POETICS OF FURNITURE:
AUGMENTING FURNITURE WITH TECHNOLOGIES

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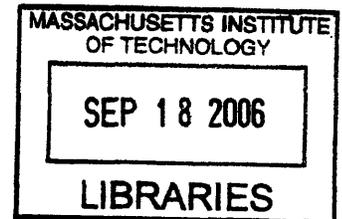Arizona State University, 1996

Submitted to the Department of Architecture in Partial Fulfilment
of the Requirements for the Degree of

Doctor of Philosophy in Architecture: Design and Computation
at the
Massachusetts Institute of Technology

September 2006

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ABSTRACT

This dissertation focuses on one genre of new hybrid objects, namely furniture augmented with electronics. It explores the role of furniture as mediators of social interactions, as well as its potential for eliciting emotional and social responses from users.

To understand the ways in which augmentations of furniture are manifested, examples of augmented furniture have been analyzed and classified into three taxonomies – by functionality, autonomy and design strategy.

The dissertation does not focus on furniture situated in activities or scenarios for work-related themes, but in the theme of *small moments,* everyday, non-instrumental social interaction scenarios between people (for example, dinner at a table, conversation with a friend, walking on the street or reading a newspaper). Although the *small moments* scenarios may appear marginal, they are in fact the very glue of our daily lives.

Three furniture projects are developed to explore the mediating role of furniture. They are the *Conversation Table, Stealing Table* and *Orev Bench.* The design strategy applied for addressing *small moments* through these projects can be best described as *poetic.* The projects are attempts to encourage moments of playful reflection and ultimately help their users learn more about themselves and about the objects they use.

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ACKNOWLEDGEMENTS

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INTRODUCTION

As technologies miniaturize, augmentations of objects and materials in our daily lives become increasingly seamless. Conductive fibres and miniaturized components are woven into textiles that can then act as active skins that sense the environment and respond to stimuli. The paint used on a wall or a table can be an "agglomerate of numerous, finely dispersed, ultra-miniaturized computing particles ... with capacity for storage, communication and signal processing"[1].

And as information and communication technologies become increasingly ubiquitous, users engage with new but also known artefacts with augmented functionalities. From third-generation mobile phones with embedded cameras to smart cars with built-in navigational systems, and from iPods and TiVos to robotic massage chairs we are surrounded by hybrids and quasi-objects (Latour 1993). Yet, not all hybrids and quasi-objects (generally referred to as "augmented" devices) are equally engaging, or vivid as relational "partners" (Kaplan 2005). Some draw us in while others keep us at a distance. Some are obedient while others seem to have a mind of their own. Some are tiny and accompany us as we transit between places while others, big and bulky, keep us grounded, posted, or even boxed in: they require that we position ourselves with respect to them.

This dissertation addresses a particular genre of everyday objects: furniture with embedded technologies, or augmented furniture. Of particular interest to the author are the evocative, transformative, and mediating powers of slightly "incongruous" tables and chairs, that is, their abilities to amuse and delight. Such tables and chairs are characterized as *uncanny* everyday objects[2] or *strangely familiar* ones (reference to familiar strangers[3]). Their main "relational" quality is that they can surprise while, at the same time, evoke the familiar. While tapping into the habitual, they gently disrupt expectations.

Three pieces of augmented furniture, specifically two tables and a bench, were prototyped for this dissertation. Everyday, non-instrumental scenarios of interaction between people (for example, dinner at a table, conversation with a friend) motivated the development of these furniture projects. The tables and the bench were subject to user studies that aimed to explore

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[1] Butera, William. *Programming a Paintable Computer*, PhD dissertation. MIT Media Lab, February 2002.

[2] Freud, Sigmund. *The Uncanny*. London, Penguin Classics. First published in 1919. Pages 121-162.

[3] The *Familiar Strangers* research project (Intel Research, Berkeley) explores often ignored yet real relationships with familiar strangers. Experiments and studies derived from Milgram (1972) have lead to the design of a personal, body-worn device called *Jabberwocky*. Retrieved on 20 April 2006 from http://berkeley.intel-research.net/paulos/research/familiarstranger.

the ability of these objects to mediate and alter the social and emotional responses of people who interact with, and through, them.

The first chapter, THINK, presents an overview of the background and context of the study, and elaborates on unique physical and cultural characteristics of furniture. The research question, theme and scope of the dissertation and an overview of related work are followed by taxonomies for augmentation of furniture.

The second chapter, CREATE, gives an introduction to the augmented furniture projects contextualized within the existing landscape. It also specifies the methodology used to develop the furniture, details their design and development and discusses the choice of technologies.

The third chapter, EVALUATE, starts with a discussion of the kinds of user observations that are appropriate for works at the border between art and human-computer interaction. This chapter presents the methodology used to conduct user observation studies of the three dissertation projects and analyses of the results of these studies. It concludes by discussing if and how social situations were restructured in presence of the furniture projects.

The final chapter, REFLECT, revisits the research question and discusses the contributions to the field of augmented furniture. In addition to generalizing the findings to other artefacts in our environments, this chapter speculates on possible directions for future work.

I

THINK

The first chapter, THINK, presents an overview of the background and context of the study, and elaborates on the unique physical and cultural characteristics of furniture. The dissertation research question and an overview of related work are followed by taxonomies for augmentation of furniture.

BACKGROUND
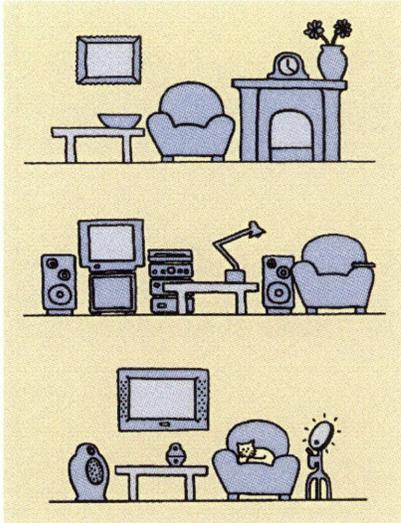
Figure 1. Sketches from *La Casa Prossima Futura* (1999), illustrating the home of the past, present and near future. Drawing by Roland Baird, Philips Design. Retrieved 2 March 2006 from http://images.businessweek.com/ss/05/10/philips2/index_01.htm

In 1999, for the *Milano Furniture Fair* exhibition *Casa di Prossima Futura* (The Home of the Near Future), Stefano Marzano, CEO of Philips Design, reflected on the appearance of the home of the future. According to him, "the house of the near future will be more like the house of the past and less like the house of the present" (figure 1). Black boxes – VCRs, stereo systems, DVD players, TVs, personal computers, etc. – that surround us in our present day homes will "disappear" into the walls, floors and the furnishings. The *Casa di Prossima Futura* exhibit indicated the ways in which Philips envisioned homes in the near future; what Marzano has also continuously stressed is the critical role of design in the process of bringing about change and 'humanizing' technologies.

Basic grammar of design imagery

Adrian Forty pointed out the capacity of design to "create acceptance of the changes" when new technologies and products emerge. He proposed a "basic grammar or repertory of design imagery" to illustrate how new technologies manifest in products. In his book, *Objects of Desire*, Adrian Forty writes:

> Design alters the way people see commodities. To take an example from this process, we consider the design of early radio cabinets. When broadcasting began in the 1920s, the first wireless sets were crude assemblies of resistors, wires and valves. Manufacturers quickly realized that if they were to sell radios for people to put in their living rooms, they had to develop a more sophisticated approach to design. In the late 1920s and early 1930s, three basic types of solution were evolved, each one of which presented the same commodity, the wireless, in an entirely different way. The first was to house the radio in a cabinet which imitated a piece of antique furniture, and so referred to the past. The second was to conceal the radio within a piece of furniture that served some entirely different purpose, like an armchair. The third, which became more common as people became familiar with radio and found it less disturbing, was to place it within a cabinet designed to suggest that it belonged to a future and better world. Each design transformed the original,

'primitive' wireless out of all recognition. **The three approaches evident in these radio cabinets, *the archaic, the suppressive and the Utopian*, have resurfaced so often in industrial design that they might be said to form a basic grammar or repertory of design imagery**. (figures 2-5 below from Forty, pages 11-12. Text bolded by L. Nikolovska)

Figure 2 (left): Pye *Unit System* radio receiver, 1922. The first radios exposed the wiring and components. (Forty, 10).

Figure 3 (center-left): The *Baufort radiogram*, 1932. Radios hidden in cabinets were the earliest manifestation of radio receivers. (Forty, 11).

Figure 4 (center-right): The *Radio Easy Chair*, 1933. Some manufacturers incorporated radios in furniture. (Forty, 12)

Figure 5 (right): Philips *Chapel Radio*, 1938. The most popular design of the radio box was "suggesting a product belonging to the future" (Forty, page 12). Philips and other manufacturers developed a variety of 'cathedral'-like models of radios. Image retrieved on 7 April 2006 from http://www.design.philips.com/about/design/section-13747/index.html. Image published with permission from Philips Design.

Two contemporary examples illustrate Forty's claim about new technologies and a 'basic repertory of design': the LED and the iPod.

The shape of the latest LED light bulbs by Philips (figure 6, presented in the Philips' *Next Simplicity* exhibit in Paris in September 2005) alludes to existing object topology, namely incandescent bulbs (figure 7) used in existing light fittings. Although these new LED light bulbs are interactive (the color and intensity of the light can be adjusted by twisting and turning the bulbs), the new technology literally uses an existing 'package'. This is an example of *archaic* manifestation of new technology.

Figure 6 (top): Philips LED bulbs. Image retrieved on 15 February 2006 from http://images.businessweek.com/ss/05/10/philips2/index_01.htm Image published with permission from Philips Design.

Figure 7 (bottom): Philips' first light bulb, 1892. Image retrieved in April 2006 from http://www.design.philips.com/about/design/section-13747/index.html Image published with permission from Philips Design.

The second example is the *IJoy robotic massage chair,* a chair with a docking station for iPod, built-in speakers and subwoofers that "blend[s] music and massage into the ultimate relaxation experience" (figures 8 and 9) (Sharper Image web site, retrieved in February 2006). In this example the new technology – audio access and storage – is 'repackaged' twice: first as an iPod ("utopian", according to Forty), and then as an add-on to a recliner / chair whose advertised, core functionality is massage ("suppressed"). With this commercial approach to design, the augmentation of the (already augmented) robotic massage chair is driven by the latest consumer trends. In his book *Hertzian Tales* Tony Dunne warns that such "… design approaches aim to optimize the experience of using an object, with the effect of constraining our experience to the prosaic." (Dunne, 1999, page 14)

Figures 8 – 9. *iPod* (retrieved in March 2006 from http://www.apple.com/ipod/gallery/) and *iJoy ZipConnect Massage Chair* (retrieved in February 2006 from http://www.sharperimage.com/)

Forty's "basic grammar or repertory of design imagery" refers to new and emerging technologies that manifest as archaic or suppressive, and ultimately find a design identity of their own in Utopian 'shells'. In addition, Forty's basic grammar refers to commercial objects, not art or conceptual design work. Although this "grammar" can facilitate understanding of approaches to augmentation of existing objects, it does not address what happens to the transitional 'host' objects such as cabinets or chairs. The grammar can help in understanding how augmentations with different technologies are manifested, but it does not address whether the characteristics of the host objects change. When is the augmentation connected to existing functions of the object (for example, when a recliner becomes a massage chair), and when is it unconnected (when a recliner develops built-in speakers and subwoofers)? Before delving into types of augmentations of furniture, a discussion of the basic characteristics of furniture is necessary.

CHARACTERISTICS OF FURNITURE

Furniture has unique physical[4] and relational characteristics. Material properties such as shape, scale as well as temporal immobility and stability fall into the category of physical characteristics of furniture. "Relational" characteristics include different functional and symbolic characteristics, as signalled / perceived within accepted cultural conventions – "scripts that guide the sequence of behaviour" (Norman 1988). The following issues unique to furniture will be reviewed in this section:

- Scale, the body and the engagement of senses
- Temporal personalization and shared use
- Stability of furniture
- Cultural conventions
- Relations between shape and arrangement of furniture, and meaning

Scale, the body and the engagement of senses

We interact in different ways with small hand-held objects or on-screen interfaces than we do with furniture or spaces simply because the scales are different and different senses may be engaged. Hand-helds and wearables are small and light, and are designed to be held or worn. They are carried along and become part of the person's nomadic self. Interactions with on-screen interfaces are mainly visual, and the proximity of the body to these objects range from arms-length to steps away. Buildings and outdoors spaces, whether furbished or not, provide shelter and places to rest and interact with others.

Furniture, too, engages our tactile, visual senses and sometimes auditory[5]. In addition, furniture keeps us settled. Chairs, beds and benches provide body-sized "zones" to rest. Tables bring

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[4] John Gloag states that "[n]early all articles of free-standing furniture are variations of two basic shapes: a platform or a box. Stools, benches, chairs, couches, beds and tables are platforms elevated on feet or legs or underframing, on which you sit, lie, or put things; chests, cupboards and wardrobes are boxes for storing anything from linen and clothes to food, wine, drinking vessels, documents or money..." (page 3-4)

[5] A recent *Associated Press* article reported that a teacher from a secondary school in Bristol, UK, sued her employer over a noisy chair that squeaked as if it 'broke wind' when she would sit in it. Despite repeated requests, the school did not replace her chair. The teacher had a nervous breakdown and resigned from her position. Retrieved on 22 March, 2006 from http://www.cnn.com/2006/WORLD/europe/03/22/britain.chair.ap/index.html

friends and families together supporting our bodies either socially (to dine or converse with others) [6] or physically (to rest, sleep or sit).

Temporal personalization and shared use

Furniture is not necessarily personalized and frequently exists in public spaces. We often share furniture, appropriating and, sometimes personalizing them temporarily, both at home and in pubic. We often settle, becoming temporarily immobile as we sit on a chair or bench, eat at a table, or lying on a bed. Occasionally, the inability to move around or shift our positions relative to the furniture (location or distance) results in peculiar social situations – from the conversations at long holiday dinners, to uncomfortable silences during social events.

Stability of furniture

Unlike consumer electronics products, augmented furniture is inherently stable. When a cell phone breaks, we can not use it until it is fixed or we replace it with a new one. When tables with embedded screens or robotic massage chairs are out of power, the objects maintain their core functionality. In other words, they keep their integrity as objects where one can eat, read, converse with others, sit or relax. This *stability* of augmented furniture is a critical feature that lends much of its instrumental and evocative powers.

Cultural conventions

Accepted cultural conventions and "scripts" guide the sequence of people's behavior (Norman 1988). Such cultural conventions include behaviors at or around tables. Table manners are one such set of culture-specific rules of behavior. In the West, proper use of dining utensils is expected. According to Western traditions, embracing these rules of etiquette shows that one

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[6] Lola Llorca, a product designer from Barcelona, provided an example of vernacular use of tables during cold winters in Barcelona. The core of the table houses a metal tray filled with charcoal. Its top is covered with long, thick fabric. Those sitting around the table cover their legs with the fabric, staying warm while eating dinner, writing homework, etc.

is civilized at the table[7]. In contrast, in many other countries of the world it is considered perfectly appropriate table manners if fingers are used instead of dining utensils. Another example of culture-specific behavior is illustrated in a report about 19th century Hindu craftsmen[8] (Cranz 1998). The squatting of these blacksmiths, carpenters, and masons while at work was interpreted as uncivilized by their English employer. He tried to force the workers to sit on chairs and work on a table, only to find them on the following day working while squatting on the top of the table (page 24). Cranz indicates that "… the reason[s] for sitting on the floor, on mats, on carpets, platforms, Chinese *k'angs,* or stools stem from cultural traditions rather than economic development." (page 26) According to Csikszentmihalyi and Rochberg-Halton, "…the notion that chairs and tables are more comfortable [than sitting on the floor, for example] in an absolute sense is not true; they are so only within a pattern of cultural habits and expectations" (Csikszentmihalyi and Rochberg-Halton 1981, page 58). In fact, traditional Japanese or Hindu homes do not have furniture[9]. Each culture possesses a unique set of beliefs about the significance and meaning of an object or a situation, as well as subsequent actions for behavior in that situation and the world. (Hall 1969 and Norman 1988)

Relations between the arrangement and shape of furniture, and meaning

An everyday example of the relation between the arrangement of furniture and its meaning can be found on university campuses. In some offices, the tables are placed to face the incoming visitor, creating a distance between faculty and visitors. In other offices, the tables are placed side by side, to welcome visitors on equal footing.

Tables have been "arenas for words" as seen in a well-known historical example, the *Round Table* of King Arthur (figure 9). King Arthur gave his knights an equal place at the table and, therefore, an equal right to speak. The circle is a shape that has infinite order of symmetry and can be split into infinite number of equal parts. The geometry of the round table facilitates the dynamics at the table and every person owns an equal part of the table. Today the term

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[7] In Macedonia, the country of origin of the author, a cup of coffee served at the end of the dinner or the visit used to signal to the visitor that time has come for them to pack up and leave. At the author's very first journey to the USA, an American host served a cup of coffee at the very beginning of a visit. Not long after she got up to leave.

[8] Cranz, Galen. *The Chair: Rethinking Culture, Body, and Design.* W. W. Norton & Company, 1998.

[9] Csikszentmihalyi and Rochberg-Halton, *The meaning of things: Domestic symbols and the self.* Cambridge University Press, 1981. Pages 58-59.

"roundtable" is a synonym for committee or assembly. The shape of the table itself symbolizes fairness and equality in group conversations.
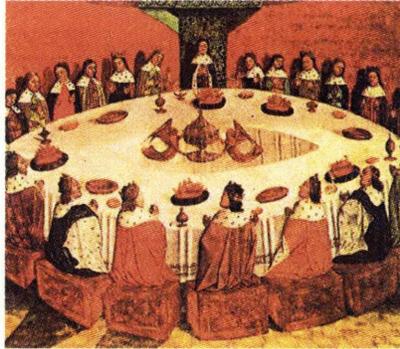
Figure 9. Sandro Botticelli, *Knights of the Round Table.*
Retrieved in October 2004 from http://pathguy.com/botticelli_round_table.jpg

One of the most "graphic and politically important instances of deliberately manipulating the shape and symbolism" (Herdeg 1983, page 27) of a piece of furniture and the concept of equality at a 'round table' occurred in Paris in the late 60s during the peace talks between the USA, South Vietnam, North Vietnam, and the National Liberation Front (NLF or Vietcong). The parties could not agree about the organization of the conference, and, in particular, about the shape of the conference table. The North Vietnamese and the NLF preferred a square table to stress equality between the parties who negotiate (figure 10 left). The USA and South Vietnam proposed a long rectangular table that didn't provide an equal "space" at the table for all the parties (figure 10 right).
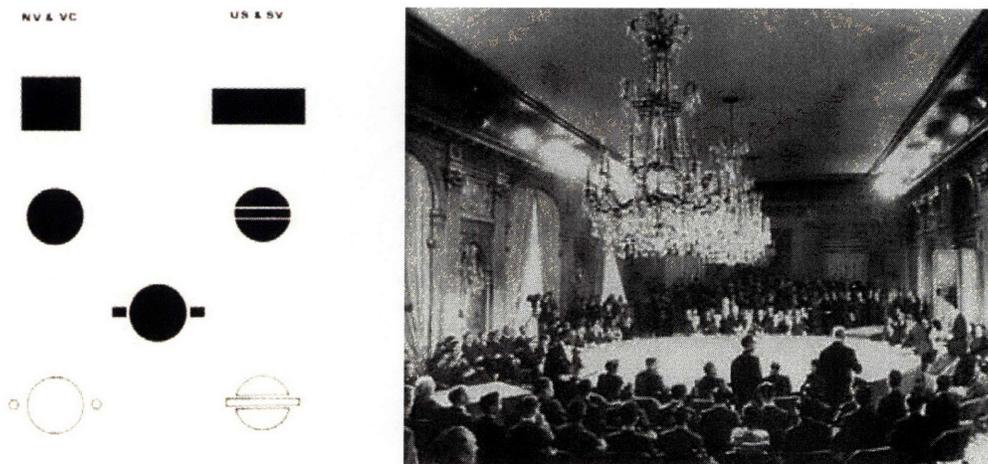
Figure 10. Diagrams with proposals for the shape of the conference table. From *The Decorated Diagram* by Klaus Herdeg, 1983 (page 28). **Figure 11.** The giant table and the signing of the peace agreement in Paris on 27 January, 1973. Image retrieved in March 2006 from http://www.gruntonline.com/TheWar/peace_accord1.htm

After numerous iterations of proposals and rejections, it was the Soviet ambassador in Paris who proposed a giant, round table with two smaller rectangular tables at the opposite side. Each of the small tables was to be located exactly eighteen inches from the main, round table (figure 11). After ten weeks of deadlock in the negotiations due to the table's shape, everyone agreed to the proposal by the Soviet ambassador. Herdeg comments that the negotiating parties never disagreed about the meaning of the proposed shapes of tables and "… both recognized and cherished the political symbolism implied in form." (page 27).

Figure 12. NY Times story about the Vietnam peace talks in Paris in 1969 with proposals for the shape of the conference table. ©*The New York Times*, January 17, 1969. Images retrieved from the book *The Decorated Diagram* by Klaus Herdeg, 1983 (page 28).

The above examples illustrate the powerful roles furniture plays in our lives, and point to the inter-weaving of physical, symbolic and cultural meanings embedded in an object. In their book *The Meaning of Things: Domestic Objects and the Self*, Csikszentmihalyi and Rochberg-Halton stress the symbolic and cultural role of objects: "Objects are not static entities whose meaning is projected on to them from cognitive functions of the brain or from abstract conceptual systems of culture. They themselves are signs, objectified forms of psychic energy. Whether through action or contemplation, objects … are meaningful only as part of a communicative sign process and are active ingredients of that process." (page 173)

RESEARCH QUESTION

The research question of this dissertation is: How can furniture with embedded technologies affect social and emotional components of interactions among individuals? In particular, the dissertation investigates issues such as restructuring of social situations in the presence of augmented furniture and how robust (or not) are social situations in the context of such interactions.

