

# ABSTRACTNESS OF MEDIATING ARTIFACTS AS PROBES

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## ABSTRACT

This research investigates *mediating artifacts as probes* that have been used to explore current and future user needs in knowledge exchange between design researchers and the users of future products and services. Four types of mediating artifacts as probes are reviewed: Design Games, Cultural Probes, Generative Techniques, and Behavioral Prototyping. Design researchers variously found the following methodological advantages of mediating artifacts: (a) eliciting situated user needs, (b) eliciting divergent perspectives and needs, (c) supporting participants' idea generation that leads to design solution ideas, (d) documenting elicited concrete and abstract types of knowledge, (e) revealing propositional, practical and sensuous knowledge, and (f) facilitating communication between participants and design researchers.

The advantages articulated above are partly relevant to the *abstractness* of the artifacts. Abstractness in this research is characterized as either a general quality shared among a set of things and events, or a representative quality which shows designated aspects of things and events. Abstractness can shape the physicality and interactivity of mediating artifacts to allow for (1)

providing clear structures of problem spaces, (2) supporting easier manipulation of design solution ideas with tangibility, (3) enhancing the communicative qualities of probes to explore problem spaces and design solution ideas, (4) eliciting various perspectives and diverse design ideas afforded by degrees of ambiguity, and (5) enhancing adaptability of probes, models, and prototypes to multiple contexts.

This research will be expanded further to investigate abstractness of the mediating artifacts as probes by designing participatory design games for a hypothetical design project with abstractness as a key characteristic.

## INTRODUCTION

During a design process, designers need to express, shape or interpret their knowledge and ideas between them and future users of the artifact. Some of the methods with which designers investigate users' needs and motivations, such as interviews and focus groups, heavily rely on verbal communication between designers and users. Verbal communication is incomplete but considered as complete because it is the most sophisticated form of communication. The inherent limitations of data generated with interview methods are known as language-games (Wittgenstein 1958 [1953]), tacit knowing (Polanyi 1966), and psychological, physical, and cultural distances between design researchers and users (Gaver et al. 1999) respectively. Moreover, some procedural, perceptual, and reflective types of knowledge are only revealed when they are

mediated with visual or tangible artifacts.

A number of designers have been developing user research methods that actively encourage non-linguistic communication to compensate for such limitations, mediating artifacts are critical elements of such methods. The following discussion of mediating artifacts in this research is especially concerned with, and limited to, artifacts that have been used as probes to generate information and gather inspiration from users.

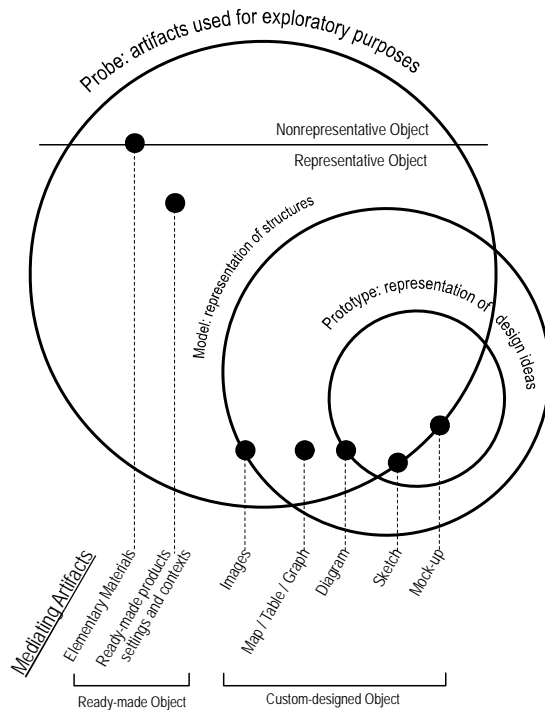


Figure 1. Inclusion Relations among Probe, Model, and Prototype

### THREE CATEGORIES OF MEDIATING ARTIFACTS: PROBE, MODEL, AND PROTOTYPE

In this research, three categories of mediating artifacts - - probe, model, and prototype -- will be defined by their functions and roles in design project research. Mediating artifacts may be used (a) as probes to explore current and future user needs, (b) as models that describe structures such as products, services, or processes, and (c) as prototypes that represent design solution ideas. If we draw the inclusion relations among them, then we can find the boundary of probes illustrated with Figure 1 in which some models and prototypes with exploratory purposes are included. This research will investigate mediating artifacts that belong

