibit in several ways. For example, a visitor could rearrange the exhibit to develop personal ways to understand it. We did not give cues about how the globes should be interpreted, and encouraged the visitors to explore the globes and that way construct their own interpretation of what the globes tell about the lives of the Angelinos. In "Delight", ambiguity was built into the exhibit by creating a visual illustration of variables identified in the probe, and by imposing a multi-dimensional chart on these images to encourage exploration and discovery.

Beyond the obvious, the "Sound" probe interpretation stops short of telling us why or conveying any aspirations towards an ideal soundscape. By positioning the "Sound" exhibit next to "Delight", the juxtaposition encourages questions such as: What's the sound of delight? Is it different for an adult than a teen? What's my home soundscape?

CONCLUSIONS

Most of the literature on probes has focused on the qualities of individual probes, their placement into people's lives, the process (Mattelmäki 2006), or, taking a more abstract tack, situating probes as either "scientific" or "artistic" traditions (see Cheverst et al. 2003, Gaver et al. 2003). The design-based analytic process has received far less attention than these aspects of probing. The transition from probes to design is either made mystical or follows a fairly straightforward requirements engineering model in which user research specifies the beginning of the design process.

By contrast, our pre-design research embraces both clarity and ambiguity without privileging one over the other. We have developed concrete methods for navigating between the Scylla of clarity and the Charybdis of ambiguity. Analysis, although well-reasoned, is honored as only one possibility and interpretation is viewed as a necessary entry into the space of inspiration. The process of moving between clarity and ambiguity is fluid; this dynamic approach



Picture 6. An initial analysis of a diary. This 3D representation, produced with a laser cutter, was the first approximation of the final, indexed representation in Picture 5. Interpretation of X and Y axis. Distance from origo describes the intensity of an emotion, direction tells the room in which that emotion took place, and the type of emotion within rooms. The Z axis describes the time of an entry over three days. Picture by Justin Gier.

allows us to make optimal use of the data to better understand the lives of the populations we study.

The exhibit environment is an open-ended one, not prescriptive, and is created by the juxtaposition of the interpretations of the probes. This visually rich environment taps all the senses to provide designers with a better understand into the lives of the people they are designing for. This provides a meaningful context for the next phase, design research.

Our methods encourage visual, aural, 2- and 3-dimensional, and experiential interpretations. A range of media are used to visualize insights that communicate in narrative text as well as sensory languages such as visual, sound, touch, and smell. To this end, we have developed an open-ended process that results in a rich context for design development. This type of pre-design research is intended to inspire and shape design research that results in an outcome, whether a communication system or product interface or new invention prototype.

It is also scalable to include designers from other disciplines such as technology, product and industrial designers, as well as other researchers from social science, anthropology, and medicine for example. Because our methodology adopts visual language as a key mode of expression, the success of cross-disciplinary collaborations are dependent on the contributions of people who are adept at using design-based analytic methods.

Our design-based analytic methods include clarity as demonstrated in the visualization of data that makes the invisible visible through charts, diagrams, and various types of bucketing. In the ambiguous phase, the designer evolves the analysis beyond the obvious through his or her interpretation as a way to convey a particular insight. This final step provokes new thinking and inspiration for the designer as well as those that encounter the artifact for the first time.

In the upcoming term, graduate students in Super Studio are asked to make a creative leap—an intervention to help families to prepare the next generation for future climate change and, in essence, the leap from pre-design research to a new phase of design research and design projects. Their creative leap may be a reshaping of their interpretive analysis or finding a new starting point. In either case, working with the research material and staying within the

bounds of the study, they will determine an opportunity area for design and develop appearance prototypes of their concepts. (Picture 7).



Picture 7. Views from Super Studio. Top to bottom: discussing the photographs from the homes; the studio space is an interactive environment with both tangible and virtual objects; group discussing the analysis of globes; photographs printed and arranged to the Studio wall for an overview; the studio space becomes a tool for inspiration, shown are sound and delight exhibits.

As the example of Super Studio 2006-07 illustrates, our methodology, which combines ambiguity and clarity, brings a new depth to the analysis and interpretation of data from probes. It enables us to reconfigure this information as a design intervention (through the exhibition format), which strengthens the design research process and the final result. Through the creative process where users interact with our research data, the researcher/ designers are more able to assimilate the meaning of the research into the design language, and then to apply this meaning concretely.

Applicable across the disciplines through partnerships with design researchers, the methods used in Super Studio 2006-07 serve to provoke new ideas in the arts

and the sciences, and to inspire new thinking about design possibilities.

NOTES

¹ Super Studio was devised in 2000 by Brenda Laurel with Andy Davidson and Allison Goodman. Brenda Laurel formalized its goals and syllabus to give the students a sense of what a start-up was like, but with the ambiguity and depth to encourage them to develop new transmedia systems to address important issues of the day. An example of such transmedia system is BLUX, a toy designed to introduce six-year-old boys to the super powers of nature and technology (www.blux.la). Lisa Nugent began co-teaching with Laurel in 2004 and together they developed a more rigorous design approach to primary research, design-based analysis, and use of domestic probes. Anne Burdick and Sean Donahue also co-teach with Lisa and contribute strategies of complex information design and graduate discourse. Guests, such as Ilpo Koskinen and Bruce Sterling, are also invited to participate in class discussion and critique. The class has evolved towards identifying opportunity areas that are rich for innovation by sharing provocative research insights and “proof of concept” prototypes.

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