COMPONENTS AND CONTEXT OF SOCIAL INTERACTIONS

This dissertation examines the potential of augmented furniture in creating unique circumstances during social interactions, from humorous or poetic to disruptive, deviant or obsessive. To investigate this potential, the dissertation projects focus on everyday, non-instrumental scenarios of interaction (de Certeau 1984) encapsulated with the term *small moments*. The following two sections i) illustrate the significance of understanding that social and emotional components of interactions are inter-woven, and ii) situate these interactions in the context of *small moments*, purposefully avoiding scenarios that focus on efficiency and productivity and that shy away from addressing emotional components of social interactions.

On socio-emotional components of interactions

Emotions, according to the sociologists Turner and Stets, "… permeate virtually every aspect of human experience and all social relations" (2005, page1). Social and emotional components of interactions represent intersecting registers contained in every interaction. In addition, emotional and social components of interactions are inter-woven, bringing people together or driving them apart:

> "… emotions are the "glue" binding people together and generating commitments to large-scale social and cultural structures; in fact, emotions are what make social structures and systems of cultural symbols viable. Conversely, emotions are also what can drive people apart and push them to tear down social structures and challenge cultural traditions. Thus, experience, behaviour, interaction, and organization are connected to the mobilization and expression of emotions."
> (page 1)

Further, as Wenworth and Yardly point out, "… the activation, experience and expression of emotions are intimately connected to the body" (1994, page 2). Although emotions are driven by socio-cultural contexts, their nature and intensity are products of biological processes (Turner and Stets 2005, page 3).

Small moments

Architecture is often experienced through *small moments*. People engage with others and with objects in the landscape, run to a meeting or slow down to reflect and talk to a friend, and layer planned encounters with accidental or serendipitous ones. Daily involvements and interactions are not only manifested in work, study or other activities that require speed and efficiency. People are also involved in much more leisurely everyday activities such as cooking, reading a book or talking to a friend. These everyday activities are interwoven with the fabrics of our workspaces, classrooms and business meetings. It is through the small, individual experiences that take place in a range of contexts that we assemble our own personal narratives and memories. These small, layered experiences of daily activities are called *small moments*.

In *Practice of Daily Life,* the French philosopher Michel de Certeau distinguishes two types of daily activities, *strategic* and *tactical,* and stresses that both have their own modes of production and consumption. He states:

> I call a "strategy" the calculus of force-relationship which becomes possible when a subject of will and power (a proprietor, an enterprise, a city, a scientific institution) can be isolated from an "environment." A strategy assumes a place that can be circumscribed as *proper (proper)* and thus serve as the basis for generating relations with an exterior distinct from it (competitors, adversaries, "clientèles," "targets," or "objects" of research). Political, economic and scientific rationality has been constructed on this strategic model. (de Certeau, xiii)

According to de Certeau, formally acknowledged social activities such as classroom-based school work, working in a job, having a meeting, or even playing in the (local) football team are strategic in their character. The concept of "strategies", according to him, refers to institutions of power that are embodied in contemporary organizations such as businesses, commerce, scientific institutions, organized enterprises, etc.

> I call a "tactic," on the other hand, a calculus which cannot count on a "proper" (a spatial or institutional localization), nor thus on a borderline distinguishing the other as a visible totality. A

tactic insinuates itself into the other's place, fragmentarily, without taking it over in its entirety, without being able to keep at a distance. ... because it does not have a place, a tactic depends on time – it is always on the watch for opportunities that must be seized "on the wing." ... Many everyday practices (talking, reading, moving about, shopping, cooking, etc.) are tactical in their character. And so are, more generally, many "ways of operating": victories of the "weak" over the "strong" (whether the strength be that of powerful people or the violence of things or of an imposed order, etc.), clever tricks, knowing how to get away with things, "hunter's cunning," maneuvers, polymorphic simulations, joyful discoveries, poetic as well as warlike.
(de Certeau 1984, xiii-xix)

Many marginal, everyday practices such as talking, reading, walking in the city, shopping, cooking, more recently surfing the web, etc. are tactical in their character. *Tactics*, according to de Certeau, implies the lack of organizational foundation. To illustrate tactical behavior while at work, de Certeau brings up *la perruque* (French for "the wig") (page 24), a practice known under different names in different countries. *La perruque* refers to the workers' practice of doing their own work while behaving as if they are working for their employer. Marginal social activities are significant for the social development of the members of the community, but are not acknowledged as such in a formal way.

The following two examples of activities – competitive games and play – occur at tables and further illustrate the difference between what de Certeau calls *strategic* and *tactical* in the context of interactions around furniture.

Activity 1: A game of chess and table tennis (an example of strategic activity)
Although forms of play are often a means of relaxation between friends, the games of chess and table tennis are in essence a type of strategic activities (figures 13 and 14). The tables where these games are played are in effect battlegrounds; they are arenas for competitions among players with specific strategies.
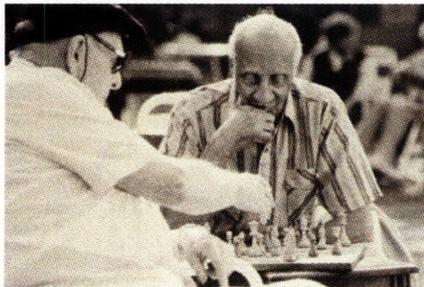
Figure 13. Game of chess.

Figure 14. Monks playing table tennis, Labrang monastery, China.

Activity 2: *Manolo is gonna have fun* (an example of tactical activity)

The furniture project **Manolo is gonna have fun** (figure 15) by the Spanish designers Lola Llorca and Hector Serrano focuses on play. One of the projects from the series is a trampoline-like coffee table that has a suspended table cloth instead of a solid tabletop. The designers invited users of the table to jump on its top for fun or to relieve stress. In effect, their design fosters an activity of 'doing nothing', a tactical activity without plan or strategy.

Figure 15. Lola Llorca and Hector Serrano. *Manolo is gonna have fun*, 2002.
Lola and Hector demonstrate how to use the table: to jump for exercise, play, or to get rid of stress.

The concept of *small moments* – everyday, non-instrumental interaction scenarios between people (e.g. dinner at a table, conversation with a friend) – motivated the development of the furniture projects for this dissertation. Rather than following a *rational* approach to creating a design strategy for addressing *small moments*, the chosen approach of this dissertation can be best described as *poetic*. The goal was, therefore, to develop designs that encourage moments of playful reflection and ultimately help us learn more about ourselves and about the objects, while also providing some flexibility in twisting the intended use of the objects.

THE POETICS OF EVERYDAY OBJECTS, AND THEIR ABILITIES TO ELICIT MEANINGFUL INTERACTIONS

While each person experiences and appropriates cultural artefacts in very personal ways – depending upon interests, experience, and background – it is also the case that objects and places set their own constraints regarding the ways in which we engage with them. In other words, not all artefacts are good enough projective materials[10]. Some are clearly better suited to foster meaningful and delightful encounters.

What is "in the eyes of the beholder"?

All forms of human imagination – from fantasy play to musing about incongruities – are based on a unique mental process that the writer Arthur Koestler called "bisociation" and which consists of "perceiving a situation or idea in two self-consistent but habitually incompatible frames of reference" (Koestler 1964, page 94). While some form of unexpected, surprising, or incongruous relation is always present in play, poetry, or humour, the presence of incongruity won't suffice to create humour, delight, or playfulness. Instead, according to Koestler, incongruity can be perceived in any of three ways: interest, fear, or amusement, depending upon the context. For an incongruous event or object to engender amusement or delight it needs to be taken seriously in its *unreality*, which in turn requires a person's ability to operate on make-believe ground, or do as-if – what psychologists refer to as *suspension of disbelief.*

A person who laughs at jokes, amused when pretending or observing incongruous events, acknowledges the "unreality" (the impossibility or absurdity) of the imagined events: events are humorous *because* they are at odds with reality. Suspension of disbelief is the one single most important qualities of human imagination.

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[10] It seems essential for designers to take responsibility for their products. They cannot assume that, no matter the external form, people will use their products as Rorschach stains. They can also not assume that the intent of the author is what will prevail through a design. Any creation, once launched, may well speak to others in ways not intended.

Objects' presence?

The poetics of everyday objects speak to an artefact's abilities to evoke incongruous yet amusing associations. At the same time, it uncovers otherwise veiled "truths" or "dangerous" ideas. It opens up new mental venues or *possibilities within* – that is, possibilities for re-digesting or reverberating deeply felt human experience.

OVERVIEW OF RELATED WORK

This section reviews compelling examples of furniture. All but two of the examples are augmented with technologies. The furniture examples are grouped into categories that stress the types of personalities that they exhibit. The aim of the review is to assess existing types of furniture with or without embedded technologies[11].

- Enlightened   *beyond lighting*
- Connected   *access to the internet*
- Communal   *supporting communities of interest*
- Therapeutic   *mediated touch*
- Critical   *public debate*
- Witty and provocative *art*
- Inquisitive   *from shy to assertive*

Additional examples of furniture augmented with technologies are available in Appendix 1.

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[11] Furniture with embedded technologies will be referred to as augmented furniture in this dissertation.

A. Enlightened: From *Eudora* to *Glowing Places*

Artificial light offers a new type of ornamentation possibility for furniture, visually bringing objects to life. Ellen Lupton[12] writes about the relationship between artificial light and artificial life:

> "A glowing object appears curiously alive. ... Artificial light signals the presence of electricity, the energy that animates the object world. ... Ordinary domestic goods – blankets, pillows, or chairs – come alive as they glow with artificial light. While most fixtures must be shielded from touch, these objects invite physical contact. Their dull interior illumination draws attention to the surface, infusing their skins with an alien energy, at once comforting and strange" (page 158).
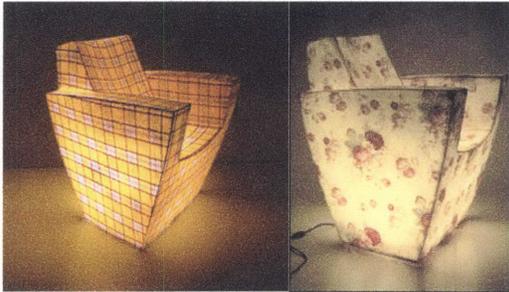
How 'enlightened' and alive are these hybrid objects? *Eudora*[13], a project by Critz Campbell, is a fibreglass chair internally illuminated with fluorescent light (figure 16). The light can be switched on or off. The chair is upholstered in a variety of printed fabrics encased in polyester resin. When lit, it resembles a giant lamp.

Figure 16. *Eudora chair*, Critz Campbell (2003). Exhibited at the Cooper Hewitt Museum Triennial. The chair in the right image is upholstered with "Norfolk Rose" by Waverly Fabrics (see footnote below). Retrieved on April 2006 from http://www.b9furniture.com/NewFiles/Eudora.html

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[12] Ellen Lupton, *Skin: Surface, Substance and Design*. New York: Princeton Architectural Press, 2002. Book published in conjunction with an exhibition at the Cooper Hewitt National Design Museum, 2002.

[13] Pages 68-69 in *Inside Design Now*, edited by Ellen Lupton, Donald Albrecht, Susan Yelavich and Mitchell Owens. Princeton Architectural Press, 2003. Also see *NY Times* article from 25 April 2003, republished on 10 September 2004 at http://www.engineeringways.com/wg_article.html
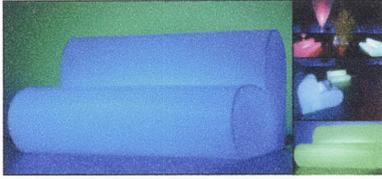
Figure 17. Designer LED Sofa, *InoAge Software Developers*. Retrieved on 26 April 2006 from http://www.inoage.de

Manufacturers increasingly offer illuminated furniture such as the **Designer LED Sofa** (figure 17) by the German company *Inoage Software Developers*. The sofa is made from internally illuminated translucent plastic. Because the lighting technology is LEDs in different colors, the sofa appears in different colors. The sofa is a symmetrical heart-shaped object that can be flipped on either side, or on its top/bottom to serve as a lamp.

In 2003 Ingo Maurer designed this limited edition **LED Table** (figure 18). A total of 278 white LEDs are encased in-between two 'leafs' of glass, resembling stars on a sky. These LEDs emit light on both the top and the bottom of the tabletop; the base is made from black steel. The table is a passive object and the LEDs can be switched on or off as wished. According to the manufacturer's specification, the life span of these LEDs is approximately 11.4 years of continuous use.

Figure 18. Ingo Maurer, *LED Table* (2003).
Retrieved on June 2005 from http://www.ingo-maurer.com/

While some illuminated objects are passive, others exhibit behaviours triggered by patterns of surrounding activities. One of the less 'enlightened', gloommier examples of embedding light in furniture is the **SitzKunst** project (figure 19) by Schellenberger, Quodt and Ritter. This is an already existing sofa whose sitting surface is covered with over 2000 LEDs. The layer of LEDs on the seat of the sofa functions as text screen and ticker tape. One can place a text message by phone or email onto the sofa sitting surface. A sofa is located in Köln, another one in Hamburg.

Figure 19. *SitzKunst*, Schellenberger, Quodt and Ritter, 2004.
Retrieved on 30 January 2006 from http://www.lightlife.de/sitzkunst.htm

Glowing Places[14] (figure 20) is another example of illuminated furniture with behaviour. This project, involving collaboration between the Royal College of Arts and Philips Design, was an investigation into people's interaction with light in urban spaces. The chairs were made of thick translucent plastic. LED strips and sensors were embedded below the top surface of the chairs. The sensors measured the number of people that sat at the chairs and the duration of the periods in which they remain seated. These measurements contributed to the creation of a "social interactive pattern" (Rutgers 2005) and seen in the variety of lighting effects emitted by the furniture. Large numbers of visitors that sat on the chairs for short periods of time triggered erratic lighting activity. Slow periods with only a few visitors triggered soft light. The pattern of light depends on visitors' collective, non-mediated use of the glowing chairs.
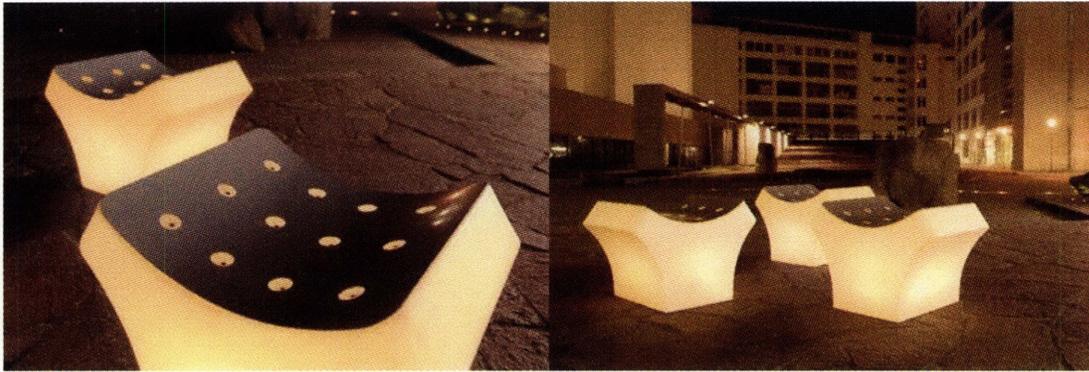
Figure 20. *Glowing Places*, Philips Design (2005). Image published with permission from Philips Design. Retrieved on 4 April 2006 from http://www.design.philips.com/about/design/section-13675/index.html

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[14] Precedent for this project was in an earlier Philips Design project called *People, City, Light* (1999). Graham Hinde (Philips Design) designed 'glowing chairs' made from translucent plastic. The top surface of the chairs had holes for TL light tubes; the chair was not dynamic / interactive.

B.   Connected: *Q4 Plugged* and *RoomChair*

Q4 Plugged is one of Philips Design's explorations of the 'connected home', where technologies disappear into the walls, floors and the furnishings. *Q4 Plugged* is a modular furniture system comprised of four upholstered square-shaped ottomans. The ottomans can be arranged in variety of configurations (figure 21). Each ottoman has a **4x4** grid of sockets on its top. One can plug small tables, arm- and back-rests in these sockets. In addition to plugging standard furniture elements, these sockets can be also used to plug electronic devices such as lamps, (textile) remote controls, LCD screens for watching TV and browsing the Internet, media players, stereo components, etc.

Figure 21. Philips Design. *Q4 Plugged*, 2001. Retrieved on 29 April 2006 from
http://www.design.philips.com/about/design/section-13622/index.html
Images published with permission from Philips Design.

In this example, use of an everyday object – furniture – has been extended by providing Internet connectivity and an assortment of plug-and-play elements. The modularity of the four ottomans and the add-ons provide flexibility in arranging the furniture for different contexts and needs.

The approach to setting up personal space in the *Q-plugged* projects is functional, rational and program-based. This approach is also present in the next example of augmented furniture. In 2000, the Italian furniture company *Felicerossi* invited eight designers to develop prototypes of seating furniture[15]. Stefano Marzano from Philips Design was one of the invited designers. He proposed **RoomChair**, an armchair inspired by the days when he was a student and studied outdoors (pages 4-11). The *RoomChair* comes with a built-in internet connection and incorporates computing peripherals such as side touch screen that doubles as a keyboard, CD ROM drive, a token dish for storing and retrieving information, and a retractable flexible screen that can be "extended over the head to display information projected via a projector located in the backrest of the chair." (page 9) The chair can recline to a lying position for the user to rest and see the two birch trees on the back of the chair (figure 22).

Figure 22. *RoomChair*, Felicerossi 2001.
Image published with permission from Philips Design.

The goal of the project was to create an armchair that will signify the moment where work, pleasure and relaxation activities of daily lives intersect. Work-related computing peripherals like screen and trackball were merged with a known artefact (armchair), thus extending the use of the armchair with tools that may enable various daily activities, layering work activities with the *small moments* of one's day. Symbols – trees – were used to suggest relaxation. This is an

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[15] *S.O.F.A. Light,* Jacco Bregonje and Carlo Magnoli (project coordinators). Felicerossi, 2001.

interesting example where the range of such activities and experiences is addressed in a programmatic way.

C.   Communal: *Living Memory* and *Presence*

The nature of daily activities addressed in the **Living Memory**[16] project, like chatting with a friend at the bar or waiting for a bus, is what De Certeau calls "tactical" and this dissertation refers to as *small moments*. These are activities that, although those involved appears to be doing nothing, nevertheless contribute to the relationship between the community members. The *Living memory* project was a European Commission-funded project from the *Connected Communities* project cluster. Its first iteration resulted in a "connected" café table and a bus stop. Based in the Corstorphine neighbourhood in Edinburgh, the project examined the role of new interfaces (nodes such as café tables or bus stops) in everyday environments and for everyday activities (looking for a plumber or a baby sitter, waiting for the bus, or drinking coffee with a friend).

Figure 23. *Living Memory* project, Philips Design et al. Table (left), user interface of the table (center), and bus stop node (right). Retrieved from *Connecting the Community: Living Memory.* Internal Philips Design publication, 2000. Images published with permission from Philips Design.

The work began with an extensive on-site ethnographic study and interviews with residents from Corstorphine. The study and interviews examined the nature of non-structured / daily activities of people from Corstorphine, and public / private contexts in which these activities take place. Several key locations were identified (the local pub, bus stop, home, library and school) for which a range of user scenarios were developed. An initial set of concept design

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[16] Collaboration between Philips Design (Eindhoven), Queen Margaret College (Edinburgh), Domus Academy (Milan) and University of Sorbonne (Paris). 1997-2000

ideas for the key locations was generated by the Domus Academy and Philips Design and then revised and developed into tangible proposals at Philips Design in Eindhoven[17]. Questions generated by the project include: What makes a community? How does community membership manifest? What are the existing means of sharing local information in local communities? What would be appropriate community nodes for Corstorphine? How does one disclose oneself in private versus public contexts?

Three nodes were prototyped: a home node (user interface on a home PC), a café table with embedded touch screen and RFID reader/writer (figure 23 left and center), and a bus stop (figure 23 right), a large poster-like display with RFID reader. The café table was the most complex of the nodes. Its shape was round with a user interface specifically designed for the table, to enable multi-person interaction at the table. It was envisioned that each café would have multiple context-sensitive tables networked with other nodes at other locations in the Corstorphine neighborhood. Five categories of local community content were available at each node: yellow pages (for example, adverts for plumbers or baby-sitters), items for sale, local events, announcements and local history. In addition to accessing the local content, the table nodes were envisioned to enable watching TV, playing a game, or posting a message. Users were able to bookmark, store and move bookmarks of content from one node to another using RFID tokens.

If we strip the café table to its essence – a table with an embedded screen – we will see that it is not very different from sports bars in which multiple screens run continuous broadcasts of sport matches. The content on the animated screens becomes a *common focus of attention* and dictates the *mutual awareness* (or lack of it) and *common emotional mood* for those present. The experience at the café table, to some extent, resembles the experience of a screen.

Presence[18] was another *Connected Communities* project. This project is an example of how technology can facilitate temporal personalization of furniture in a public space, and how this personalization brings about social and community issues. The target audiences for the *Presence*

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[17] The Philips Design team consisted of five members: usability specialist / interaction designer, interaction designer / architect, product designer / geneticist (with understanding of biological systems), screen graphic designer and electrical engineer / programmer. The concept phase took 6 weeks; detailing and prototyping took 10 weeks.

[18] European Commission-funded project from the *Connected Communities* cluster. Collaboration between Nederland Design Institute (Amsterdam), Royal College of Arts (London), Domus Academy (Milan), Nokia, etc. 1997-1999. The Biljmer project was lead by the RCA team (Dunne and Gaver).

project were elderly people in several countries around Europe. One of the studies took part in Bijlmer, an Amsterdam immigrant neighbourhood with a reputation for being unsafe. The designers used *cultural probes* – packets filled with disposable cameras, questionnaires, stickers, drawings, maps and journal logs (figure 24) – to gather information about the participants in the study. Using the materials in the packets, the study participants were asked to keep diaries about their daily lives in Bijlmer.

Figure 24. *Presence* project, Royal College of Arts, (1997-99). Packet of *cultural probes* given to participants of the study in Bijlmer, Amsterdam.