within the boundary of 'probes'.

A probe is defined as “any small device [...] which can penetrate or be placed in or on something for the purpose of obtaining [...] information” (all definitions from OED 2006). A probe is the broadest term among them as it may include any objects, settings and environments, and even models and prototypes developed to investigate design research questions. Both representational and nonrepresentational objects can be used as probes. Representation has subcategories depending on what is represented, such as model and prototype. A model is defined as “a simplified or idealized description or conception of a particular system, situation, or process [...]”; a conceptual or mental representation of something”. A model can be a representation of both physical and abstract concepts, but it is not necessarily visualized or materialized in three dimensional forms. When a model is representing a design solution, then it may act as a prototype which is defined as “a preliminary one made in small numbers so that [...] mass-production can be evaluated”. As models are representations of structures of any kind, and a prototype is a partial representation of a solution, a prototype can be a kind of model. Not all models are prototypes, however, since models do not necessarily represent solution ideas. Not all probes are models either because probes are not necessarily a representation of structures.

### METHODOLOGICAL ADVANTAGES OF MEDIATING ARTIFACTS AS PROBES

Four types of mediating artifacts as probes are reviewed in this paper. First, mediating artifacts may be used as *Design Games* to engage participants in game format research activities (Ehn and Sjögren 1991; Brandt 2004). Design Games aim to (1) explore users' current practice, future needs and design solution ideas, (2) provide fun and engaging atmospheres, and (3) create a space for a discussion of organizational issues such as differences in perspectives and inequalities in participation.

Second, mediating artifacts may also be used as *Cultural Probes* to solicit participants' spontaneous and imaginative responses in relation to the provocative qualities (Gaver et al. 1999). Such responses are not meant for scientific research analyses, but rather they reveal some aspects of participants' lives that designers can use as resources of their creativity.

Third, mediating artifacts are used as *Generative Techniques* (Sanders 2001a) to externalize participants'

tacit and latent kinds of knowledge, and the activities themselves and collected materials enable researchers to project desirable future from what the participants 'make' along with interviews and observation data.

Fourth, mediating artifacts are used as *behavioral prototypes* (Poggenpohl 2002) or mock-ups (Iacucci et al. 2000; Brandt 2005) to materialize design ideas. Iterative prototyping facilitates communication between designers and users as well as offering opportunities for further exploration.

In the discussion below, how mediating artifacts as probes can facilitate designer-user knowledge exchange will be argued with design project research cases.

#### ELICITING SITUATED USER NEEDS

Used within proper contexts, mediating artifacts can elicit situated user needs, both current and future ones. Ehn and Sjögren (1991) developed the Carpentripoly game which was a role-playing game intended to stage carpenters' current work experiences. Carpentripoly is a board game similar to Monopoly, but the market opportunities in Carpentripoly were based on the real business situations at the time. Artifacts used in Carpentripoly, a board game, three roles, and stack of cards with opportunities and disasters, constituted models of the business settings and opportunities and disasters. Due to the design of this game, the responses generated are grounded in the real business situations that the carpenters faced.