The wealth of gathered material revealed that elderly Bijlmerians had safety concerns but were also proud to be residents of this neighborhood. This inspired the designers to search for ways to communicate the concerns of the elderly to others in the neighborhood. The initial designs were highly speculative (for example, Faraday-like cages for the protection of the elderly while they take a walk). The final prototypes were a series of benches equipped with antennas and screens embedded in the backs of the benches (figure 25). The residents were invited to anonymously submit thoughts about their daily life in Bijlmer. These postings were displayed on the backs of the benches. The prototypes were not fully networked or wireless. Instead, the designers used analog versions; hand-written submissions were printed on big rolls of paper. The rolls were placed behind the glass screens of the benches scrolling back and forth to display different submissions.

Figure 25. Messages posted on the Presence benches. Note that text on the bench in the third photo on the top says "Ik ben bang" (I am afraid).

In cities like Amsterdam, benches adorned with inscriptions are as ubiquitous as bulletin boards and graffiti. They carry messages of small, shared moments; public displays of emotions, thoughts, or simple reminders of who was there at the time. The messages are left as indications of memory for those that inscribed them and for those that visit. In essence, strangers can 'meet' and 'talk' with each other through these messages. The designers for the *Presence* project chose to use urban furniture, a bench, as a place to display community messages. The bench, a transparent entity in a neighborhood where people were disenfranchised by fear, became a powerful force for people to declare their fears and act on them. The project encouraged neighborhood citizen groups to come forward and work toward increasing the safety of their neighborhood. Even though the Bijlmer residents requested to install the benches for permanent use, they were removed once the user studies were completed. The project is an example of how a type of urban furniture can serve as catalysts for human-human interaction.

D.   Therapeutic: *Robotic Massage Chairs* and *Squeeze Chair*

Among commercial products in the domain of augmented furniture, this dissertation reviews the case of **Robotic Massage Chairs**[19]. These objects, successors of the LazyBoy, have a very precise functionality: they give massage yet at the same time they capture our imaginations in a deeper ways. These chairs embody the meaning of mediated touch. Operating on the purely perceptual level (tactility), these chairs are able to interpret the topography of a person's body and match it to a fixed repertoire of motions. A pair of quad rollers or "a contoured tracking system" located in the back panel of the chair 'scan' the back of the user by "following the contour of [their] spine" (figure 26). The same rollers are used to create a variety of massage patterns. The user can choose a duration and a specific type of massage (rolling, kneading, compression or percussion) using a remote control. Models of robotic massage chairs also include options like the i-Pod docking station, built-in speakers, subwoofers and beverage-holder, to "blend music and massage into the ultimate relaxation experience" (see figure 9).

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[19] The images of robotic massage chairs were selected from the *Sharper Image* online catalogue at
http://www.sharperimage.com/
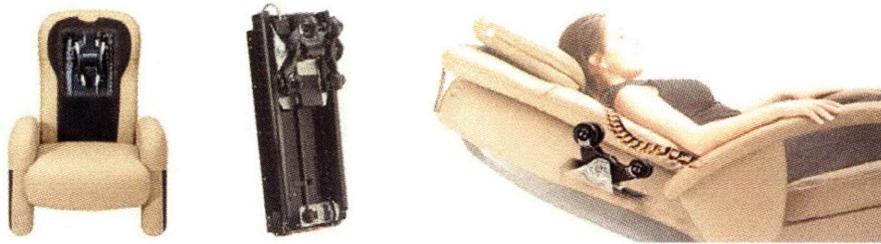
Figure 26. Patented quad rollers in the back of the chair both 'scan' the spine of the user and provide massages.

Figure 27. *Panasonic EP3202 Real Pro robotic massage chair* with "body scan technology and memory" providing "Swede-atsu" massage. Image retrieved on 28 September 2004 from http://www.sharperimage.com/

SharperImage advertises the *Panasonic EP3202 Real Pro* as a robotic massage chair that "…replicates Swedish or Shiatsu massage … providing over 167 motions" (figure 27). Another advertisement for the *IJoy™ Robotic Massage Chair®* describes their patented *Human Touch Technology®* as "wrists and arms" that behave as the "hands" of a trained massage professional (figure 28). Below is a caption from their brochure:

> *Meet your new, best friend. The science of comfort.*
>
> Inside every iJoy™ Robotic Massage® Chair are the "hands" of a trained massage professional, just waiting to provide you with a soothing back massage. But don't take our word for it. Sit down in one. Human Touch Technology® starts with a patented mechanism that works like "wrists and arms," we added "hands"-- massage rollers that move three-dimensionally on a straight track. The result is a Robotic Massage® that feels remarkably human. (Retrieved on 28 April, 2006 from http://www.abtelectronics.com/product/16957.html)

Figure 28. *Interactive Health iJoy Robotic Massage Chair*, model IJOY130MBK. Product brochure retrieved on 3 April 2006 from http://www.ijoy.com

While the rhetoric used in the chair advertisements conveys to consumers the object's selling points by referring to the embedded technologies as the 'hands' of a human, these adverts actually sell mediated touch. The topic of mediated touch was researched by Rachel Maines[20] in her work on early 20th century therapy for treating female hysteria using small electric appliances. Maines found that: "[t]he idea that technologies are socially "constructed" – that is, that they are deliberately shaped for social purposes – is now widely accepted, but the phenomenon of camouflage is less familiar." [21] (page 116-117) The word 'camouflage', according to Maines, means that the advertising rhetoric of products conveys what the item offers without endorsing all of their possible uses (including the socially prohibited ones!) (Maines 2001, page 117).

Although robotic massage chairs do not have 'clandestine' advertising needs – they are still chairs! – the variety of rollers, 'kneading' or 'percussion' possibilities, remote control as well as all the additional audio-etc. peripherals, seem to obscure the very core use of the object. The

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[20] See Maines, Rachel *The Technology of Orgasm*. John Hopkins University Press, 1999. Also in Maines, Rachel *Socially Camouflaged Technologies: the Case of the Electromechanical Vibrator* (pages 117-143) by Carol Pursell (editor), *American Technology*. Blackwell Publishers, 2001.

[21] As an example of camouflage Maines mentions paper for rolling cigarettes. This paper is used for rolling tobacco cigarettes but can be also used for rolling drugs.

object, after all, is a chair where one can sit and relax. Paradoxically, with more functions added to the chair, the more precise these functions become. When Baudrillard talks about gadgets or "thingamajigs", he states: "[s]o precise is the function proposed, in fact, that ... such objects are *subjectively* functional, that is to say, obsessional."[22] (page 113-114) He stresses that gadgets or thingamajigs

> "... *answer no need other than the need to function;* it answers, in other words, to the functional superstition according to which for any operation there is – there must be – a corresponding object, and if none exist then one must be invented. ... [N]o true innovation is to be seen, but by juggling stereotyped techniques objects are created that are at once incredibly specific in their function and absolutely useless." (page 113)

Arguably, these chairs *are* functional, "declare their own existence" and remain stable even if technology fails and there is market demand for them. Although the ambition to optimize the experience of the object has pushed the "experience to the prosaic" (Dunne 1999, page 14), these strange, fascinating objects with many purposes still serve us. And as Baudrillard puts it, "[l]ike all obsessions ... this particular variety has its poetic side." (page 114)

The **Squeeze Chair** by Wendy Jacob provides another example of therapeutic furniture that deals with the notion of mediated touch, this time in the form of an artwork. In the mid 90s, Wendy Jacob, faculty from the MIT Visual Arts program, read a *New Yorker* interview about Temple Grandin. Temple is a renowned American animal scientist best known for designing livestock facilities that restrain and calm animals before they are killed. Grandin, herself autistic, writes[23]:

> From as far back as I can remember, I always hated to be hugged. I wanted to experience the good feeling of being hugged, but it was just too overwhelming. It was like a great, all-engulfing tidal wave of stimulation, and I reacted like a wild animal. Being touched triggered flight; it flipped my circuit breaker. I was overloaded and would have to escape, often by jerking away suddenly.

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[22] Baudrillard continues by stating that the same obsession exists for the opposite, aesthetic approach to designing objects: "As for the opposite, 'aesthetic', approach, which omits function altogether and exalts the beauty of pure mechanism, this ultimately amounts to the same thing. For the inventor of the Concours Lépine, the creation of a solar-powered boiled-egg opener or some other equally dotty gadget is merely an excuse for obsessive manipulation and contemplation." (page 114) See Baudrillard, Jean. *The System of Objects.* London & New York: Verso, 1996.

[23] Grandin, Temple *Thinking in Pictures.* Vintage Books, 1995. The quotes are from Chapter 3: *The Squeeze Machine: Sensory Problems in Autism* (pages 62-82) and Chapter 4: *Learning Empathy: Emotion and Autism* (age 83).

Many autistic children crave pressure stimulation even though they cannot tolerate being touched. It is much easier for a person with autism to tolerate touch if he or she initiates it. When touched unexpectedly, we usually withdraw, because our nervous system does not have time to process the sensation. (1995, page 62)

Through a series of self-experiments since her teen years, Grandin discovered that the use of physical pressure on animals and autistic people produces similar results:

Pressure reduces touch sensitivity. For instance, gentle pressure on the sides of a piglet will cause it to fall asleep, and trainers have found that massaging horses relaxes them. The reactions of an autistic child and a scared, flighty horse are similar. Both will lash out and kick anything that touches them." (1995, page 83)

Based on this insight and her previous experiences in designing squeeze machines for livestock, Grandin designed a human squeeze machine for autistic people. In addition to lessening hypersensitivity and anxieties of autistic people, her goal in designing the machine was "… to enhance the feeling of being embraced." (page 80) If the user suddenly resists, she cannot pull out of the machine. One has to "relax and lean forward" to open the handle of the *squeeze* machine. (page 80) Users can control the amount of pressure on their own, and as Grandin states, "give in completely to the gentle feeling of being held." (page 80)

Figure 29. Wendy Jacob, *The Squeeze Chair*, 1997-present. Top left: *Chair*, 1997 (blue wool, wood, vinyl, pneumatic system with pump and hoses). Top right: *Squeeze chair with floral motif*, 1998. Bottom left: *Squeeze Chaise Lounge*, 1998, (red mohair, wood, hardware). Bottom right: *Child Squeeze Chair*, 2001. Images published with permission from the author.

Wendy Jacob remarks that she "... was intrigued with this idea of taking something as emotionally complicated as an embrace and reducing it to something mechanical." [24] She carried out a series of interviews and conversations with Temple Grandin. The outcome of this collaboration is *The Squeeze Chair* (figure 29), an armchair designed to soothe people. The chair behaves like Grandin's squeeze machines, but, as Jacob says, it is "a chair that even looks comfortable" (Jacob, 2000).

The armchair has two curved arms that inflate to embrace the person that sits in it. The arms are inflated using an attached foot pump. Regulating the amount of air into the chair increases or reduces the strength of the arms' embrace. The pump is activated either by the person who sits in the chair or by an outside observer. If someone else is pumping, the chair's "blind tendency" to hug or let go is out of the control of the person who sits in, in which case the chair may be perceived by this person as being autonomous, with a mind of its own. Some versions of the *Squeeze Chair* are smaller and the person who sits in the chair can regulate the air pressure herself. Those that used this armchair identified the experience as soothing and relaxing, as if one received a giant, firm hug. The interest for this chair comes both from the art, and also the autism community as this object has the potential to enhance the quality of daily life for autistic individuals.

E.   Critical: *Critical Vehicles / Table-Vehicles* and *Hertzian Space / Placebo project*

Wodiczko[25] writes about what he means by *Critical Vehicles*:

> The word *vehicle* is associated with the concept of a carrier. In some dictionaries, it is described as a "person or a thing" used as a medium "to convey ideas or emotions". It is commonly understood as a means of transmission, display, and expression. The term *critical* suggests judgment, an act of pointing out shortcomings, defects, or error. ... It denotes a point or state in which change of properties or characteristics take place – a turning point or crisis that may demand an urgent response or action. A critical vehicle is, therefore, a medium; a person or a thing acting as a carrier for displaying or transporting vital ingredients and agents. It is set to operate as a turning point in collective or singular consciousness. It transmits those ideas and emotions that are indispensable to the comprehension of the urgency and complexity of a situation. In short, the critical vehicle is an "ambitious" and "responsible" medium – a person or

[24] Jacob, Wendy. *Squeeze Chair*. Creative Capital Channel web site, 2000. Retrieved on 14 May 2006 from http://channel.creative-capital.org/project_311.html

[25] Wodiczko, Krzystof. *Critical Vehicles: Writings, Projects, Interviews*. Cambridge: MIT Press, 1999.

piece of equipment – that attempts to convey ideas and emotions in the hope of transporting to each human terrain a vital judgment toward a vital change. (1999, page xvi)
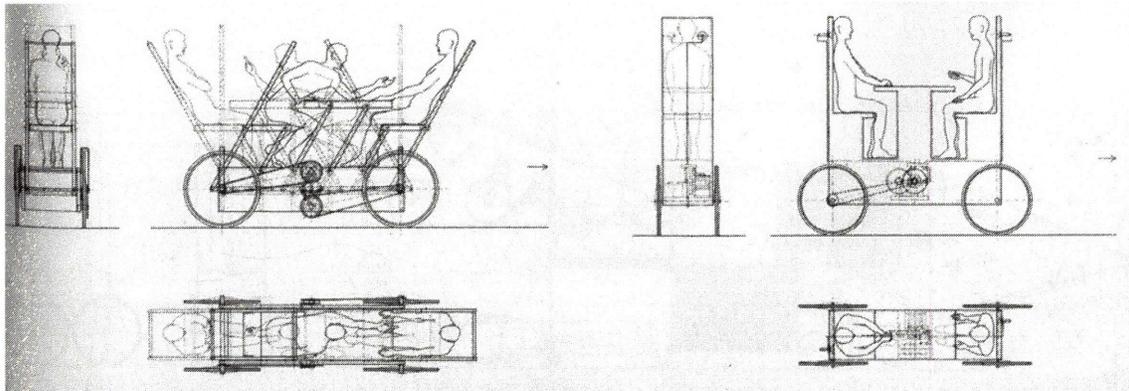
Figure 30. Wodiczko's *Vehicle-Café* and *Vehicle-Coffee Shop*, 1977-79 (page 76)

As part of his *metaphoric vehicles* project series, Krzystof Wodiczko developed sketches for two vehicles featuring interactions between two people. Talking or body movement at the mobile table result in the movement of the table-vehicle. In the *Vehicle-Café* (figure 30 left), the voices of the people activate the vehicle engine. The nature of their conversation (inert vs. vigorous) influences the speed of motion (Wodiczko 1999, page 76). In the *Vehicle-CoffeeShop* (figure 30 right), he sketches a situation in which back and forth body movements produce the swinging motion of the table and the seats. Gears transmit this 'motion dance' to the wheels. Both vehicles move "in a straight line and in one direction only". The speed of the vehicles is thus the result of the dynamic interaction between the participants. (pages 76-77)

The **Hertzian Space** and **Placebo project** by Dunne and Raby are related to Wodiczko's *critical vehicles,* but are situated in the domain of industrial design for domestic use. Dunne and Raby state that while "[b]eing provocative and challenging might seem like an obvious role for art … art is far too removed from the world of mass consumption and electronic consumer products to be effective in [that] context, even though it is of course part of consumerist culture." (2001, page 58) They call their design philosophy *critical design:*

> The goal of critical design is not to present the dreams of industry, attract new business, anticipate new trends or test the market. Its purpose is to stimulate discussions and debate among

designers, industry and the public about the aesthetic quality of our electronically mediated existence. ... Critical design takes as its medium social, psychological, cultural, technical and economic values, in an effort to push the limits of lived experience not the medium. (2001, page 58)
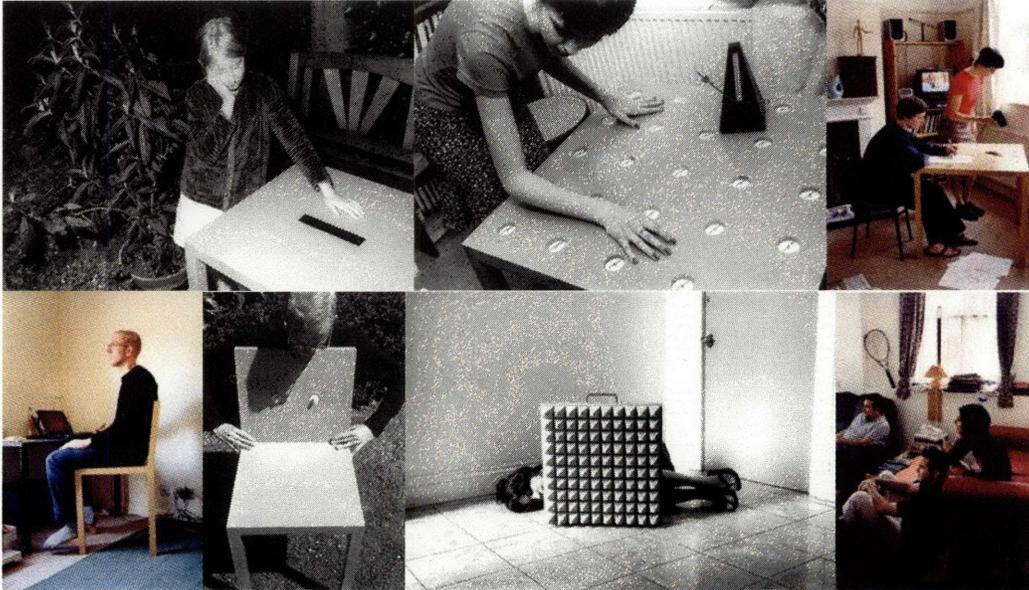
Figure 31. Dunne + Raby. *Placebo project*, 2001. Photos by Jason Evan. From left to right: GPS table, compass table (black and white), compass table (color), nipple chair, electro-draught excluder and parasite light. Images published with permission from the authors.

Dunne coined the notion of **Hertzian Space**[26] as a reference to the electromagnetic radiation[27] present in the spaces we inhabit. Their **Placebo**[28] project (figure 31) was a collection of eight prototypes, both furniture and domestic objects, designed to react to electromagnetic ranges. Electromagnetic ranges were made visible through the object behaviour. Most of the designed objects – tables, chairs, lamps – were functional. One of them – the electro-draught excluder – a plain placebo object, did not respond to any electromagnetic range. The objects were made from MDF and devices that detect a variety of electromagnetic radiation (GPS, magnets, etc). All the objects gave an impression of a non-design by using very iconic forms and were "purposely diagrammatic and vaguely familiar" (Dunne and Raby 2001, page 76).

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[26] Anthony Dunne, *Hertzian Tales: Electronic Products, Aesthetic Experience and Critical Design*. Royal College of Arts CRD Research Publications, 1999.

[27] From AM and FM radio frequencies, baby intercoms, blue tooth, microwaves, mobile phone frequencies, TV, radars, GPS, infra red, to ultra-violet, X-rays, gamma and cosmic rays. (Dunne and Raby, page 11)

[28] Anthony Dunne and Fiona Raby, *Design Noir: The Secret Life of Electronic Objects*. Birkhäuser Publishers, 2001.

The goal of the *Placebo* project was "… to investigate people's attitudes to and experiences of electromagnetic fields in the home" (page 76). The objects were given away for adoption to selected volunteers who took them to their homes for limited periods of time. The designers then interviewed the volunteers to survey the emotional connection (or lack of it) that the owners created with the objects. The study found that the *placebo* objects "declared their own existence" (Dobson) and that the owners acquired personal relationships with the augmented furniture they 'adopted' on a temporary basis.

Dunne and Raby state that conceptual objects such as the ones in *Placebo* are usually exhibited in galleries; the *Placebo objects,* on the other hand, have been 'invited' to become part of people's daily life and routines. They stress that they do not intend to solve an existing problem, and conclude: "Designers cannot always solve problems … [they] cannot change reality, [but they] can change people's perception of it. Like a medical placebo, the objects in this project do not actually remove or counteract the cause of concern, but they can provide psychological comfort." (Dunne and Raby 2001, page 76)

F.   Witty and Provocative: *Bird's feet* and *Confession chairs*

The **Table aux pieds d'oiseau** *(Table with bird's feet)* (figure 32) by the Swiss artist Meret Oppenheim was developed for the *Exhibition of Fantastic Furniture* at the *Galerie René Drouin et Leo Castelli* at Place Vendôme in Paris in 1939. Oppenheim exhibited together with Surrealist artists such as Max Ernst, Leonor Fini, Alberto Giacometti and others. The tabletop, made from wood painted in gold, had bird feet imprints. The legs were made from bronze. Much like Oppenheim's most famous work – *Le déjeuner en fourrure*[29] (*Breakfast in fur* or *Fur tea cup*) – the *Table with bird's feet* mixes humor and provocation.

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[29] Meret Oppenheim never thought much of this icon of both dada and surrealism and explained its creation as fortuitous. She was making a fur-covered jewelry at the time. In a conversation with Dora Maar and Picasso, while in a Paris café, Picasso commented that one can cover anything with fur. Oppenheim answered "Why not this tea cup?" In Burckhardt, Jacqueline and Curiger, Bice. *Meret Oppenheim: Beyond the teacup.* New York: Independent Curators Incorporated, 1996.

Figure 32. Meret Oppenheim, *Table aux pieds d'oiseau (Table with bird's feet)*, 1939.
From the *Exhibition of Fantastic Furniture*. Note: The black & white photo shows the 1939 original;
the color image photo one of the 30 additional, signed copies made for an exhibit in Basel in the early 1980s.

The table was possibly inspired by the small round Paris café tables where Oppenheim met with fellow artists. Both the table and the fur tea cup push cultural and aesthetic possibilities of objects. Due to their semiotic ambiguity, these objects continually transform back and forth, from an everyday object into an object with animal (visual or material) properties. The purpose of these objects is to be provocative, ask questions, stimulate debates, and at times, make people laugh.

The work of the Polish artist Pawel Grunert can be seen as a related, contemporary neo-dada / neo-surrealist, example from the world of furniture. His **Confessional Chair** (figure 33) resembles a straw broom, a sanitary device used to sweep away all unhealthy, polluted, unhygienic acts of one's life. The **Straw Bed** (figure 34), made from straw held together with glue, invites one to hide inside. The **Growing Chair** (figure 35) suggests a slow change of the height of the seat. It sprouts roots and also symbolically ascends to the sky.

Figure 33 (left). Pawel Grunert, *The Confessional Chair*, 1999. Exhibit in 2004 called "Natur ganz Kunst" in the "Museum für Kunst und Gewerbe", Hamburg. Image retrieved from http://de.red-dot.org/885.html in October 2004.

Figure 34 (center). Pawel Grunert, *Łóżko ze zboża (Straw bed)*, 1992. Straw and glue, 100x200x150cm. Image retrieved from http://www.grunert.art.pl in April 2006.

Figure 35 (right). Pawel Grunert, *Krzesło rosnące (Growing chair)*, 1990. Wood and roots, 70x70x120cm. Image retrieved from http://www.grunert.art.pl in April 2006.

Grunert's furniture inspires interesting questions including: What is the meaning of these objects? How is that meaning influenced by their representation? How does the choice of material (straw, roots) inform or influence the rituals (confessing sins, going to bed, throne) associated with their use? The theme of Grunert's furniture work is very personal as he seems to draw on the *small moments* of his own everyday life.

G.   Inquisitive: *Table Childhood*

The **Table childhood** (figure 36) by Max Dean and Raffaello D'Andrea is an example of inquisitive furniture. This autonomous robotic table 'resides' in an enclosed room in The National Gallery of Canada. It selects one of the museum visitors that came to see it and attempts to start a "conversation" with them. The development of the dance between the table and the chosen one are based on the movement and behaviour of the visitor. If the visitor is timid, the table becomes inquisitive and pursues the visitor around the enclosed space. If the situation is reversed and the visitor is assertive, the table may either run away or become unfriendly.

Figure 36. Max Dean and Raffaello D'Andrea. *Table childhood*, 1984-2001. Collection of *The National Gallery of Canada*, Ottawa. Photos by Robert Keziere. Images published with permission from the authors. Retrieved on 30 September 2004 from http://www.fundacion.telefonica.com/at/vida/paginas/v4/etable.html

The project name refers to the developmental stages of the early childhood. It is anticipated that the behaviour of the table will resemble the development of a child who acquires increasingly complex abilities. The table has a "vocabulary loosely based on the intricacy of how people initiate relationships" (Dean 2001). In a presentation at MIT in May 2006, Rafaello D'Andrea pointed out that the table is not a technologically complicated device but it *appears* to behave complicated because the people who engage with it behave in complicated ways. The object appears to be brought to life or animated by being given the ability of selecting viewers. As the artwork chooses who to pursue, it is the viewer that becomes the selected object of attention and, ultimately, the viewer becomes artwork. The roles of viewer and artwork in this case are reversed.

The table moves using four motors located at top of the each leg. The sensing of the location of people in the room is done by using a computer vision system in which a camera is mounted on the ceiling of the room. This system enables real-time tracking of the location of the selected person in relationship to the table, and controls the table's movement in the space.

TAXONOMIES OF AUGMENTED FURNITURE:
FUNCTIONALITY, AUTONOMY AND DESIGN STRATEGY

The examples presented in the previous section can be categorized and ordered in multiple groups. For this dissertation, three different taxonomies of augmentation of furniture are proposed: related to their functionality, autonomy and design strategy. Each of these taxonomies represents a continuum. In addition, the taxonomies are not mutually exclusive categories but rather, they represent intersecting registers.

Functionality

A first, very basic dimension, or continuum, refers to the **functionality** of augmented furniture. The augmentation can be *connected* to the existing functions (for example, when a recliner becomes a massage chair or a work chair with built in computing peripherals). In this case the core functionalities are extended and the object becomes a *hyper object*. Examples of *hyper objects* are *Robotic Massage chairs*, Philips Design's *Interactive Tablecloth* (a tablecloth that can also heat the meal), *RoomChair* (a chair for work and rest), *Q-Plugged* (ottomans with add-ons that provide connectivity and access to media content), and KVA's *Electroluminescent Plywood Table* (a work table with built-in light. At other times the augmentation can be *unconnected* (for example, when a recliner or a chair acquires built-in speakers or built-in refrigerator).

At other times the augmentation can be *unconnected* (for example, when a recliner acquires built-in speakers and subwoofers, or built-in refrigerator). In this case the functionalities are tangential to the core use of the object and the object becomes *an alien object*. The *Placebo project* (domestic objects that detect electromagnetic ranges) and *SitzKunst* (sofa with a LED screen used for text messaging) are examples of *alien objects*.

Autonomy

A second dimension, or continuum, refers to the degree of *autonomy*[30] of augmented furniture. Elsewhere, Ackermann[31] has explored "agency, identity, attachment and control" as well as the "relational' qualities of artificial play-partners, or "Ani-mates". She distinguishes three levels of autonomy in animated toys: "good slaves" (malleable and obedient), "inner driven" (stubborn) and "good dancers" (autonomous yet responsive) (2005). When thinking about augmentation of furniture along a passive to autonomous continuum, the observation is that augmentations are more like gradients rather than clear-cut categories because even autonomous objects are passive at times. Nikolovska and Ackermann (2006) have proposed the following continuum relevant to autonomy and relational qualities of furniture:

- **PASSIVE (ORNAMENTED, "PRETTY" YET INERT)**

  These objects remain stable within a certain state. These types of objects are passive because they are submissive: they accept any state imposed upon them without resistance. Numerous examples of passive augmented furniture use light (from fluorescent light to LEDs and electroluminescent wires) as a decorative element that offers new kind of ornamentation possibilities. In these cases where light is used, the object maintains its state – it is either switched on or off. Examples of passive furniture are the *Eudora chair* by Critz Campbell, a translucent fibreglass chair internally illuminated with fluorescent light, and the *LED Table* by Ingo Maurer where over 200 miniature LEDs are encased between two layers of glass.

- **OBEDIENT (GOOD SLAVES)**

  These objects are able to sense and respond. They exhibit behaviours that range from simple and predetermined one-to-one behaviours, to more complex, branched ones, where each choice of interaction (for example, press of a button on a remote control) opens multiple paths and possibilities for interaction. In some simpler cases of obedient furniture, the duration of the response is proportional to the duration and the intensity of stimuli. One such example is the *Squeeze Chair*: the more air is pumped into the chair, the more the chair squeezes. In *History Tablecloth* the fabric

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[30] An autonomous object is self-governing, independent, not ruled by external law or force. For detailed discussion on autonomy see Winner.

[31] Ackermann, Edith. *Playthings that Do Things: A Young's Kid's "Incredibles"!* In IDC 2005, June 8-10 2005, Boulder Colorado.

placed on the tabletop lights below placed objects; when the objects are removed, the light slowly fades away. In *Placebo,* domestic objects respond to ranges of the electromagnetic spectrum. In some more complex cases, objects exhibit hierarchical, branched behaviours. Examples are the *Robotic Massage Chairs* that are operated with a remote control and *Glowing Places,* interactive LED stools where the user behaviour relates to patterns of illumination.

- **"GOOD DANCERS" (AUTONOMOUS YET RESPONSIVE)**
  These objects are more "human-like" and address ideas about freedom and control. An autonomous object is "… self-governing, independent, not ruled by external law or force." (Winner, page 16). They are ideal relational partners that share control and engage in dialogic gives-and-takes with their users. Because they are autonomous, they appear to have personality and empathy. The *Table-Childhood* by Dean and D'Andrea falls in this category. The table chooses a viewer and attempts to establish a relationship with them: as Ackermann puts it, this table 'likes' a good dance.

As mentioned in the introduction to this taxonomy based on autonomy, the three categories – passive, obedient and 'good dancers' – are not clear-cut. If an augmented object is classified as autonomous, this object will be at times passive and at other times autonomous. Instead of clear-cut categories, the mix looks like a gradient. Objects can be both passive and autonomous; the amount of active versus passive at a given situation differs and the behaviour depends on the types of activities carried out with the passive versus with the autonomous parts of the object.

Design strategy: from rational to poetic

A third dimension emerges from a conscious **design strategy**. Projects like *Robotic Massage chairs* are designed in a *rational and programmatic way*: a clear, rational program of input and outputs drives the design of the object. By contrast, projects such as Jacob's *Squeeze Chair*, Dean and D'Andrea's *Table Childhood* and Dunne and Raby's *Placebo* objects are designed to allow the emergence of incongruous or surprising responses to people's solicitations. This *poetic approach* emphasizes the emergence of *small moments* and, incidentally, enriches the relational qualities with two new categories which are called *mediator, mischievous* and *quiet*. These new categories will be elaborated in the second chapter, CREATE. They represent the design strategies taken in conceptualization of the projects for this dissertation.

2

CREATE

The second chapter, CREATE, gives an introduction to the dissertation projects and contextualizes them within the existing project landscape. The chapter specifies the methodology used to develop the projects, details the development of each project and discusses the choice of technologies.

INTRODUCTION TO THE DISSERTATION PROJECTS

As discussed in the previous chapter, everyday objects such as furniture have the potential to evoke surprising, amusing or incongruous associations and responses from individuals. Interactions with these objects reveal otherwise disguised "truths" or "dangerous" ideas, and also offer possibilities for re-digesting or re-thinking experiences.

The dissertation projects, the *Stealing Table, Conversation Table* and *Orev Bench*, have been designed to investigate the potential for technology to both influence interactions between individuals, and individuals and objects. Although augmented, these projects remain simple pieces of furniture whose original intent as furniture remains even when the embedded technology is switched off or dismantled. Rather than taking a pragmatic, practical approach to design incorporating a purely rational dynamic this author has designed objects with a nuanced, poetic, non-linear dynamic. This approach is especially appropriate to the study of how people interact with mundane, every day objects like furniture. Poetry, that is the experience of the whimsical sense of the object rather than its rational, original purpose, can be seen in the unusual behaviours of the *Stealing Table,* the user interactions with the *Conversation Table* and the quietness of the *Orev Bench.* Rather than attempting to control every aspect of the interactions with the objects, this author's aspiration is that users will engage with these designs as they would with animate beings, and project their own experience. Any creation, once launched, may take on a life of its own and speak to its users in ways not intended by its designer. Perhaps it is the unexpected reactions of people to the objects that may be, in fact, more interesting to this author than the objects' simple use.

The dissertation projects illustrate that some objects are better suited to foster meaningful and delightful encounters while others remain solely furniture. The potential for objects as "projective materials" has been explored in this dissertation through the concept of *small moments*. Examples of objects that are designed to be act as a mediator, mischievous interloper and a quiet observer will be discussed in the following section.

MEDIATOR (THE EYE OF THE PSYCHOANALYST): *THE CONVERSATION TABLE*

The **Conversation Table** is an embodiment of what an "intelligent" listener role may be – the psychoanalyst's eye. Without being intrusive, and if one pays attention, this table reveals otherwise unspoken aspects of the dynamics of interaction between its users.

Conversations often take place at tables, either among colleagues in a business meeting, or between family members that have come together for an everyday meal or special celebration. Each of these occasions for getting together and talking – at work or at home – carries its own set of accepted cultural conventions that guide the sequence of behavior of those involved (Norman, 1988). In the south of Europe, where the author comes from, it is not uncommon for several people to speak simultaneously during dinner, weaving in and out of multiple conversational threads running at the table. Although considered appropriate within the context of immediate family, this behavior is not common when the family has guests.

The *Conversation Table* project was inspired by such everyday conversations. The goal of the project was to offer a commentary on power dynamics as they occur during conversations (figures 37 and 38). The table, made from cardboard, was designed for two people, each seated at one end of the table. Two microphones placed at each end below the surface of the table, capture the initiation, duration and volume of speech at regular intervals. The captured signals trigger the lighting of an array of LEDs (light emitting diodes), going from the person who speaks to the person who listens. From having a conversation and having a mutual awareness of each other, users of the *Conversation Table* suddenly become aware of an unusual feature for a table. The animation of the LEDs provides a visual representation that mirrors the conversational dynamics between the people seated at the table.

Figure 37. Kelly Dobson and Susanne Seitinger at the *Conversation Table* during the "Four Tables" exhibit at MIT Rotch Library in October 2005.

Figure 38. *The Conversation Table.* Photos by Kate Kunath, December 2005.

The making of the *Conversation Table*

This table is made from honeycomb cardboard, fastened with metal corner braces. The electronics consist of two microphones with amplifiers and band-pass filters (to isolate the human speech from background noise), twelve ultra bright red LEDs, and a 'cockroach' circuit with a PIC18 microcontroller that receives the filtered input from the microphones and controls the lighting of the LEDs. The PIC18 microcontroller is programmed in PIC-C.

The author's intention was to suggest that this is an unusual and possibly a "fake" table by using an impermanent building material such as cardboard.
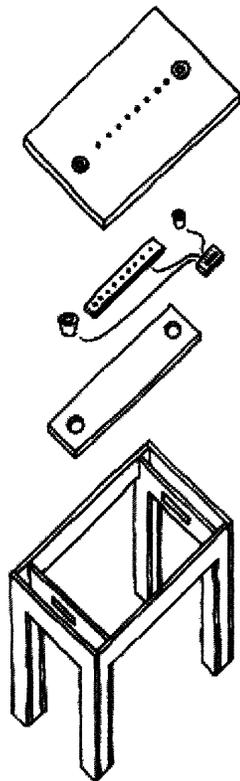
Materials

- 1/2" honeycomb cardboard (purchased online from charrette.com)
- several types of metal corner braces, nuts and bolts (purchased at Home Depot)
- custom-made aluminium rings cut on a water-jet cutter
- washers for covering the LED holes and vellum as a light diffuser

The electronics consist of:

- 12 ultra bright red LEDs
- microphones with amplifiers and band-pass filters
- 'cockroach' circuit with PIC18 microcontroller

Figure 39. Sketch of the structure of the conversation table.

Conversation Table and the three taxonomies

The Conversation Table may be categorized as a hyper-functional object rather than as an alien one. Its core functionality is extended and relevant to the existing uses of tables. The table is passive until it "wakes up" to a person's voice. In its relational engagement with users, its behaviour appears obedient. Even when the table's lights dance up and down the table, triggered by voices, the augmentation appears visually quiet. Much like a psychoanalyst, the non-intrusive nature of this object can reveal unspoken parts of conversations only if one is open to them. The design strategy was poetic; the object was designed to allow the emergence of incongruous or surprising responses to people's solicitations.

MISCHIEVOUS (THE THIEF): *THE STEALING TABLE*

The ***Stealing Table*** is a kind of furniture that can be characterized as *uncanny everyday objects* (Freud 1925) or *strangely familiar ones* (ref. familiar strangers[1]).

The German word for uncanny is *unheimlich*, the opposite of *heimlich* (homely) and *heimish* (native), the opposite of what is familiar. It is tempting to think that the uncanny is frightening precisely because it is not known and familiar. Yet not everything that is new and unfamiliar is frightening. One can only say that what is novel holds the potential of being frightening. In this dissertation the world "uncanny" is used as a non-frightening incongruity, or gentle "disruption".

Figure 40. Early sketch of the *stealing table.*

Magic operates in the realm of the uncanny. Magicians have mastered the art of illusion, offering optical illusions such as floating ghosts and oracles, vanishing elephants, ladies sawn in half, or cabinets equipped with angled mirrors that give the illusion that whoever was inside, disappeared.[2] The audience often knows that the whole event is an illusion, but is unable to understand the reason for the outcome. Magic and the act of disappearance have been inspiration for the *Stealing Table* project. The project was designed to examine what happens when personal objects placed on its top are "absorbed", instead of being held / supported by a tabletop. Disappearance can be interpreted as magic, suspension of disbelief and the understanding of a situation as something out of one's immediate control. It is interesting to point out a same surface level phenomenon – disappearance of an object – can be interpreted in multiple ways. Possible interpretations are magic, borrowing, storing, replacing or even cleaning. The table, in this case, is the magician, the thief, etc., and it has a "taste" for every small and light object placed on its top. The chosen name for the project was "stealing" to emphasize object behaviour that is unanticipated and purposefully mischievous.

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[1] The *Familiar Strangers* research project (Intel Research, Berkeley) explores often ignored yet real relationships with familiar strangers. Experiments and studies derived from Milgram (1972) have lead to the design of a personal, body-worn device called *Jabberwocky*. Retrieved on 20 April 2006 from http://berkeley.intel-research.net/paulos/research/ familiarstranger.

[2] Steinmeyer Jim. *Hiding the elephant: How magicians invented the impossible and learned to disappear.* Carroll & Graf Publishers, 2003.

The making of the *Stealing Table*

The frame of the table is made from honeycomb cardboard (figure 41). The top of the table is made from eight black plexiglas planks reinforced with aluminium L-shaped profiles and metal pipes. As the longer sides of the table hold the eight plexiglas planks, servo motors, sensors, wiring and all needed custom made aluminium elements; they needed to be reinforced with stronger material that will be able to withhold the weight. Custom-cut half inch birch plywood was attached to the cardboard on the inside of the table frame (figure 41). Servo motors and weight sensors (explained below) were mounted onto the plywood with custom-made aluminium elements.
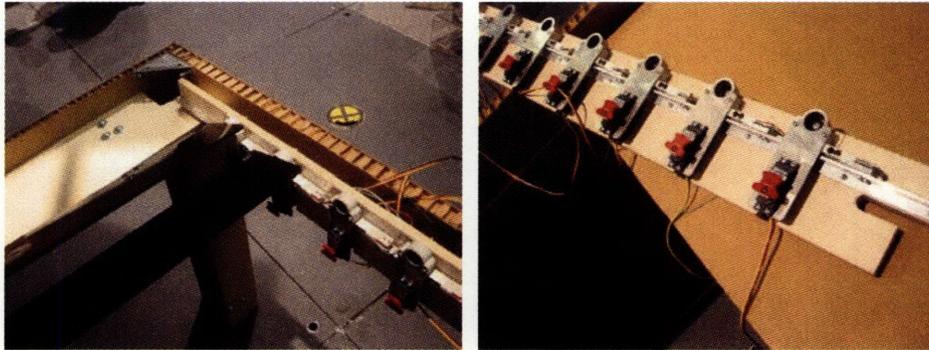
Figures 41. Plywood side board with attached servos and weight sensors are built into the cardboard frame.
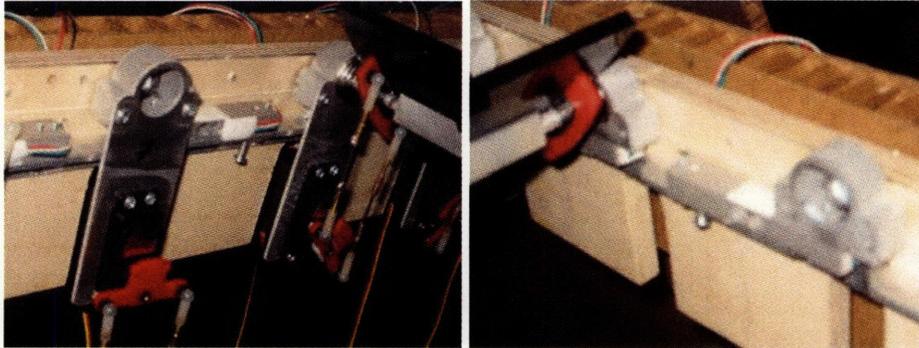
Figure 42. Custom-made aluminium parts are attached to the servo motors and load cells. Red plexiglas elements connect the servos with ball linkages and rods.

The making of the mechanical parts of the table included building of custom-made aluminium and plexiglas elements. A water jet cutter was used to cut the ½" and 1/8" aluminium parts (figures 41 and 43). It was necessary to make plexiglas parts that, on one side, were attached to each servo and on the other side on the bottom of each plexiglas plank (see red plexiglas parts in figure 42). The servo and plank red plexiglas parts were then attached among themselves with

threaded ball linkages and rods. Finally, ball bearings were attached to the aluminium rods (hidden in the images below by the angle aluminium profiles attached to the black plexiglas planks). These were then placed into the Ω-shaped aluminium elements to finally complete the connection of the plexiglas planks with the servos (figure 42).

Figure 43. Corner of the *Stealing Table* with weight sensors, custom-made aluminium parts, and servo motor.

Figure 44. The two side circuits receive and amplify the load signal before sending it to the main 'cockroach' microcontroller located in the middle of the photo.

After reviewing a number of different technology options for sensing objects placed on the table, it was decided to use weight sensors, also called load cells. Another option was to use a computer vision system, but the main argument was that this project is not about seeing but about sensing by "touch". Inexpensive load cells were purchased from a Chinese manufacturer. These particular load cells, usually used for postage scales, could sense weight from several grams to 3.5 kilograms (7.7 pounds). The weight sensors react to weight within the above weight range (hence their 'preference' for light objects). Their signal was received, amplified and averaged before being sent to the main 'cockroach' controller (figure 44) who decided which planks will rotate and when (see Appendix 2 for the circuit).

The planks do not rotate when heavy or rather long objects covering more than two planks are placed on them. The assumption was that these large objects may get stuck between the planks. The planks can also rotate fast or within a limited range, resulting in objects being either thrown from the top of the table, like a pin ball machine, or slowly moved.

Materials

- *honeycomb cardboard, 1/2" and 1" (charrette.com)*
- *metal angles (several types of "corner braces" purchased at Home Depot)*
- *ball-bearings (VXB.com part #R4AZZ)*
- *threaded ball linkages and rods (servoCity.com part #GPMQ3841)*
- *1/2" aluminium L-angles and 1/4" round bars (North Coast Metal)*
- *custom-made 1/8" and 1/2" aluminium parts cut on a water-jet cutter*
- *custom-made plexiglass parts (J. Freeman, Inc. Plastics from Dorchester MA) cut on a laser cutter.*
- *cotton cloth with zipper and grommets.*

The electronics consist of:

- *8 servo motors (servoCity.com, Hitec Servo HS-322HD)*
- *16 load cells (3kg weight sensors from Xiamen ELANE Electronics) with 16 amplifiers*
- *'cockroach' circuit with ATMEL32 microcontroller that controls the servos and interfaces with the weight sensors*
- *the circuit boards were printed at Alberta Printed Circuits.*
- *programming in Atmel AVR Studio.*

Stealing Table and the three taxonomies

In the first half year in which the table was used by subjects, it behaved as it was designed: people would put small, light objects such as mobile phones, wallets and pencils on the tabletop, the planks would open up and the table would "absorb" the personal object. When subject would put large and heavy objects, the table remained still: it had 'taste' only for small, personal objects. Half a year after it was made, the behaviour of the table became unpredictable. The hardware components were heavy, and the honeycomb cardboard used for construction of the frame weakened due to the frequent transport of the table. As a result, the inner frame made of plywood, the plexiglas planks and the sensors misaligned. The planks on the tabletop continued to sense and absorb objects, but started to open and close spontaneously, surprising users who tried to predict the pattern of behaviour. The table became the quintessential example of an "uncanny" piece of furniture. When least expected, this kleptomaniac with a preference for small objects struck and asserted its own presence.