#### ELICITING DIVERGENT PERSPECTIVES AND NEEDS

Mediating artifacts can elicit divergent perspectives and needs that participants can discuss together to set priorities. The Landscape Game (Brandt and Messeter 2004) was designed to encourage discussion among stakeholders with different perspectives, by introducing imagery and simple means for prioritization. Pictorial images given to participants were interpreted in many different ways, sometimes indirectly based on the projection of their different backgrounds and experiences. Prioritization of their choices of images (important things go to the center) led to discussions in which participants talked about the reasons behind their choices.

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#### SUPPORTING PARTICIPANTS' GENERATION OF DESIGN SOLUTION IDEAS

Mediating artifacts may support participants' problem-solving activities as a part of design idea generation. Ehn and Sjögren (1991) provided Layoutkits to carpenters to examine current layout of their workplace to discover problems, and their suggested layout to discover possible solutions to the problems. The machine cards in the Layoutkits supported the participants' creative problem-solving activities by providing models that they could form and reform. Modeling and visualization are reported to be useful for problem-solving, as graphical external representations reduce participants' cognitive burden by functioning as a "visual-spatial scratch-pad component of working memory" (Baddeley 1990 quoted in Cox and Brna 1995).

#### DOCUMENTING ELICITED CONCRETE AND ABSTRACT TYPES OF KNOWLEDGE

Mediating artifacts may document elicited concrete types of knowledge with iconic representations, and materialize abstract types of knowledge with metaphoric representations. The resulting space layouts using Layoutkits (Ehn and Sjögren 1991) were iconic representations of users' current or imagined future workplaces. User interfaces created with the Velcro-modeling Toolkit (Sanders and William 2002) capture users' embodied ideas. The Cognitive Mapping Kit (Ibid.), on the other hand, supports diagrammatic representations of user experiences, and the generated maps are metaphors of invisible processes such as personal experiences. Other examples of metaphoric representations are the concentric circles used in the Landscape Game (Brandt and Messeter 2004) which is an abstract representation of a work environment where horizontally and vertically laid out images from the User Game are abstract representations of the flows of stories participants came up with when the game was played.

#### REVEALING PROPOSITIONAL, PRACTICAL AND SENSUOUS KNOWLEDGE

Mediating artifacts reveal propositional knowledge, practical experiences and sensuous knowledge (Wittgenstein 1958[1953]) that users have with current products and services or may have with future artifacts. Ehn's 'design-by-doing' methods revealed both propositional knowledge and practical experience in computer use from the observations of participants' direct interactions with prototypes (Ehn and Sjögren 1991).

## FACILITATING COMMUNICATION

Mediating artifacts facilitate communication by mediating physical, cultural, and sometimes verbal communication gaps between participants and design researchers. Cultural Probes (Gaver et al. 1999) are used for two overarching purposes. First, a probe may partly resolve the communication problems that researchers have when they work with users they meet for the first time: the psychological, physical, and cultural distances, and the generation gaps, between the design researchers and participants. Second, a probe can elicit more than obvious needs and desires by using oblique wording and evocative images. The value of cultural probes are argued as “opportunities [they provide] to discover new pleasures, new forms of sociability, and new cultural forms (Gaver et al. 1999, p. 25)” which might have been harder or impossible to see with controlled methodologies to solve predefined problems.

## ABSTRACTNESS OF MEDIATING ARTIFACTS

The advantages of using mediating artifacts as probes are partly relevant to the abstractness of the artifacts. Abstractness in this research is characterized as two qualities: First, it is “a general quality or characteristic apart from specific objects or instances” (abstract 2007) which reveals common structures of things and events that belong to a same set. Second, it is a representative quality which shows designated aspects of things and events without being distracted by unnecessary details. Abstractness can shape physicality and interactivity of probes, for example the abstractness of a probe with low appearance fidelity can remind users of many things with similar forms (association) which can lead to exploration of fresh ideas. In the discussion below, how the physicality and interactivity of mediating artifacts can benefit from the abstractness will be discussed with examples.