Figure 45. Student playing with the *Stealing Table* during the "Four Tables" exhibit at MIT Rotch Library in October 2005.

The functionality of the *Stealing Table* swings between *alien* and *hyper* object. It is related to its function – placing objects at tabletops – but it is not related to what one expects should happen: tabletops are not supposed to take away / absorb objects. This function of the table is camouflaged exactly because it addresses expected, learned sequences of behaviours at tables. In regards to the degree of *autonomy* of the object, the table swings from passive to autonomous, but by no means is this table obedient. Although not designed as autonomous, the table's quirks and malfunctions have been perceived as such. The object taps into the ordinary, normal use of objects but then it disrupts expectations: it "strikes" both when expected and not expected. The applied design strategy was *poetic*. This object was designed to foster unexpected and incongruous responses to people's solicitations.

Similar to the *Conversation Table,* the author's intention was to suggest that this is an unusual and fictional table by using plexiglas and an impermanent material such as cardboard as construction materials.

QUIET: OREV BENCH[3]

The geometry of benches facilitates that they are shared by more than one person. These objects exist in public spaces in many cities around the world benches. They are often covered with messages of small, shared moments of people that once sat at them on their own or together. Often by the bench stands a light post, illuminating the location of the bench for its visitors.

The *Orev Bench* project brings together the quiet nature of urban furniture such as benches and light posts. The project was an exploration of using light as an ornament in a finished piece of furniture.
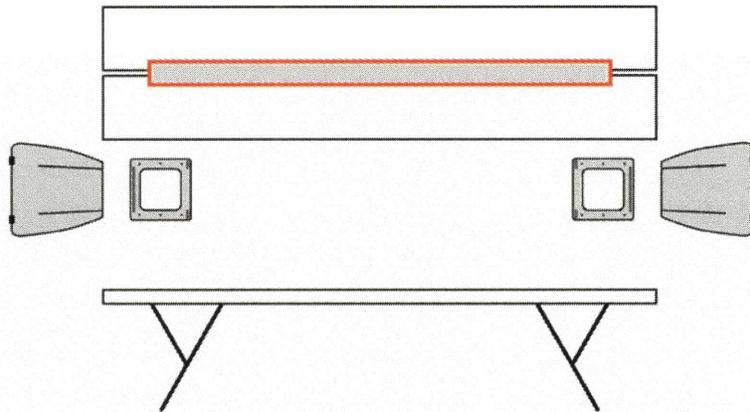
Figure 46. Early drawing of the *Orev Bench*.

Designed as a planar object made of surfaces and "lines" with various thicknesses (figure 46), the bench was the only piece of furniture made from solid materials, hardwood for the sitting surface and bent steel sheets for the legs. The light was used for decorative purposes and to enable that the object is seen in dark. During daylight people don't notice the light; at night they see two parallel light lines.

The making of the *Orev Bench*

This bench is made from the trunk of a walnut tree. The core of the trunk was originally damaged and was removed. A U-shaped steel profile connected the two parts of the trunk back together. The legs are made from a steel sheet cut on the water jet cutter, are then bent by

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[3] *Orev* means walnut in Macedonian.

flaming and are welded onto rectangular steel plates designed to attach the bent legs to the wooden trunks. The steel elements are finished by grinding, sanding and painting. Finally, two layers of polyurethane are applied.

Figure 47. The core of the wooden board was damaged and removed. The board was cut in half lengthwise.

Figure 48. The legs were made from steel sheet, cut on a water jet cutter (files made in Adobe Illustrator and Omax); the center part of the steel sheet was bent with flaming.

Figure 49. The legs were welded onto 11"x11" steel plates with which they were attached to the wooden boards.

Figure 50. The bottom side of the wood boards was routed 1/8" and these steel plates were flushed. The last image shows the connection between the leg and the boards.

walnut board
variable width (8 - 10")
height 1.75"
length approx 6'

finish:
linseed oil
2 coats of polyurethane
polished with steel wool (#000)

lexan (acts as a diffuser)
H 1" x W 3/8"

2.3mm high brightness red
electroluminescent wire
(flexible tube with electrically
chargeable phosphorus coated wire,
coolneon.com). runs on 2 AA batteries.
*Note: first used for marking of ad-hoc
landing sites by the Israely army*

steel profile W 2" x H 1-1/4"

OREV BENCH N51
detail of connection between wooden board and steel U profile
scale 1:1

Figure 51. Detail of the link between the steel profile and the wood boards.

Two parallel red lines of electroluminescent light wire run along the center of the bench, in-between the U-shaped profile and the wooden trunks (figures 51 and 53). These lines resemble blood vessels, symbolizing a living tree, and could be seen in the dark. The U-shaped profile and the two parts of the trunk are separated by two, 3/8" thick pieces of lexan. The lexan is used as a spacer, holder of the electroluminescent light wire, and as a light diffuser. The electroluminescent light wire is powered by two AA batteries (3 Volts) or with an adapter. The

controller for turning the wire on and off is located at one end of the bench, and fits inside the U-shaped profile.
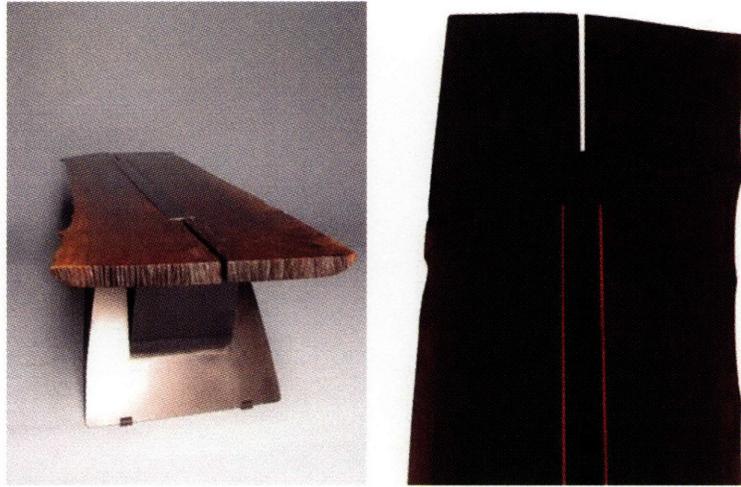
Figure 52. Chain saw marks on the edge of the bench. Photos by Kate Kunath.

Figure 53. Two parallel lines of electroluminescent light wire (photo background is deleted).

The bench is finished with multiple coats of linseed oil, satin polyurethane, and iron wool as a final polish. It can be reproduced in large series as its components are very simple, planar elements. The object can be used both outdoors and indoors, and can be easily spotted in the dark. Each bench will have unique characteristics due to the shape of the boards, color of light and use of specific wood specie.

The size of the bench is H 17", W between 20"-24", L approximately 6'.

Materials
- *walnut*
- *steel sheet*
- *lexan*
- *coolneon high brightness red wire, with controller and 2 AA batteries (coolneon.com)*
- *rubber pipes (for cushioning the feet of the legs and to prevent scratching of floor surfaces)*

Figure 54. The *Orev Bench*. Photos by Kate Kunath, December 2005.

Orev Bench and the three taxonomies

The bench is augmented passively and the augmentation with light was decorative. Passively augmented objects are inert, they do not react nor change their state based on environmental conditions or patterns of behaviours of users.

The augmentation of the function of the object (related – unrelated) does not appear relevant. The use of light is discrete (two lines of red light) and does not add nor conflict with the object's existing function. While clearly rational and pragmatic – light was used to visually inform about the location of the bench at night – the augmentation (or perhaps the author's interpretation of the augmentation) is poetic. The heart of the wood was damaged and replaced with a metal core. Two parallel red lines of light resemble blood vessels and run along the metal core of the trunk. Although trees do not have hearts or blood vessels, their inner bark is pipeline through which food is passed to the rest of the tree. Here the lines of light symbolize a living tree, or a memory of a living tree.

REMARKS

The furniture projects are experiments in which innovative conceptual designs are transported to the realm of the mundane, everyday experience. Furniture, by its very nature, is both plastic and functional. We spend each day sitting on chairs both working and reclining and writing and eating on tables. Furniture that has been amplified through embedded technologies remains furniture. The objects are still functional within the scope of their original intent yet the ramifications for the potential of these technologies leads to very interesting interactions between users and objects.[4]

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[4] For additional examples of furniture explorations by this author, see Appendix 2.

3

EVALUATE

The third chapter, EVALUATE, opens with questioning types of user studies for hybrid design/art - human computer interaction projects. The chapter then presents the methodology used to conduct user studies of the furniture prototypes and analyses the results of these studies. It concludes by discussing if and how social situations are restructured in the presence of augmented furniture.

WHAT KINDS OF USER EVALUATIONS ARE APPROPRIATE?

Research by Höök, Sengers, and Andersson suggests that methods for evaluating human-computer interaction (HCI) are "...useful for improving the design of interactive systems, yet may be rejected by non traditional technology disciplines such as media art" (2003, page 1). Art projects and human-computer interaction (HCI) projects are complicated to combine[1] and indeed, when it comes to usability, the arts and HCI are at odds. Both disciplines have selected different evaluation methods and perspectives. HCI evaluation strategies are routinely applied to find out how and where to improve the performance of products or systems. HCI researchers use ethnographic observations or quantitative-scientific / user studies. Art projects, on the other hand, are evaluated either by art critics, professionals skilled in placing the work in a specific socio-cultural context, or by the actual audiences. The interpretation is subjective and, in the mind of the artist, users should derive their own conclusions or interpretations of the work they observe and experience.

For artists, the artwork is the "medium through which they can express their ideas to the user and provoke them to think and behave in new ways" (Höök et al 2003, page 2). In an informal conversation with Professor Wendy Jacob, the creator of the Squeeze Chair, the author asked if any formal evaluations were done for this project. Jacob replied that the project is not a research investigation and no scientific evaluations were sought. As an art project, the projects' "evaluators" are its audience. Adam Whiton, long time collaborator of Professor Wodiczko, was also queried about the kinds of evaluations done by Wodiczko and his team for the Homeless Vehicle project. Whiton replied that a small number of end users, in this case homeless people, were asked to utilize the object and were then interviewed. In essence, Wodiczko's user evaluations investigate the socio-relational aspects of objects by setting artifacts in social context for upheaval. The goal of the study was not to improve the work but to document its potential uses, to look at the ways in which people relate to objects and more importantly, to open a public debate on homelessness and the marginalization of homeless people in today's society.

In industry, products are designed to reach a large number of people who will hopefully use them without much "scratching of their heads". Commercial objects, too, may provoke different

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[1] Michael Mateas also writes about the differences between *cultural production* in the arts and artificial intelligence (AI). Whereas the first relies on poetics, audience perception, specificity and artistic abstraction, the focus in AI is on task competence, objective measurements, generality and realism. (page 149) See Mateas, Michael. *Expressive AI: A hybrid art and science practice.* In *Leonardo: Journal of the International Society for Arts, Sciences, and Technology* 34 (2), 2001. 147-153.

thinking and behaviour, but the nature of consumption is different. The goal of user studies, in this case, is to enhance the clarity of interaction with the product, while pre-planning and refining every direction the interaction sequence can take. Many companies also rely on a variety of market research strategies (focus groups, ethnography, and participatory methods) to help with innovation. Moreover, a company's survival is dependent on its ability to innovate and in effect reinvent itself each time new technology or trend arrives[2]. On the other hand, when asked about the role of end users in innovation, Henry Ford responded: "If I had asked people what they wanted, they would have said faster horses." In a less cynical way, Brenda Laurel[3] makes the same point in her book *Utopian Entrepreneur*:

> "Asking people to choose their favourites from among all the things that already exist doesn't necessarily support innovation; it maps the territory but may not help you plot a new trajectory. On the other hand, most people are not very good at inventing *new objects of desire*. If you asked someone in 1957 what new thing they would like to play with, chances are they would not have asked for a plastic hoop that they could rotate around their hips. Somebody had to invent the Hula Hoop."
>
> (2001, page 37)

While essential to refining the use of a product, the lore goes, user studies are not necessarily the best bet when it comes to envisioning the future, or designing innovative concepts and products.

One approach used to remedy this problem is what is known as co-creation, or *co-designing with users*. In this approach, designers work together with users, immersing both users and themselves in the projected uses of a product. Another approach that Philips Design and other design consultancies apply to evaluate "visions of the future" projects is known as *expert evaluation studies*. The idea is to bring experts who know the field intimately, and to interview them about the issues potentially important for the projects. As Deasy[4] states, it is important to "[b]e broad in your definition of expert; for example, teens make great experts when you are investigating instant messaging." (2001, page 173). Experts can be brought in any phase of the project. The goal is that designers get enough critical support without 'killing' the seeds of ideas that seem uninteresting or irrelevant early on. However, even "vision of the future" projects

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[2] A famous example is Finish Nokia who started as paper manufacturer, continued as rubber industry, etc.

[3] Laurel, Brenda. *Utopian Enterpreneur*. Cambridge: MIT Press, 2001.

[4] Deasy, Dorothy. *Non-Assumptive Research*. In Brenda Laurel (editor), *Design Research: Methods and Perspectives* (pages 172-175). Cambridge: MIT Press, 2003.

evolve and at some point go through user evaluations as known in HCI. They are not art projects.

How to bridge the gap? As a result of the 'conflict' of interest in user evaluations for art and HCI, "...hybrid artwork-interfaces are often evaluated through a combination of argument and informal conversation with a user" (Höök et al 2003). The reporting of evaluation results is also informal. In the paper *Sense and Sensibility: Evaluation and Interactive Art* Hook, Sengers and Andersson discuss evaluation techniques used in two Royal College of Arts (London) projects, *Presence* and *Placebo*. In *Presence*, a European Union (EU) project, the evaluation included informal reflections by the authors Dunne and Gaver about the installation process and on-site use of augmented benches by people in the Bijlmer neighbourhood in Amsterdam. In *Placebo*, a project by Dunne and Raby, a small number of people were interviewed and recruited to "adopt" one of the eight placebo objects. These people lived with the objects in their homes for a short period of time after which the designers interviewed them about their "unusual electromagnetic" experiences with the objects. These interviews are transcribed verbatim in the book about the project, and as Sengers and Gaver state, the authors offer no analysis or conclusions, thus leaving all the thinking to the readers. On the other hand, ethnographic research and user study evaluations were continuous throughout the *Living Memory*[5] project (another EU project from the same project cluster as *Presence*). *Living Memory* was developed among project partners from industry and academia. The evaluation of the interaction scenarios in *Living Memory* was embedded with the design work.

The *Designing for Interpretation* paper by Sengers and Gaver[6] looks at user evaluations conducted for the *Key table* (part of the Equator project by Gaver et. all). This table was designed to assess people's emotions by interpreting how they drop objects on its top (whether they slam the keys or gently leave the wallet). It was given to a London family for a month. The family placed the table close to the entrance door of their home. A photo of a dog was hanging above the table. At some point the family members related the photo of the dog (figure 86) to the table, and started addressing the table as if it were alive. Instead of capturing the family mood – the designers assumed that slamming objects on the table will mean that someone is emotionally

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[5] One of the *Living Memory* project partners was the Communications Department at the Queen Margaret College from Edinburgh. They closely worked with human factors specialists from Philips Design in Eindhoven.

[6] Sengers, Phoebe and Gaver, Bill. *Designing for Interpretation*. Proceedings of Human-Computer Interaction International Conference, 2005.

upset – the family started to think of the table as "moody". They even named it *Terrence the Table*, thus, as Gaver remarks, anthropomorphising or "caninomorphising" the table.[7]

The question brought up by Sengers and Gaver is whether this object and its evaluation were successful. They affirm that from HCI point of view, the object and the evaluation were unsuccessful, however, "[b]y the authors' opinion, the studies were also design successes because the objects were appropriated by the users in many unexpected ways and because the objects remained compelling over period of time. The systems did not work as they were intended to, so how can they be improved?" (Sengers and Gaver 2005, page 5) While this commentary illustrates the divergence between object authoring and object reception, it trivializes the object and the experience with it. It appears that HCI user observations do not necessarily give validity to a project. This raises serious questions regarding the validity of user evaluations in first place.

The conflict of interest in user evaluations for art and HCI, as stated earlier in this chapter, need not be a conflict. Arguably, much of the interactive media artwork can benefit from critical HCI insights about its usability. We are already seeing a new genre of art critics emerge, ones grounded in HCI. In the end, it will be the users that will have the final word.

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[7] Context matters: if the table was placed elsewhere in the home, or with a different family, the results would have been different.

USER STUDIES SETTING

The main goal of the user studies of the dissertation projects was to investigate the role of augmented furniture as mediator with transformative effects on social interactions between individuals. In addition, the goal was to explore the presence and range of social and emotional responses manifested in people's interactions with and through such furniture.

Observation and reflection

The user studies consisted of two parts: observation of subjects while they perform certain pre-arranged tasks and an interview in which subjects reflect on what they think happened during the tasks. The assumption was that these two parts will illuminate the differences between interaction-observation and interaction-interpretation.

Study setting

The user studies were conducted in classroom 3-401 at the MIT School of Architecture and Planning. Part of the classroom was divided into two separate spaces in which the furniture projects were placed, one in each space (figure 55). Figure 56 below is snapshot from a typical angle / location of the video camera.
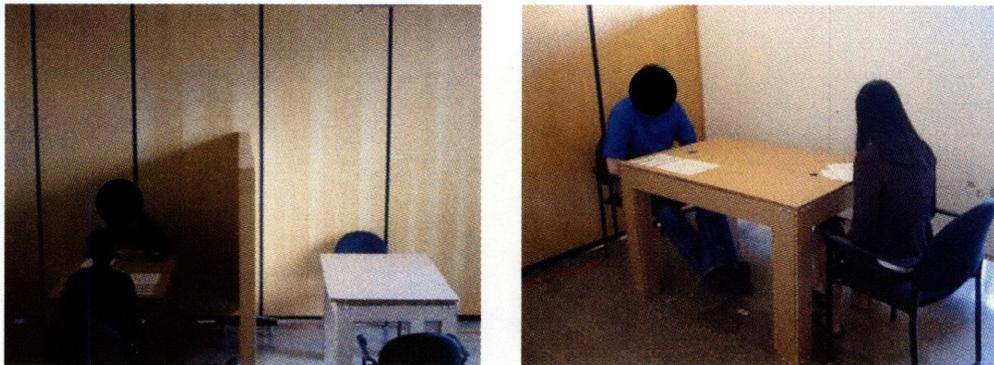
Figure 55. Set of the user study space with a separator in between the two tables.
Figure 56. Two participants in the user study at the *Conversation Table.*

Studied furniture projects

The *Stealing Table, Conversation Table* and *Orev Bench* were the main objects of the user study. A plain, non-augmented table – the *Plain Table* – was used as a control object. The *Orev Bench* was an object representative of the passive category of augmentation. The *Orev Bench* was used once and the *Plain Table* was used twice. The *Stealing Table* was used four times and the *Conversation Table* was used five times.

Tasks

The first part of the user study employed tasks as a way to start and focus conversations between the subjects: some ice-breaking is needed even among friends, especially since conversations were conducted in front of a video camera.

The subjects were asked to complete two types of tasks, one for each of the two furniture projects: 1) talk about an ethical dilemma, and 2) talk about a personal object. For the first task they were given four slips of paper, each with a different ethical dilemma (see Appendix 3.1 for ethical dilemmas). For the second task they used their own personal objects. The first task was used for the *Plain Table* and the *Conversation Table*. The second task was used for the *Plain Table*, *Stealing Table* and the *Orev Bench*. Each task was fifteen minutes long.

The *Conversation* and the *Stealing Tables* were not turned on when the users started working on the tasks, to capture user behavior before and after the objects became active. Half way through the study the tables were turned on. The *Orev Bench* was turned on all the time.

The exact tasks, as read to the subjects, follow:

TASK 1   ETHICAL DILEMMA   [OBJECT: *plain table, conversation table*]

I would like to ask you to please read these short ethical dilemmas selected from "The Ethicist" (NY Times). Negotiate among yourselves to decide which dilemma you will talk about. Talk about your opinions on the pros and cons of certain arguments. Have you done anything like that? What would you do if it happened to you?

Come up with a list by collaborating with your colleague / friend. Please use the provided paper and pencil.

TASK 2   PERSONAL OBJECT   [OBJECT: *plain table, stealing table, bench*]

Please talk with the other person at the table about your favorite or most important personal object (mobile phone, wallet, keys, ipod, etc.) Why is it favorite or most important? Do you carry it with yourself all the time?

Please show and pass your personal object to the other person at the table. Make sure to explain any special features or memories associated with the object. What would happen if you lost it? What might have happened to it? What would you do?

Sequence of tasks in the study

The sequence of the tasks in the study was:

INTRO | SIGN PAPERS | **TASK#1/OBJECT (OFF/ON)** | TASK#2/OBJECT (OFF/ON) | **FOLLOW UP INTERVIEW**

User study props

The subjects used the following props as aids in completion of the study tasks:

- *Conversation topics*: slips of paper with possible conversation topics
- *Personal objects* owned by the subjects themselves (mobile phones to keys, wallets, money holder, hat, knife, laptop, watch, etc.)

Order of studied furniture

The order of furniture projects was not deliberate, rather it was the result of moving the camera back and forth between the two set-ups in the study room during the individual user study and in-between studies.

Duration and number of studies

The duration of each user study, both subject performing tasks and follow-up interview, was 40-50 minutes. A detailed timeline with tasks is given later in this chapter, in the section User Study Protocol.

A total of eleven studies were scheduled, however only seven were conducted due to last minute cancellations or subjects not appearing for the study. The first user study was carried out as a pilot user study to refine the study process, timing and tasks. Six user studies with twelve participants were completed.

Subjects

A total of fourteen subjects were interviewed in pairs of two (seven pairs). They were recruited in pairs by placing printed adverts across MIT campus, emailing to campus bulleting boards and by inviting people in person. One of the prerequisites in the recruitment of pairs of subjects was that they know each other as friends, colleagues, spouses etc., so that "ice-breaking" among strangers is avoided during the user study. Three of the subjects were men, eleven were women. The age of the subjects ranged from nineteen to fifty years and all of them were affiliated with MIT.

Confidentiality procedures

This study was approved by the MIT *Committee on the Use of Humans as Experimental Subjects* (COUHES). At the beginning of the session the subjects were asked to read and sign two COUHES approved consents: to participate in the study and to be video-taped. The subjects were asked for their age, MIT affiliation, and country of origin. Providing this information was not a requirement and not all of the subjects provided the above information. No other identifying records were requested nor kept.

Pairs of subjects

This section gives overview of the user study subjects and their relationships to one another.

PAIR 1	COLLEAGUES		March 9
	SUBJECT 1	(V)	MIT employee (admin), mid 40s, female
	SUBJECT 2	(J1)	MIT employee (admin), mid 40s, male

STEALING TABLE (ST) *TASK 1: Personal object (keys, money holder, mobile phone, wallets, knife, watch)*

CONVERSATION TABLE (CT) *TASK 2: Ethical dilemma*

PAIR 2	ACQUAINTANCES		March 9
	SUBJECT 1	(R)	MIT grad alumna (course 4), late 20s, female
	SUBJECT 2	(D)	MIT visitor (musician), late 30s, female

CONVERSATION TABLE (CT) *TASK 1: Ethical dilemma*

STEALING TABLE (ST) *TASK 2: Personal object (wallets, mobile phones, keys)*

PAIR 3	FRIENDS		March 16
	SUBJECT 1	(A1)	MIT undergrad (course 6), early 20s, female
	SUBJECT 2	(L1)	MIT undergrad (course 1), early 20s, female

STEALING TABLE (ST) *TASK 1: Personal object (mobile phones, wallets, keys)*

CONVERSATION TABLE (CT) *TASK 2: Ethical dilemma*

PAIR 4	WIFE and HUSBAND		March 16
	SUBJECT 1	(B)	MIT grad student (Sloan), husband, early 30s
	SUBJECT 2	(J2)	MIT visitor (attorney), wife, early 30s

PLAIN TABLE (PT) *TASK 1: Personal object (hat, mobile phones, keys)*

CONVERSATION TABLE (CT) *TASK 2: Ethical dilemma*

PAIR 5	WIFE and HUSBAND		March 16
	SUBJECT 1	(A2)	MIT visitor, husband, mid 30s
	SUBJECT 2	(R2)	MIT grad student, wife, mid 30s

PLAIN TABLE (PT) *TASK 1: Ethical dilemma*

STEALING TABLE (ST) *TASK 2: Personal object (laptop, wallets, keys, mobile phones)*

PAIR 6	MOTHER and DAUGHTER		March 23
	SUBJECT 1	(M)	MIT alumna (physicist), mother, late 40s
	SUBJECT 2	(D)	MIT junior, daughter, 19

BENCH (B) *TASK: Personal object (wallet, wrist watch)*

CONVERSATION TABLE (CT) *TASK: Ethical dilemma*

USER STUDY METHODOLOGY

The experimental techniques used in the user study included:

- *Observation of subjects interacting at the furniture projects*

  The subjects were observed while they performed tasks seated at a piece of furniture. They were seated at the opposite sides of the tables, facing each other, or side by side at the bench. The role of the tasks was to initiate and also to ground the conversations in the context of everyday scenarios or *small moments*. The author was present in the study room but not in the view of the subjects, to ensure that the subjects had privacy during their interaction.

  The interactions between the subjects performing tasks were captured with video camera, so that the author can observe and analyze their activities at a later date.

- *Follow up interview with the subjects*

  The observation of the users performing tasks was followed by an interview, to illuminate the differences between author's observation and subjects' self-interpretation of what they think happened during the tasks. Both subjects from each pair were interviewed at the same time, to allow the subjects to inspire and trigger each other's thoughts. The interview consisted of ten questions. The first seven questions of the interview were *reflective*, designed to explore what the subjects themselves thought and felt had happened. The last three interview questions were *projective,* designed to explore how subjects imagine possible, future uses of furniture augmented with technologies. The subjects were given the freedom to choose who will answer the questions first. The interviews were captured with video camera.

- *Collection of data*

  The subject interactions and the subsequent interviews were captured with video camera, to allow the author to review and analyze the interactions and interviews at a later date. The video tapes were labeled with the subjects' initials and with the date and time of the user study.

- *Interpretation of data*

  Each interaction session was reviewed to identify parts of the social interactions that revealed the ways with which subjects related to each other and to the furniture

projects. These identified parts of the interaction sessions were digitized for future analysis and presentation.

All follow-up interviews were transcribed (see Appendix 3.2). The author looked for emergence of specific themes within each interview and also across all interviews. The answers to each interview question were summarized. First, quotes or/and key words that represented the essence of the subject's answer were listed. These quotes or/and key words were further summarized to represent themes or issues. For example, if the subject identified that s/he has "noticed used materials (cardboard, cloth bag), metal parts and servos", the author summarized that this answer is related to the object's properties. If a subject identified that s/he "felt safe, didn't feel scared, mostly felt curiosity and laughed" her/his answer was summarized as "emotion: curiosity / fun".

It was during this phase of the interpretation of the data that specific themes started to emerge (for example, the stealing table distracts; the conversation table supports competition between subjects, etc.).

In the first version the summaries were grouped by pairs of subjects. These summaries are not given in the dissertation because they did not identified issues by piece of furniture. In the second version documented in this chapter, the summaries were grouped by studied furniture object and by identified issue / theme.

- *Comparison of findings from observations and interviews*
  The themes that emerged from summarizing subjects' self-interpretations of their experiences during the user study were compared to the video footage from the user observation. The analysis of patterns of exchange between the subjects and the evolution the subjects' thinking is given in the last section of this chapter entitled "Discussion: analysis of the user study findings".

User study protocol

ACTIVITY #0	WELCOME: SIGNING NON-CONSENTS	00:00 – 00:05
Welcome and introduction of user study	*Welcome and thank you for agreeing to participate in this study.* *The study will take 50 - 60 minutes.* *The two of you will take part in this study together, and will be asked to complete two tasks. Each task will take approximately 10-15 minutes to complete.* *Once you complete the task, I will conduct a short follow up interview with you.*	
Participants sit at a desk to go through the consent forms. **Collect consents when done**	*Before we start, I would like to ask you to first go through these two consent forms: one with which you agree to take part in the study and second one for video recording of the study. Please feel free to ask any questions.*	2 FORMS PER PARTICIPANT - Consent to participate - Video consent form **TOTAL 5 mins**
— move to the first study object —		

ACTIVITY #1	TASK: SHORT CONVERSATION	00:05 – 00:20
Participants sit at the table	*Please have a seat, one person at each end of the table.*	
Turn the camera on and check if it records.	*I will now turn on the video camera and check if the records ok.*	
Introduce task **TABLE IS OFF** Leave the room **TURN THE TABLE ON**	*I would like to ask you to please talk about your opinions on the pros and cons of human cloning. Come up with a list by collaborating with your colleague / friend. Please use the provided paper and pencil.*	Pen and paper provided **TOTAL 10 - 15 mins** **Middle of the experiment**
Check if they are done after 10 mins; interrupt if it takes more than 15 mins. **Switch off / move camera**	*Thank you for completing this task.*	
— move to the second study object—		

ACTIVITY #2	TASK: PERSONAL OBJECT	00:20 – 00:35
Participants move to the next table **Turn camera on, check if it records.**	Now let's move to the next object. Please have a seat at each end of the table. You can also stand if you prefer.	**TOTAL 10 - 15 mins**
Introduce task **TABLE IS OFF** Leave the room	Please talk with the other person at the table about your favorite or most important personal object (mobile phone, wallet, keys, ipod, etc.) Why is it favorite or most important? Do you carry it with yourself all the time?	
TURN THE TABLE ON	Please show and pass your personal object to the other person at the table. Make sure to explain any special features. What would happen if you lost it? What might have happened to it? What would you do?	**Middle of the experiment**
Check if they are done after 10 mins; interrupt if it takes more than 15 mins.	Thank you for completing the task.	Unzip the table bottom if any object falls through to return the object
— start follow-up interview —		

ACTIVITY #3	FOLLOW UP INTERVIEW	00:35 – 00:50
The camera keeps recording	We will now do the interview. It will take about 15 mins.	
	1. Did you have any initial thoughts when you sat at the table(s) / bench? 2. What do you think the tasks were about? 3. How did the object influence the social interaction? What kind of social interactions? 4. Did you experience that you could influence the object in any way? 5. Did the object raise any emotions with you? Which/what kind of emotions? 6. What does this object remind you of? 7. What did you think about the light / motion of the planks? Used material? 8. How do you think this object can be used? Why would it be used? 9. What do you think about embedding technologies in furniture? If you had no constraints, what would you do? Why? 10. Is there anything else you would like to add?	**TOTAL 10-15 mins**
Camera off, put new tape	Thank you for participating in the study.	Reimburse participants with $10 or movie voucher.
— end of user study —		

USER STUDY FINDINGS

Summaries of interview answers

The next section presents a summary of the user study interview answers grouped by question. The responses within each question are grouped by piece of furniture.

The *Conversation Table* is represented with the acronym CT. *Stealing Table* is ST, *Plain Table* is PT, and *Orev Bench* is B. The first initial of the subject's name is preceded by the object acronym (for example, Lira-Conversation Table is represented as L-CT).

The section following the findings provides analysis of user observations and interviews and looks at subjects' patterns of exchange and evolution of thinking.

I. ***Did you have any initial thoughts when you sat at the table(s) / bench?***

General		
D	wondering what will happen	EMOTION
V	didn't know what to expect, anxiety	EMOTION
J	table was interesting, wondered what to do in the task	TASK

Plain Table (PT)		
R2-PT	didn't notice plain table	OBJECT PROPERTIES / TRANSPARENCY
B-PT	noticed materials (cardboard, metal bolts)	OBJECT PROPERTIES
J-PT	noticed material (cardboard)	OBJECT PROPERTIES
L-PT	what is the table going to do?	OBJECT BEHAVIOR
J-PT	anxious but not worried	EMOTION
A1-PT	what are we going to have to do?	TASK

Conversation Table (CT)		
R1-CT	curiosity, anticipation	EMOTION
D-CT	fun, amusement, surprise	EMOTION
M-CT	no initial expectations followed by surprise	EMOTION
J-CT	anxious but not worried	EMOTION
L-CT	what is the table going to do?	OBJECT BEHAVIOR
B-CT	noticed materials (cardboard, metal bolts)	OBJECT PROPERTIES
J-CT	noticed material (cardboard)	OBJECT PROPERTIES
A1-CT	what are we going to have to do?	TASK

Stealing Table (ST)		
R1-ST	what is the table going to do? glow?	OBJECT BEHAVIOR
R2-ST	wondered if plexi planks will rotate, give messages	OBJECT BEHAVIOR
R2-ST	noticed material (cardboard), rough on elbows	OBJECT PROPERTIES
A2-ST	noticed materials (cloth bag) and metal parts, servos "noticed that it was kind of a "special" table"	OBJECT PROPERTIES

Bench (B)		
M-B	noticed material (wood and metal), "good quality" noticed "faint light"	OBJECT PROPERTIES

Summary of question 1

The responses of the subjects to this question were consistent for all three pieces of furniture.
Three pairs of subjects (total of six subjects) identified their emotions as they sat at the study
objects. Only one of these subjects was male. Two subjects in a same pair identified anxiety as
their initial thoughts. Three other subjects from different pairs identified fun, amusement,
curiosity and surprise as initial thoughts. The initial thoughts of three subjects from three
different pairs were related to the potential, unknown behavior of the study objects.

All three male subjects and two of the female subjects commented on the used materials and other object properties of all three furniture projects. Two subjects from two different pairs wondered what they will need to do during the tasks.

2. *What do you think the tasks were about?*

General		
V	method of communication, interaction at a table	SUBJECT-SUBJECT INTERACTION
J	see if "we were paying attention at the table, at each other and the props"	OBJECT-SUBJECT INTERACTION
D	seeing how furniture assists interaction	OBJECT-SUBJECT INTERACTION

Plain Table (PT)		
J-PT	describe objects	TASK
B-PT	interaction, relating to one another	SUBJECT-SUBJECT INTERACTION
R2-PT	basic interaction, how people talk to each other, "how they feel their position in relation to the table"	SUBJECT-SUBJECT INTERACTION

Conversation Table (CT)		
L-CT	observation, speech observation	SPEECH OBSERVATION
A1-CT	"it was really cool" the object communicates, "sends signal"	OBJECT-SUBJECT INTERACTION
R1-CT	"the object connects [people]"	OBJECT-SUBJECT INTERACTION
B-CT	change in the interaction	SUBJECT-SUBJECT INTERACTION
J-CT	subject talks about the issues raised in the ethical dilemmas	TASK

Stealing Table (ST)		
R1-ST	"the object creates distance [between people]"	OBJECT-SUBJECTS INTERACTION
R2-ST	"to see if people are willing to put down objects that were important to them" identify change in the interaction	OBJECT-SUBJECT INTERACTION
A2-ST	distracter	OBJECT-SUBJECT INTERACTION
R1-ST	distraction, surprise distrust in the object can't figure out the tasks	SUBJECT SELF-REFLECTS
A1-ST	"it seemed it was randomly moving"	OBJECT BEHAVIOR

Summary of question 2

Six of the twelve subjects either explicitly or implicitly stated that the purpose of the tasks was to study the role of augmented furniture in the interaction between the subjects. Two subjects (both females) from the same pair identified either nervousness or distraction in the attempt to identify the purpose of the tasks. One subject thought that the completion of the tasks was the sole purpose of the tasks. Three subjects (two females and one male) from different pairs stated that the purpose of the tasks was to study interaction between the subjects themselves, as well as to study the change in the interaction due to the activity of the study objects. One subject

(male) who sat at the *Conversation Table* stated that the purpose of the task was to study the change in the interaction [between the study participants].

Two subjects thought that the stealing table had a role in determining the attention of the study subjects. One of these two subjects referred to the *Stealing Table* as a distracter. Another subject referred to the *Stealing Table* as an object that enables establishment of connection between people, an ice-breaker, while she perceived the *Conversation Table* as an object that generates distance.

3. *Did you experience that you could influence the table / bench in any way?*

Conversation Table (CT)		
L-CT	doesn't know, "some sort of sensors observing their speech"	YES
AI-CT	volume of speech, location of participant	YES
J-CT	"thought so at first but then it didn't do anything"	YES
B-CT	"lights crossed when both spoke simultaneously; delay in the motion"	YES
V-CT	speech	YES
M-CT	"talked more and louder when they learned how the table behaves" "we are the kind that doesn't like to raise our voices… so we ended up sitting lower" (closer to the microphones)	YES
D-CT	thinks her "end" of the table was less sensitive	YES

Stealing Table (ST)		
J- ST	yes, by placing objects	YES
R2	by placing objects, unpredictable behavior	YES
A2	by placing objects on the tabletop	YES

Bench (B)		
M-B	couldn't influence the bench	NO
D-B	couldn't influence the bench	NO

Summary of question 3

All subjects who answered this question identified that they could influence the behavior of the *Conversation Table* and *Stealing Table*. The subjects that used the *bench* identified that they could not influence it.

All subjects who responded that their activities could influence the *Conversation Table* and *Stealing Table* referred to the active (switched on) state of the tables.

Two subjects from the same pair (mother and daughter) changed the nature of their interaction (speaking louder, leaning lower to the *Conversation Table*) once they discovered the object's behaviors.

4. *Do you think the objects influenced your social interaction in any way?*
What kind of social interactions? How did they influence it?

General		
V	supported interaction; "concrete conversation topic and using objects helped"	PROPS, CONVERSATION TOPICS
J	describes activity with props	PROPS COMPARISON
B	shadows comment of previous person	PROPS COMPARISON

Conversation Table (CT)		
A1-CT	wonder, amusement	YES / DISCOVERY
J-CT	looking at the dots, trying to figure it out	YES / DISCOVERY
R1-CT	expectation, "was expecting something to happen"	YES / DISCOVERY
V-CT	not distracting, curiosity	YES / DISCOVERY
J-CT	no influence on interaction	NO
B-CT	took notice, no change in interaction	NO
D-CT	amplified the interaction, "let's make it light up" "competition to talk more (and light up the table)"	YES / PLAY
M-CT	not to dominate, but to have the lights go both ways *increased volume of conversation*	YES / PLAY

Stealing Table (ST)		
V-ST	not distracting, curiosity	YES / DISCOVERY
D-ST	object-related curiosity	YES / DISCOVERY
D-ST	distraction from communication	YES / DISTRACTION
R1-ST	"wasn't prepared for what happened", distracting, game-like, created distance "rebel table, doesn't want anything on it!"	YES / DISTRACTION
R2-ST	distracting, less focus on conversation	YES / DISTRACTION
A2-ST	interrupts emotional exchange between participants	YES / DISTRACTION
L-ST	"it threw me off, then I forgot about it because I was more interested in the actual conversation"	YES, THEN FORGOT
J-ST	distracting, unsure what to do; then forgot about it	YES, THEN FORGOT

Summary of question 4

Five pairs of users identified that the *Conversation Table* and the *Stealing Table* influenced their social interaction in some way. They reported that the changing state of the objects was distracting at first but later forgotten as the subjects continued with the tasks.

Only one pair (a married couple) identified that they noticed the change of the state of the *Conversation Table*, but that did not influence their social interaction in any way. Once one pair of subjects (a mother and a daughter) discovered that the conversation table is active, they engaged in play with the object.

Four subjects (one male, three females) from two pairs identified that the behaviour of the *Stealing Table* was distracting. The male subject identified that the *Stealing Table* interrupted the "emotional exchange" between him and his wife.

For five subjects (four from two pairs; one male and four female) the influence of the objects was related to discovery as they were expecting something to happen and tried to "figure it out".

5. *Did the object raise any emotions with you? Which/what kind of emotions?*

General		
J	likes cardboard; the actual table "stoke a cord"	MATERIAL AFFECTION
V	excited to see what they are going to do with the tables excited and curious to see how [the tables] function	CURIOSITY, EXCITED
R1	no emotions	NO EMOTIONS

Plain Table (PT)		
J-PT	describes activity	TASK-RELATED ANSWER
B-PT	*comment shadows previous person*	TASK-RELATED ANSWER

Conversation Table (CT)		
M-CT	"this setting is my cup of tea"	TASK-RELATED ANSWER
J-CT	table is cool, likes the material	MATERIAL AFFECTION
B-CT	"would like to build all their furniture from cardboard"	MATERIAL AFFECTION
L-CT	felt safe, didn't feel scared; mostly felt curiosity, laughs	CURIOSITY, FUN
A1-CT	curiosity; cool; laughs	CURIOSITY, FUN
D-CT	amplified the interaction, "let's make it light up" "didn't forget it's there"	CURIOSITY, FUN
M-CT	"I told her… come forward so we can see … who is dominating the conversation"	CURIOSITY, FUN
M-CT	"we tested it and then *it* became the topic of interaction"	ANTHROPOMORPHISM

Stealing Table (ST)		
L-ST	felt safe, didn't feel scared; mostly felt curiosity, laughs	CURIOSITY, FUN
A1-ST	curiosity; cool; laughs	CURIOSITY, FUN
A2-ST	interrupted emotions and emotional connection between participants	DISTRACTING
R2-ST	distracting, less focus on conversation	DISTRACTING
R2-ST	"felt tortured by the table"	ANTHROPOMORPHISM

Bench (B)		
M-B	"this setting is my cup of tea"	TASK-RELATED ANSWER
D-B	no emotions raised	NO EMOTIONS

Summary of question 5

Six subjects from three couples identified that they felt curious about the *Conversation Table* and the *Stealing Table*, and that they found the experience fun and exciting. Three subjects, two of them males, liked the use of cardboard as a building material. Two subjects stated that they felt no emotions during the interactions with the augmented objects. These same two subjects identified emotions in some of the other interview answers.

Two subjects from the same pair were disturbed by the *Stealing Table* because it interfered with their conversation and sense of intimacy. They anthropomorphized the table as a creature with its own, unpredictable mind. Three subjects gave answers about their emotions raised by the tasks.

6. *What does this object remind you of? (help note to interviewer: person, animal, situation, another object, plant, etc.)*

General		
V	the tables remind her of her husband who makes lots of projects with his hands and plans to build table	LOVED ONE

Conversation Table (CT)		
L-CT	sending signals	COMMUNICATING
R1-CT	conversation table felt formal; felt like meeting "the microphone made it feel formal", "the topics made it more structured"; resembles political meetings with deputies	FORMAL OCCASION MEETING, POLITICS
J-CT	robot, space age	SCIENCE FICTION
B-CT	doesn't remind him of anything but table; the color reminds him of wooden table	TABLE
M-CT	reminds of another project at the Media Lab	ANOTHER PROJECT

Stealing Table (ST)		
A1-ST	doesn't remind of person, but of stereo lights	STEREO INDICATOR
J-ST	alien landing strip in New Mexico	UFO (SCI-FI)
R2-ST	Dart Vader because it's black	DART VADER (SCI-FI)
A2-ST	reminds me of TV "because it distracts me a lot when it's on"	TV
J-ST	memory of father and grandfather who were builders	LOVED ONE
R-ST	stealing table is better ice breaker; amusing;	ICE-BREAKER, FUN
R-ST	resembles soccer / football tables	PLAY
D-ST	fluid, water, shiny surface = shiny waves "water can take object and make it disappear"	WATER

Bench (B)		
D-B	reminds of sitting in parks in the summer with other people	SITTING IN THE PARK

Summary of question 6

Three subjects identified that the objects reminded them of other people or activities. Two of the subjects were reminded of loved ones who work with furniture. One was reminded of sitting in the park with friends.

The *Conversation Table* reminded one subject of light indicators on stereos, and another subject of alien landing sites in New Mexico. This table also triggered memories of formal occasions and meetings.