## PROVIDING CLEAR STRUCTURES OF PROBLEM SPACES

The abstractness of the artifacts provides clear structures, sometimes alternative perspectives, of problem spaces when they serve as models of the problem spaces. The structures and perspectives externalized with models support the participants’ understanding of the problems.

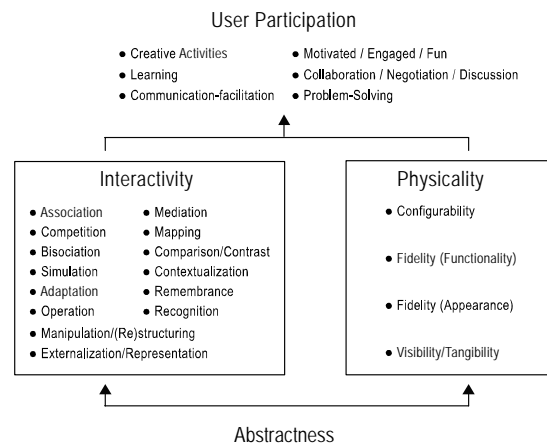


Figure 2. Abstractness That Shapes the Physicality and Interactivity of Probes

Problems that we encounter in design projects are often messy and ill-structured when multiple stakeholder groups are involved, because of their multiple perspectives and conflicting interests. One of the goals of user research is having clear understanding of current problems, and the abstractness of mediating artifacts supports it when they are used for user research to construct models of the problem spaces by summarizing common aspects of problem descriptions from diverse sources. Such a benefit is described as ideal or platonic types of boundary objects by Star and Griesemer (1990) in which we do not see any detailed descriptions for any one locality, but they preserve common structures of the individual elements. For example, an abstract diagram of a machine layout in a factory can give us a chance to understand the current workflow of this factory, from a holistic viewpoint without being distracted by unnecessary details of various machines, and also from a different viewpoint since normally no one looks down the entire factory from the roof. That is a good place to start to consider the rearrangement of machines for optimal workflow.

## SUPPORTING EASIER MANIPULATION OF DESIGN SOLUTION IDEAS WITH TANGIBILITY

When mediating artifacts serve as exploratory models of problem spaces or design solution ideas, the abstractness of the artifacts supports easier manipulation by substituting something manageable in our hands for uncontrollable world with.

Latour (1986) describes this point with the advantageous characteristics of immutable mobiles that are scalable, easily shuffled with other artifacts, and mobile including the ability to be transported to other physical locations if necessary. These characteristics allow design researchers

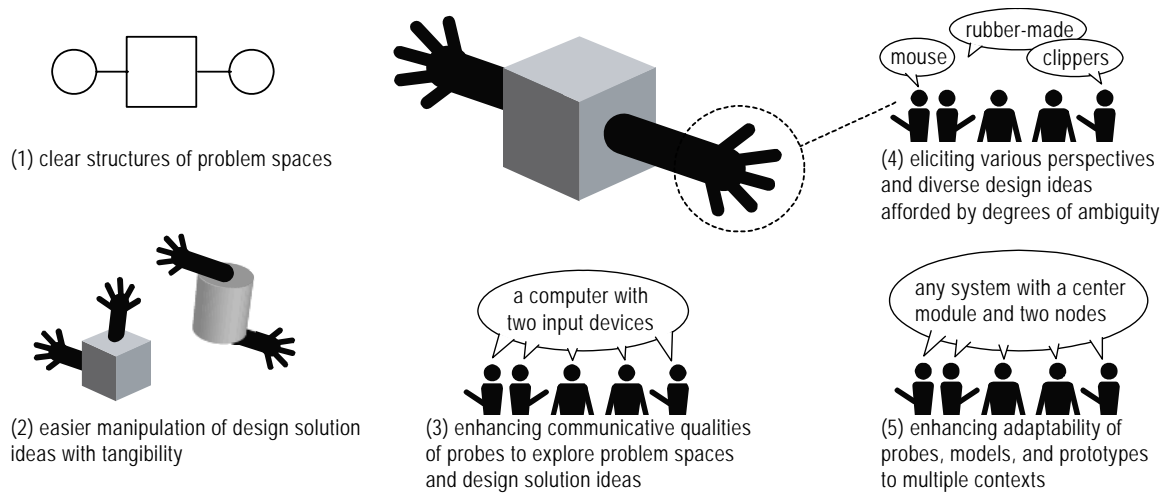


Figure 3. Advantages of Abstractness of Mediating Artifacts

and users to explore problems by iterative materialization of ideas with mediating artifacts, and share the result with others who did not directly participate to the development process. Explorative prototyping with cheap and malleable materials, for example building a computer with cardboards, encourages experiments in diverse directions. Whether the materials are the same or different from final products does not matter in the early stages of design if all participants understand the prototypes as abstract representations of certain aspects of future artifacts. For the same reason, it is not weird to add something foreign to the prototype, for example adding rubber gloves to the cardboard computer if every participant understands the gloves are just abstract representations of new input devices working like hands as illustrated in Figure 3.

#### ENHANCING THE COMMUNICATIVE QUALITIES OF PROBES TO EXPLORE PROBLEM SPACES AND DESIGN SOLUTION IDEAS

The abstractness of artifacts as models can make the meaning of the artifact clear to all participants to varying degree. Representing objects and relationships with other artifacts, especially simpler and more abstract ones, means looking at certain aspects of the objects and relationships, and the models are designed to include only such aspects. For example, a Venn diagram is a model reduced to the inclusion relations of the represented entities. Due to its abstractness, its meaning is easily communicated to readers, and the shared understanding serves as mutual knowledge as the basis of mediating different perspectives. In another example, if a group of participants are working on a computer designing project, and having a discussion

with a prototype, a cardboard box with two rubber gloves attached, then to make the discussion work, everyone should agree to the assumption that the box is a computer and the two rubber gloves are new input devices. They will then voluntarily look at the analogous aspects between the box and a computer, or rubber gloves and input devices only. This agreement is an act of building mutual knowledge.

#### ELICITING VARIOUS PERSPECTIVES AND DIVERSE DESIGN IDEAS AFFORDED BY DEGREES OF AMBIGUITY

The abstractness of artifacts may elicit various perspectives and diverse design ideas because the meanings of the artifacts are ambiguous (Gaver et al. 2003). If we go back to the example of the cardboard computer, it is possible for any of the participants to be reminded of something else than input devices by looking at the rubber gloves, anything that shares similar functionality of hands, because the rubber gloves themselves are mere representations of input devices, and the relation between the representation and the represented is rather ambiguous. If one of the participants starts to notice another aspect of the rubber gloves such as the flexibility of material, then a new idea could be developed from the ambiguous meaning of the representation.

#### ENHANCING ADAPTABILITY OF PROBES, MODELS, AND PROTOTYPES TO MULTIPLE CONTEXTS

Abstractness and ambiguity are closely relevant to the last characteristic, adaptability. As the mediating artifacts were abstract to some degrees, they are adaptable to different problem structures across multiple contexts.

The same overlapping circles we see in Euler's circles or Venn diagrams are useful in representing other kinds of inclusion relations. Cardboard boxes are abstract objects that represent any closed structures with empty spaces inside, and any design ideas that require such structures can be prototypes with them regardless of forms and materials in the early stages of a design project.

## FUTURE PLAN

This research will further the investigation of the physicality and interactivity of mediating artifacts as probes and their methodological advantages that stemmed from abstractness of the artifacts. Empirical approaches are used, meaning user research methods are actually designed reflecting the abstractness and used for a project. This research will provide a partial, but practical base in designing and conducting user research for design practitioners, especially a way to choose and create engaging probes for their research purpose in the early stage of human-centered design process. The content knowledge from empirical user research of online news media will contribute to web-based interactive media development.

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