The *Stealing Table* reminded two subjects of science fiction (Dart Vader, robot or space age), and another subject of a TV set. This subject perceived the TV (and this table) to be very distracting when on. Finally, one subject thought of water – its shiny waves and ability to absorb objects when thinking about the *Stealing Table*.

7.   *What did you think about the light / motion of the planks? Used material?*

Plain Table (PT)		
R2-PT	doesn't like the cardboard, rough on her elbows	DISLIKES MATERIAL
A2-PT	loves the material, used to work in the construction industry	LIKES MATERIAL

Conversation Table (CT)		
M-CT	liked it	LIKES THE TABLE
L-CT	light is much better	LIKES LIGHT
A1-CT	depends on what one needs it to do	NO PREFERENCE
D-CT	"I think mine was not working so much"	–
J-CT	"the light was interesting at first, then forgot about it"	INTERESTING / FORGOT
B-CT	not interesting once he figured out how the lights work	INTERESTING / FORGOT

Stealing Table (ST)		
L-ST	light is much better	LIKES LIGHT
R2-ST	likes smooth motion of the planks	LIKES MOTION
A1-ST	depends on what one needs it to do	NO PREFERENCE
R1-ST	choice of material would influence object perception "if it was wood and not plexi…"	ALTERNATIVE MATERIAL
J-ST	"hard to eat on it, stuff will fall inside"	REAL-LIFE SCENARIO REF
V-ST	good for her little daughter who doesn't like to eat	REAL-LIFE SCENARIO REF
R2-ST	wondered if the planks' motion was remotely controlled	WIZARD OF OZ

Summary of question 7

This question asked for personal preferences, likes and dislikes, resulting in "mixed bag" of responses. One subject preferred light to the motion of the planks. Another subject liked the use of cardboard as a building material, while his pair-subject disliked cardboard because it was "rough on her elbows". One subject reflected on the cardboard tables' construction and material issues, suggesting that a different material like wood be used. She assumed that use of wood would not trigger any unusual expectations for the table.

One subject wondered if the planks on the stealing table were remotely controlled.

8. *How do you think this object can be used? Why would it be used?*

Conversation Table (CT)		
L-CT	"if you can't hear, you can probably see this way"	PEOPLE W/ DISABILITIES
J-CT	if someone was deaf, they could tell who is talking	PEOPLE W/ DISABILITIES
J-CT	hearing-impaired people	PEOPLE W/ DISABILITIES
B-CT	hearing-impaired people	PEOPLE W/ DISABILITIES
A1-CT	remote feedback of conversational turn-taking in conversation among two people	FEEDBACK MECHANISM
M-CT	to measure volume of one's voice	FEEDBACK MECHANISM
M-CT	to teach people not to talk too loud by buzzing, maybe use something annoying like buzzing	FEEDBACK MECHANISM
M-CT	doesn't have to be lights; it can be any feedback mechanism	FEEDBACK MECHANISM
V-CT	game in a large auditorium with multiple participants	GAME
R1-CT	play element would be fun for children; perhaps children in doctor's waiting room	CHILDREN PLAY
D-CT	in cafes, to break the ice and to encourage more talking	ICE BREAKER

Stealing Table (ST)		
L-ST	swallows objects, takes them away	REMOVE OBJECTS
R1-ST	planks open after dinner, table cleans itself	CLEAN/REMOVE OBJECTS
A-ST	doesn't really see any use of the table	NO USE
D-ST	can be same for a chair: "person comes to sit, and all of a sudden, there is no bottom"	PRACTICAL JOKES
B-ST	as a decoration	DECORATIVE PURPOSES
A2-ST	game, meeting tool (mirrors and projectors for presentation)	GAME
R2-ST	educational tool; can convey messages with rotation of the planks	EDUCATIONAL TOOL

Summary of question 8

This question was intended to be about functionality in the known, usual sense, and not about socio-emotional possibilities of augmented furniture.

Four subjects suggested that the *Conversation Table* can be used by people with hearing disabilities. An additional two subjects said that the *Conversation Table* can be used to give some kind of feedback based on the participation of the involved people and possible be used as an aid for children with autism. A subject from the last interviewed pair thought that the *Conversation Table* can be used as an ice-breaker and means to encourage conversations between strangers.

One subject saw no use for the *Stealing Table*. Two subjects thought that it can be used to remove objects from its top or to self clean itself after meals.

Subject did not provide answers about the *Orev Bench*.

Two subjects identified a potential for the development of games; one suggested that use for the *Stealing Table*, another one for the conversation table. Yet another subject proposed that the tables would have benefit for children and can be used for play or as educational tool.

9. *What do you think about embedding technologies in furniture? If you had no constraints, what would you do? Why?*

Tables		
AI	table with video screen and camera for remote surveillance	TABLE W/SCREEN
V	parts of table to drop in height to accommodate to a small child / person height	TABLE W/ADJUSTABLE HEIGHT
B	table with embedded refrigerator	TABLE THAT COOLS FOOD (WITH FRIDGE)
D	table surface that heats or keeps food at certain temperature during the meal	TABLE THAT WARMS FOOD
J	table that brings and cooks food	COOKING TABLE
J	table that cleans itself	SELF-CLEANING TABLE
V	table that self-cleans itself, collects the dishes	SELF-CLEANING TABLE

Chairs		
L	chair that can help disabled people	CHAIR FOR DISABLED
R1	chairs and devices for impaired people	CHAIR FOR DISABLED
J	chairs that move … "so you can stay lazy"; such chairs	CHAIR THAT MOVES
J	chair with wireless access to the Internet (keyboard on the armrest, monitor elsewhere)	INTERNET CHAIR
B	recliner with an embedded remote control in the arm rolling chairs controlled with a remote control	CHAIR W REMOTE CONTROL REM. CONTROLLED CHAIR
B	ref. to Seinfeld episode where George has a recliner with a refrigerator in the side of the chair	CHAIR WITH FRIDGE
J	would like heated chair with automatic lumbar support	HEATED CHAIR ERGONOMIC CHAIR
R2	ergonomic chairs that sense one's pasture; senses tension and does a massage"; chair that is able to adjust its position and moves to support your body in certain ways"	MASSAGE CHAIR
R2	"shock treatment" if you put your hands on a bad place (both subjects laugh)	SHOCK-TREATMENT CHAIR
V	"chair that keeps people out" (ejects them)	CHAIR THAT CATAPULTS
	"chair that tickles people"	CHAIR THAT TICKLES
	"chair that folds around a person, and eats them temporarily (laughs)"	CHAIR THAT EATS YOU
J	"whoopy cushion" that makes an embarrassing noise	CHAIR THAT 'BREAKS WIND'

Beds		
A2	bed that stands up like in "Wallace and Grommet"	BED THAT STANDS UP
A2	bed that shakes like an earthquake (both laugh)	BED THAT SHAKES
R2	augmentation with music	BED WITH MUSIC

Other		
R1	"to embed technology…makes you a more passive human being; I think it's not good"	SOCIAL ASPECTS OF TECH
L	"would do stuff that moves"	MOBILE FURNITURE
M	"taping with camera", discussion if surveillance is legal	SURVEILLANCE
D	discussion of MIT project TEAL (Technology Enabled Active Learning)	EDUCATION

Summary of question 9

This question asked the subjects to brainstorm, and the replies were most detailed. The subjects talked about tables, chairs and beds, and the augmentation-related ideas were either about additional object functionality or object behavior.

For tables, all answers referred to additional functionalities of tables. For example, one subject suggested a table with an embedded video screen. One subject proposed creating a table with an adjustable height at different parts of the table, to better accommodate a small child. Most table-related ideas dealt with food and maintenance. Preparing, refrigerating, warming up or cooking food was suggested by four subjects. The idea of a table that is self-cleaning came up twice. All table-related ideas for augmentations were related to the existing use of the object. The preferred object's behavior was obedient and the augmentations were rational.

For chairs, the proposals were either about their additional functionalities or behaviors. Two subjects suggested the development of chairs for people with disabilities. Two subjects dealt with the mobility of chairs; one of them proposed remotely controlled rolling chair. Four of the proposals referred to therapeutic furniture (ergonomic chair, massage chair, chair with automatic lumbar support and chair with a heated back). Three of the suggestions were proposals for chairs with embedded remote control, wireless internet and keyboard, and a fridge either in the arm or the side of the chair. All of the chair-related ideas were related to the existing use of the object and an obedient behavior.

Two pairs of subjects engaged in brainstorming back-and-forth about humorous or not-so-humorous behaviors by chairs. The desired behavior of these chairs was autonomous, and the augmentation was either related or unrelated to the object's core function, but in any case, the ideas were to elicit emotional responses. When thinking about embarrassing situations, the subjects suggested chair that "breaks wind" once a person sits at it. When thinking about people they don't like, the ideas ranged from chair that catapults a person, to a chair that folds around and temporarily 'eats' a person. Another suggestion was to make people laugh by crafting a chair that tickles the person sitting on it.

For beds, all the ideas came from the same pair of subjects (wife and husband) who seemed to have problems with waking up in the mornings. Consequently, their ideas ranged from bed that

stands up (like Wallace's bed in the clay-mation series "Wallace and Grommet") to a bed that shakes like an earthquake or plays music.

One pair of subjects discussed how augmented furniture can be used in surveillance and in educational purposes. Another subject pointed out that it is not good "... to embed technology [in furniture]… makes you a more passive human being."

10. *Is there anything else you would like to add?*

L	–	
A1	–	
J	–	
V	audited COUHES last year and was interested in the process of a COUHES study	
D	children may react to these objects differently than adults children may have "many amazing ideas about technology" because they are not confined by current knowledge	KIDS
B	–	
J	–	
R2	"fun experience", at first confused, tried to second guess what to do and then all she wanted is to get her stuff back (both laugh)	FUN
A2	"great experience"	FUN
D-CT	"more of these, they are good"	FUN
M	"embedding of technology in the stuff is the 21st century; making it part of daily life"	VISIONS OF FUTURE

Summary of question 10

Not all subjects answered this question. Two subjects from the same group proposed user testing and interviewing children, as children are "…not confined by current knowledge" to their opinions. Three subjects referred to the experience of the study as enjoyable. One subject talked about a future where technologies will have permeated the places we inhabit.

DISCUSSION: ANALYSIS OF THE USER STUDY FINDINGS

Initial engagement with the furniture projects

When the subjects engaged at the *Plain Table,* the *Orev Bench* and the inactive *Stealing* and *Conversation Tables,* the common focus and the nature of subject-subject exchange remained stable (figure 57). The tasks and props became common focus of attention and exchange between the observed subjects (figures 58-59). The objects were "transparent", in the background of the social interaction. All subjects reported novelty as an initial factor when experiencing the furniture objects as inactive.
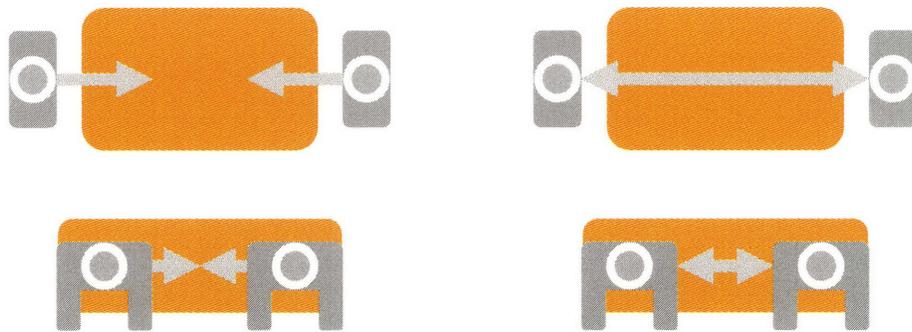
Figure 57. The tables and the bench are 'transparent' objects during conversations.
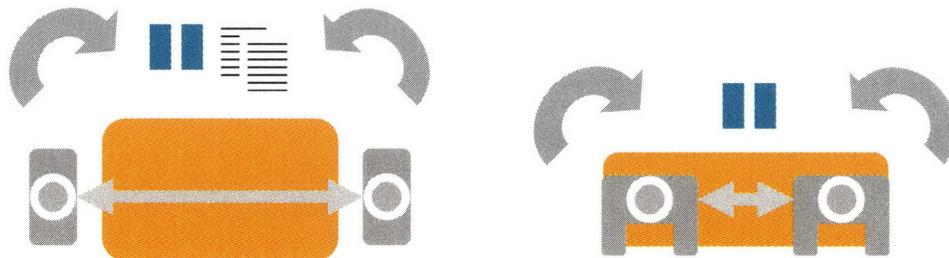
Figure 58. The tasks and props (blue rectangles for personal objects, parallel lines for ethical dilemma topics) used during the user studies became common focus of attention and exchange between the observed subjects.
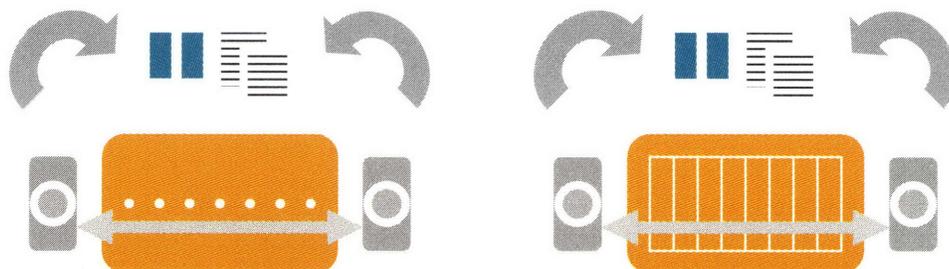
Figure 59. The focus of attention and exchange between the subjects remained stable at the inactive *Conversation* (left) and *Stealing* (right) *Tables.*

Continued engagement with the furniture projects

The subjects' continued engagement with the *Plan Table* and the *Orev Bench* remained stable throughout the tasks. When subjects engaged with the active *Conversation Table* or *Stealing Table*, the common focus temporarily shifted from the props to the tables (figure 60).
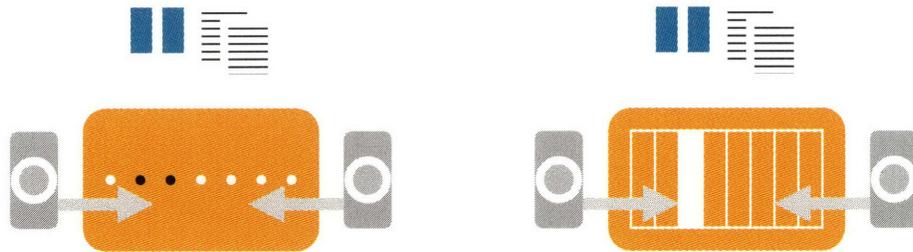
Figure 60. The focus of attention and exchange between the subjects was temporarily shifted from the propos to the active *Conversation* and *Stealing Tables*.

The time delay from the moment when the tables were turned on to the moment when the subjects acknowledged verbally or with gestures that something has happened did not vary significantly. This was likely the case because the subjects knew each other well before coming to the user studies. The time delay in acknowledging the table's active state was due to the fact that users were waiting to see additional evidence that something has really happened in first place.

The *Plain Table* and the *Orev Bench* were in their respective states (non- augmented and augmented passive objects). The *Orev Bench* was lit / turned on from the beginning of the task. They did not raise any concerns, nor influenced the social dynamics among the subjects in any ways. The subjects focused on the tasks, and answered negative when asked whether these study objects raised any emotions or influenced their social dynamics in any way.

From the background to the foreground of the interaction: when furniture become "alive"

Initially, all the furniture projects were transparent, as props in the background of a social interaction. Once the *Conversation* and *Stealing Tables* were turned on, the majority of subjects identified the sudden interference of the tables (figure 61).
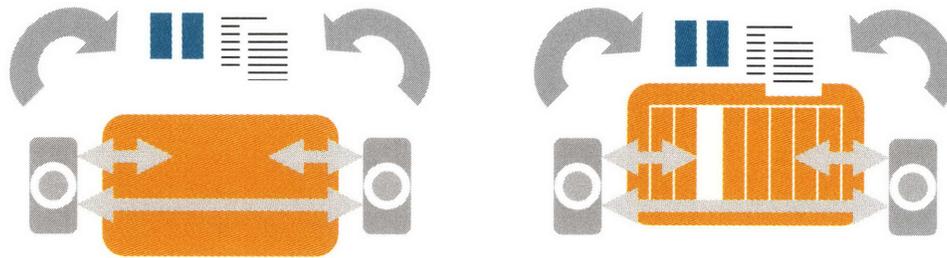
Figure 61. The majority of subjects identified the active tables as distracting and interfering with their tasks.

The discovery of the behaviour of the *Conversation Table*, documented in user study videos, appeared comical at times. For example, two unsuspecting users, a mother and a daughter, were seated at the table and discussed whether it is ethical to use other people's wireless Internet access. Although the topic of their conversation was a task given as part of a user study, the conversation appeared natural, possibly like many other conversation the mother and daughter have already had. It illuminated closeness between the users, a supportive mum and slightly stubborn teenager. Their conversation also revealed that the teenage daughter, MIT freshman, assumed the expert position on this topic. An excerpt from the dialogue where these two subjects discover that the table is "special" follows:

|	
Daughter	…like [name], he is using someone else's wireless from the house, but the other person lets him. *(she is poking with her fingers into the microphone area of her end of the table)*
Mother	So you have to know their account?
D	No, you don't have to know them, but in his case he asked them… *(doesn't stop poking into the microphone area)*. There is an antenna … which detects it …
X	*(The conversation table is turned on. Complete silence from both subjects for about 10-15 seconds. The daughter looks with wide opened eyes at the microphone area and keeps poking at it. She then looks back and forth from her mum to the area on the table she pokes. Then the mum starts poking, they both poke and are quiet.)*
D	Oh my God… *(silence, both stop talking or poking)*
M	Yeah, maybe if we go on talking…
D	Hello…
M	Say something. See, now I am talking and it is lighting!
D	*(starts poking again)* S**t!!
	(both laugh)
D	*(comes closer to the table)* Hi!! Wait, don't say anything… Hiii…
M	Now yours is lighting.
D	I think there is a microphone underneath. *(pokes at the microphone area)*
M	Don't push it, this is soft, you'll break it.
	(both laugh and then start talking louder)
D	So… do you think that's ethical? It really depends on how much money the person spends.
M	So the whole issue is about stealing.
D	Yeah, because if other people are using your Internet and it makes it slower and you don't get the speed that you need…
	(both pause; their attention is back to the table)

| M | … Is it still working? |
| D | Yeah, you have to put your mouth closer. Hello! |

(from this point on, the conversation between the subjects is much louder; both subjects lean closer to the table)

Once the table was turned on, the conversation came to an instant halt. The subjects sought a mutual reassurance that both share the same experience. While encouraging each other to say something, addressing the table as an animate object and wondering if the table is remotely connected to someone else, they started discovering how the table behaves. They also started speaking louder for the remainder of their task: their mission was to have those LEDs lit!

The object did not remain a constant centre of attention but weaved in and out from the background to the foreground of the conversation between these two users. The subjects frequently "checked" on it, wondering if it is still "listening". They engaged in *play* with the *Conversation Table* ("we were trying to make it light up"), and continued to 'check' whether the object is active during their conversation. In a way, their interaction became consciously tri-partite as the users continually attempted to engage the object. During the follow up interview, these two users stressed that after the initial interruption in their interaction, the *Conversation Table* temporarily became the topic of their conversation. From being in the background, the object emerged to the foreground of the interaction. These two users further proposed that the table can be used as an ice breaker between strangers.

Similar experiences were reported by the other subjects. The *Conversation Table* was perceived as transparent prop in the background of the subjects' social interaction. Once the *Conversation Table* was turned on, the majority of subjects identified its sudden interference. All of them attempted to understand how the table's behavior occurred. Most of these subjects continued with the tasks after they discovered the table's behavior, at which point they either no longer actively observed the behavior of the object or the table faded in and out of the focus of their attention. A majority of subjects identified competition and dominance as the key components brought forward while interacting at the *Conversation Table*.

While subjects perceived the behavior of the *Conversation Table* as simple to understand, the subjects who engaged with the *Stealing Table* had difficulties establishing the patterns of behaviors of the table. This table had its own quirks: the planks sensed and absorbed objects placed on them but also random planks opened spontaneously at random time intervals. Prior to the user studies, other subjects have engaged with the *Stealing Table* at an exhibit and several

project demonstrations. In the first half year in which the table was used by subjects, it behaved as it was designed: people would put small, light objects such as mobile phones, wallets and pencils on the tabletop, the planks would open up and the table would "absorb" the personal object. When subject would put large and heavy objects, the table remained still: it had 'taste' only for small, personal objects. Half a year after it was made, the behaviour of the table became unpredictable. The hardware components were heavy, and the honeycomb cardboard used for construction of the frame weakened due to the frequent transport of the table. As a result, the inner frame made of plywood, the plexiglas planks and the sensors misaligned. The planks on the tabletop continued to sense and absorb objects, but started to open and close spontaneously, surprising users who tried to predict the pattern of behaviour. The table epitomized an "uncanny" piece of furniture.

The *Stealing Table* was initially perceived as a transparent prop in the background of a social interaction between two subjects. All of the subjects identified the interaction as tri-partite once the *Stealing Table* was switched on. This third 'protagonist' asserted itself and continued to intrude and demand attention. The below summary of a subject pair interaction is an example of the evolution of thinking and patterns of exchange once the table "moved" from the background to the foreground of the interaction:

> Two unsuspecting users, a wife and a husband, were seated at the *Stealing Table* and talked about their personal objects. The topic of their conversation was a task, and much like in the conversation mentioned in the section on the *Conversation Table*, their conversation gave insight into the dynamics between these two people. Recently married, they chatted, laughed and frequently smiled at one another while remembering peculiar details and stories about some of their personal objects. They placed all of their objects – her wallet, notebook and keys, and his laptop, wallet and keys – on the top of the table as soon as they sat. Her wallet disappeared inside the table seconds after the table was turned on. Both users were temporarily startled, looking at the tabletop without saying anything, and then continued with the task while removing their personal objects: they were not to take any further chances with this object. The situation evolved into comical placing object on the table, planks opening and closing under placed object or away from them, all while the subjects tried to keep on task and pretend nothing was happening. At one point the planks opened and she tried to reach for her wallet: the planks "bit" her, grabbing her fingers. Her next decision was to

"throw" a bate for the table, placing his wallet in the area where she lost hers. The table responded to her bate, and she quickly removed both wallets. They laughed because she tricked the table.

In the subsequent interview, this pair of subjects was disturbed by the interference of the table because it interrupted their conversation and sense of intimacy. The husband described the interference as *noise* ("it reminds me of TV when it's on because it distracts me a lot"). The wife frequently anthropomorphised the table during the interview, and referred to its aggressive, unpredictable personality ("Hello! What is it doing now?"... "I think this table is a little menacing"). As mentioned before, interactions at tables carry their own set of accepted cultural conventions. For these two subjects, this table "disregarded" accepted cultural conventions and sequences of behaviour. While the subjects explicitly found the table's "behaviour" not acceptable, they implicitly reacted to the object as an autonomous, anthropomorphic entity. The subjects' "exchange" with this augmented, alien object stood in contrast to the integral "furniture" related properties of the object and the known, accepted interactions of those that use them.

All subjects referred to the behaviour of this table as unpredictable and distracting. They also identified the interaction at the *Stealing Table* as tri-partite. Though the table itself still functioned as an object in the background, it pushed the boundary of "accepted" interference and quirkiness. Unlike the case of the *Conversation Table,* none of the subjects who interacted with the *Stealing Table* engaged in play. When a personal object was absorbed by the table, the focus of the subjects shifted from the task (talking about a personal object) to attempt to retrieve the object they 'lost' and then back to the task while trying to avoid any further prospects of 'losing' a personal object. Their strategy of interaction was defensive and the subjects identified the table as an intruder.

From the analysis of the video tapes of the observations, it was apparent that the ways in which the subjects related to each other before and after the tables were turned on was not influenced by the tasks or the tables. The dynamics between the subjects remained stable and was not dependent upon whether there was a dominant user in the pair.

The *Plain Table* and the *Orev Bench* were perceived within their original, intended functions and meaning. They did not influence the social interactions in any way. Although augmented, the

bench was not perceived as such. None of the subjects expected anything to happen at the bench.

Table construction issues

The topic of the construction of the tables and the bench as well as the used materials came up in all interviews.

The author's intention was to suggest that the *Conversation Table* is an unusual and perhaps even a fake table by using an impermanent building material such as cardboard. The follow-up interviews revealed that although use of cardboard was found unusual and interesting, it did not take away from the "tableness" of the object. No subject suspected that something may happen and perceived the table "as is". This may be the case because the technologies were completely hidden and there was no hint to what may be happening "under the hood".

The *Stealing Table* fostered entirely different reactions. The electronic and mechanical components in the tabletop were not completely concealed and also two different materials (cardboard for the frame and plexiglas planks for the tabletop) were used. Similar to the *Conversation Table,* the use of construction materials were intentionally chosen to suggest the impermanent and fictional nature of the object. In this case, users perceived the table as a "special" table. Given the use of two different building materials and the nature of the construction of the table and glimpses to the electronic and mechanical components, it was evident to the users that something may happen even before the table was switched on. Subsequent versions of this project would benefit from examining ways with which the mechanical and electronic parts are concealed.

The *Orev Bench* raised no concerns regarding use of embedded technologies and their influence on subjects' social interactions because the object was passive. Built from hardwood and metal, the object was at the background of the interaction because of the subjects' historical and cultural familiarities with such designed objects.

Imagining the future

The interview replies were most detailed when the subjects were asked to imagine that they would not have any technological constraints and to brainstorm about embedding technologies in furniture. Most augmentation-related ideas were either about additional object functionality or object behavior.

For tables, most of the subjects' ideas concerned food preparation, cooking, preservation (refrigerating) and heating (maintaining the temperature of a cooked meal). The idea of a table that is self-cleaning was also popular. It appears that the subjects projected functions of the kitchen to the designs of their imagined, "special" tables.

For these subjects, the augmentations were related to the existing function of the table. The augmentations were rational and the subjects favored that these tables are obedient and predictable.

For chairs, the subjects proposed additional functionalities and behaviors. They encouraged development of chairs for people with disabilities and also therapeutic use of furniture (ergonomic chair, massage chair, chair with automatic lumbar support and chair with a heated back) were proposed by six of the subjects. Three proposals dealt with embedding remote control, wireless internet and keyboard, and a fridge.

Similar to the table ideas, subjects imagined obedient objects with augmentations that were rational and related to the core functions. Only one pair of subjects brainstormed about chairs that had autonomous behavior, either humorous or not-so-humorous. These two subjects proposed augmentations that have the potential to elicit emotional responses from their users (from chairs that "break wind" when someone sits on them, to chairs that catapult unwanted visitors or tickle the person sitting in them).

The setting of the study – a classroom at a university – and the context – a user observation at the end of which the users are reimbursed – 'detached' the tasks from real-life *small moments* contexts in which such exchanges occur.

In the future, a user study of both the conversation and the stealing tables should include a real-life setting (at a café or another public setting) for a longer, continuous period of time, to examine user behaviors that is not explicitly solicited (such as in the case of a structured user

study with tasks). Observing social interactions in presence of the furniture projects in a different cultural setting other than the USA will most likely yield different results. Another possibility is to observe more than two users interacting at the furniture projects. One might also have multiple pieces of furniture in the same setting.

Remarks

It would be presumptuous to over generalize the results of these user studies. The studies involved fourteen users, a statistically insignificant representative number of any user population, even a particular MIT population. In addition, subjects recruited from the MIT population are, by default, technology savvy. Conducting the user studies with members of other universities or other populations might have yielded different results. Nevertheless, the user studies and their results give initial ideas about the types of responses that may arise from different target audiences in different contexts.

4

REFLECT

The final chapter, REFLECT, revisits the research question in respect to the dissertation work and discusses the contributions to the field of augmented furniture. In addition to generalizing the findings to other artefacts in the environments, this chapter discusses possible directions for future work.

Dissertation motivations

The primary motivation for this dissertation was to understand better the role of new hybrid objects, such as furniture augmented with electronics, in redefining the cultural landscape of furniture. Designers, artists and scientists have exhibited and published individual works in the field of augmented furniture, but there has not been a comprehensive study that brings all of these works together. This field will benefit from further in-depth research into specific projects and themes.

The secondary motivation for this dissertation was to develop examples of augmented furniture that explore activities or scenarios that are not driven by work themes. Designing for work-related activities or scenarios implies focusing on efficiency, productivity, relationships between clients and providers, etc. This approach is *rational* and *programmatic*, implying 'air-tight', 'wind tunnel' tested objects – furniture, domestic appliances, mobile phones, user interfaces, etc. – that will not fail nor allow any unplanned ambiguities when used by end users. This dissertation explores the theme of *small moments,* everyday, non-instrumental social interaction scenarios between people (e.g. dinner at a table, conversation with a friend, walking on the street, reading a newspaper) that may appear marginal but are in fact the very glue of our daily lives. In fact, the information technology developments in the last decades have enabled work, pleasure and leisure activities of daily lives to intersect (Mitchell). Rather than designing for these intersections, or creating a design strategy for addressing *small moments* in a rational way (the dominant HCI approach), the chosen approach can be best described as *poetic.* The goal of this dissertation was to develop furniture that encourages moments of playful reflection and ultimately help us to learn more about ourselves and about the objects we use, while also providing some flexibility in manipulating the objects' intended use.

The third motivation for this dissertation was to understand better the ways in which augmentations of furniture are manifested. For this purpose, examples of augmented furniture were analyzed and three taxonomies, or continua, were proposed.

The first taxonomy referred to the functionality of furniture and augmentation that is connected or unconnected to the core function of the object. The second taxonomy was based on the degree of autonomy of the object. According to this taxonomy, augmented furniture can be passive, obedient and autonomous. *Passive* furniture remains in a certain state until that state is not changed by the user. The term *obedient* has been borrowed from Ackermann's research on

animated toys, and refers to furniture that exhibits more complex behaviour determined by pre-designed interaction protocols. *Autonomous* furniture refers to objects that can be described as independent, uncontrolled or self-governing. It is important to point out that the range of passive to obedient and autonomous behaviours doesn't represent clear cut categories but a continuum. Objects exist throughout the continuum, from passive to autonomous. The mix depends on the types of activities that one carries out with the passive versus with the obedient or autonomous parts of the object. The third taxonomy emerged from the design strategy applied in designing the object. The analysis of existing examples of furniture suggested that the design strategy swings between rational to poetic.

The fourth motivation was to explore the role of furniture as mediators during a type of daily interaction around furniture, as well as the potential for eliciting emotional and social responses from the users. Several themes emerged as a result of the user studies. In regards to social interaction, all subjects identified that the augmented tables disrupted and then influenced their interactions. One subject observed that the *Stealing Table* connects people while the *Conversation Table* pulls them apart. The augmented tables assert themselves from the moment the users discover their 'special' behaviours, and the social interactions effectively became tri-partite. In regards to emotional experiences, the subjects reported that their emotional experiences ranged from frustrating to enjoyable. The behaviour of the *Stealing Table* was perceived as unpredictable and autonomous, as a result of which subjects anthropomorphized the object.

Finally, a very personal motivation for this dissertation has been to lift the author's own work from the screen into the physically tangible world. Working on furniture has been a theme of long personal interest.

Generalization of the findings

Furniture is one among the many objects in our environment that have been augmented with information and communication technologies. For example, personal, wearable networks woven in the clothing can measure biometric data of one's body and also provide connectivity to various services. Mirrors can be more than mirrors, enclosing LCD screens where one can play videos, read text or leave messages. Even mundane objects such as picture frames can be augmented – they now come with LCD screens and memory – and can display slide shows comprised of many images. Occasionally "perverse couplings" occur, which is not exclusive to

this wave of technology.[1] The findings of this dissertation can be generalized to other artefacts and objects in the environment. The types of augmentation of every family of objects need investigation within its own universe.

Although the dissertation projects have been placed in the context of *small moments,* the research and findings can be used when designing furniture for work contexts. Interactions need not be only rational to be meaningful; they can be enriched if addressed in a poetic way.

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[1] For example, embedding shaver into a mobile phone.

FUTURE WORK

Conversation Table

Currently the *Conversation Table* isolates human voice frequencies from background noise, and triggers the animation of the LEDs when the human voice is above a certain volume threshold. Regardless of the volume intensity above that initial light-triggering threshold, the LEDs light in the same fashion. There is no differentiation based on the volume of the voice of the subjects, pitch and frequency of their voice, or whether one subject speaks more frequently than the other. In future versions of this table, the properties of the individual voices as well as the structural elements of their conversations can be used as additional input to the behaviour of the LED animation. Based on these properties, the LEDs can change their intensity (from faded to bright), light up in different patterns and with different speeds, or exhibit range of behaviours related to their actual geometry.

The table has been designed to facilitate interaction between two subjects. A possible future project can be to explore interactions between more than two users, for example at round tables, and to see how power dynamics among three and more users are influenced by furniture such as the *Conversation Table.*

In regards to studying user behaviour, the project would benefit from being deployed in different contexts: from different setting (not a controlled study in a classroom, but a public space such as a café or in everyday use in someone's home, for example), recruiting subjects from different cultures or using multiple pieces of furniture at the same time. As discussed in the first chapter of this dissertation, accepted cultural conventions guide the sequence of behaviour between people, and the same object may have different influences or be perceived in different ways.

Stealing Table

Currently the *Stealing Table* reacts to objects placed on its top: by simply opening the planks to absorb them. The nature of the construction of the mechanical parts of the table can enable objects placed on the tabletop to move slowly (like a carousel, by slowly moving and carrying the object from one plank to the next) or to be thrown off the table (like a pin ball machine, by quickly moving the plank on which an object is placed).

In addition, if a vision system is employed, it would be possible to investigate scenarios when this table "develops a taste" for objects that are, for example, red or made from metal or are round, etc. Peculiar emerging behaviour may be triggered by introducing more than one parameter (currently it is the object's weight) based on which this table senses objects.

Finally, future prototypes of the table can investigate different ways of absorbing objects from the tabletop. One possible direction is to go back to the original sketch (see figure 40) and explore what it would mean if the tabletop is constructed like threads on a loom, and have these threads open when objects are placed on them.

In regards to studying user behaviour, this object can be deployed for everyday use, at home or in public settings and with different target audiences.

Orev Bench

The *Orev Bench* was the only piece of furniture that was built from conventional building materials. By being passive, the object did not relate to subjects the way the two table projects did. The fact that it was augmented with light was not perceived as unusual nor had any apparent social or emotional influences on the interaction between the subjects.

This project has merely scratched the surface in the exploration of light as an element with both an ornamental and interactive potential for furniture design. Future work can investigate the use of other types of solid state lighting technologies, as well as scenarios where the object "wakes up" from its passivity (dream) and gains behaviour and autonomy.

CONCLUDING REMARKS

What is it that "poetically" links people and "augmented" furniture? How can such a link, or rapport, form and evolve? What thoughts and feelings draw people to certain artefacts? What qualities of the artefacts themselves may lead to engaging or amusing interactions?

People are born into a world of signs, symbols and human-made artefacts, and as they grow older, they appropriate these objects, re-creating and interpreting their meanings through the lenses of their interests and experience. Cultural artefacts, on the other end, go beyond affordances. They exhibit relational and poetic qualities best described in terms of objects' *presence* and *personalities*.

As a way of conclusion, a few words on people, things, and the poetics of playful interactions, or *small moments*, follow.

On people and play

In the first part of this dissertation, it has been suggested that the understanding of beauty depends on the individual's perception (page 26 in Chapter 1). In particular, it was shown that without suspension of disbelief one would not be able to engage in play, or appreciate a joke or a work of art. Like imagination itself, pretend play and joking are non-literal. They are about make-believe. Both pretence and humour allow a person to step back occasionally from the seriousness of everyday life and approach it with a "grain of unreality." Symbolic replays, through dramatization or humour, are not confusing provided the context is safe. Likewise, fantasy play is not an escape from reality. Rather, it helps people from all walks of life to better understand reality.

On things

If the understanding of beauty ultimately relies on perception ("eyes of the beholders"), not all objects are equally good projective materials. As a way to capture the *hidden qualities* of artefacts that enable meaningful encounters – and sustain engagement over time – a useful

heuristic has been to "ask" the object itself a host of questions relative to *its' relational abilities to draw in people and keep them engaged*. The following relational vocabulary, developed by Ackermann[2], presents a means to capture many essential qualities, usually left unexamined by instrumental or rational approaches to object's affordances:

- *Holding power:* The ability to engage person's attention and sustain her interest long enough for a meaningful relation to take place (play it again).

- *Transformative power:* The ability to *let* the person *in*, i.e. to encourage her initiative, both physical and mental (do, transform).

- *Evocative power:* The ability to bring about rich associations and thus to unleash a person's imagination (be transported, inspired).

- *Mediating power:* The ability to facilitate the expression, communication, and negotiation of feelings and ideas (say it with...).

- *Reflecting power:* The ability to open up a space for reflection and contemplation (stop and think).

On the poetics of playful interactions, or *small moments*

As mentioned earlier in this dissertation, designing for work-related activities or scenarios implies focusing on efficiency, productivity, and transactions between clients and providers. This approach is deliberately *rational* and *programmatic* and the goal is that 'products' will not fail nor allow unplanned ambiguities when used by end users. This has been the dominant HCI approach, and much work falls in that category. Instead, the chosen approach of the dissertation projects is best described as a *poetic*. In regards to people's perception of projects that have applied the *poetic* approach to design strategy, this author would like to point out the contrast between the author's (poetic) intention and the subjects' ideas about augmentation of furniture. As illustrated in the answer to user study interview question in this dissertation about embedding technologies in furniture in the future (see pages 94 and 95 in Chapter 3), ten of the twelve

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[2] Nikolovska, Lira and Ackermann, Edith. *Exploratory Design, Interactive Furniture: On the Importance of Objects' Presence*. In *Collaborative Artefacts, Interactive Furniture*, ed. by Pierre Dillenbourg, Jeffrey Huang and Mauro Cherubini. Springer-Verlag. (book chapter accepted for publication in 2006)

subjects imagined rational and programmatic augmentations of the functionalities of furniture. Given that the number of tested subjects was small, the study will benefit from further research about subjects' ideas about augmentation of furniture in a poetic versus rational way.

Small moments, everyday, non-instrumental interaction scenarios between people or between people and artefacts have been explored as a central theme of this dissertation and its projects. Although the significance of such interaction can be marginalized, it is these very *small moments* that bring people together or draw them apart.

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AI

ADDITIONAL
RELATED WORK

*The contents of Appendix A1 relates to the
first chapter. It includes additional furniture
examples: from analog and digital furniture
projects, to movies with peculiar situations
related to furniture.*

APPENDIX 1: ADDITIONAL RELATED WORK

This appendix includes additional furniture examples: from analog and digital furniture projects, to movies with peculiar situations related to furniture.

Enlightened (continued): *Symbiosis, KVA electroluminescent table*
Symbiose von Tisch und Licht (Symbiosis of Wood and Light) is a project by Catharina Brukner, Herbert Klamminger and Stefan Moritsch of the *BKM Design Working Group*. This is an interesting lighting study looks at the transformative effect of lighting when a light fixture moves through a table with a perforation (figure 62).
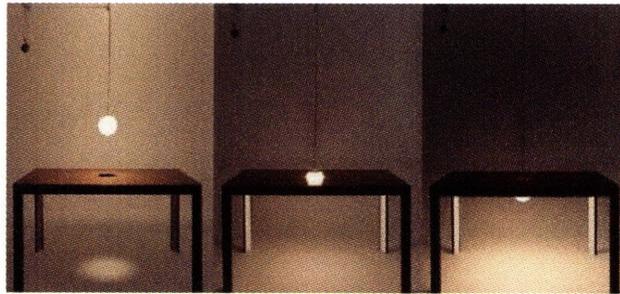
Figure 62. *BKM Design Working Group*, Vienna.
Retrieved on 8 May 2005 from http://www.bkm-format.com/flash.html

The ***Electroluminescent Plywood Desk*** (figure 63) by Kennedy & Violich Architecture (KVA) is an experiment in how emerging materials can be integrated into existing artifacts. Specifically, the research focus in this project is solid-state lighting technologies for work surfaces. The manufacturing process involves layering plywood with a flexible polymer, spraying the polymer with a coating of phosphorus, and sealing the composite material. The end result is that an illumination surface is incorporated into the table.
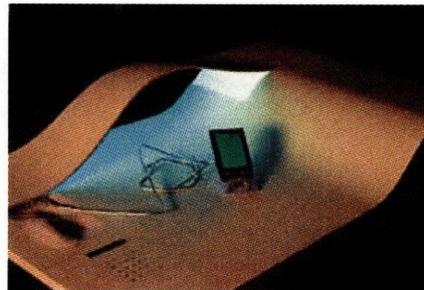
Figure 63. KVA. *Electroluminescent Plywood Desk*, 2001.
Image published with permission from the author.

Communal (continued): *TablePortation* and the *Key Table*

The ***Tableportation project***, developed by Giorgio Olivero and Peggy Thoeny from IVREA, is an investigation of interactions occurring at tables in cafés. Activities that take place on each of the connected tables are projected onto wall displays. People seated at different tables collectively contribute to the creation of the collage on the display (figure 64).
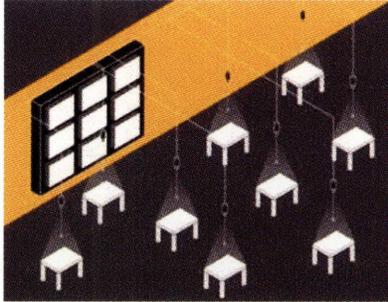
Figure 64. Giorgio Olivero and Peggy Thoeny. *Tableportation project,* 2003.
Image published with permission from the authors.

The ***Key Table*** is part of the Equator project. The table is designed to interpret people's emotions. People drop objects on its top and the table interprets the events (figure 65). The table was given to a London family for a month. A photo of a dog was above the table and at some point the family started addressing the table as if it was a dog. The designers assumed that slamming objects on the table will mean that someone is emotionally upset. Instead of the table capturing the family mood, the family started to refer to the table as a moody dog / object.[1]

Figure 65. *The Key Table*, Equator project (2002) by Gaver, Boucher, Law, Pennington and Walker, Goldsmiths College, University of London. Image grabbed from the paper *Designing for Interpretation* by Phoebe Sengers and Bill Gaver, 2005. Image published with permission from the author.

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[1] The author's remark is that context matters: if the table was places elsewhere in the home, or with different family, the results would have been different.

Drifting: *Drift Table, BrainBall, Tidy table, Horse Table* and *The Chair*

The **Drift Table** is a coffee table that displays aerial views of the British countryside (figure 66). A peephole in the center of the tabletop allows users to view centered part of the aerial image. The tabletop is equipped with load cells (weight sensors) and an internal built-in monitor. Placing weights (i.e. objects with any weight) at a certain part of the tabletop works like clicking on scroll buttons. The aerial image pans to the part located under the placed weight.
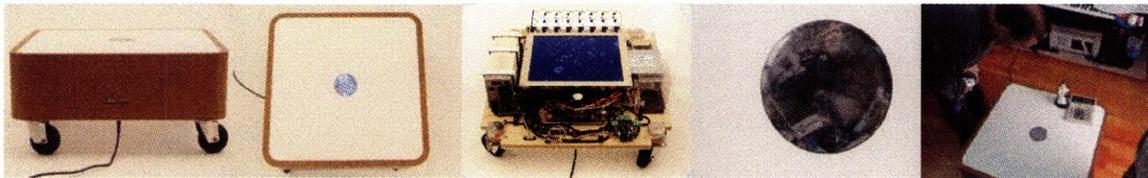
Figure 66. *Drift Table*, Equator project (2002). Gaver, Boucher, Law, Pennington and Walker. Goldsmiths College, University of London. Images published with permission from the authors. All images and quote are retrieved on 6 July 2005 from www.interaction.rca.ac.uk/equator/weight_furniture.html.

The authors state that the project "…was designed to investigate [their] ideas about how technologies for the home could support ludic activities-that is, activities motivated by curiosity, exploration, and reflection rather than externally-defined tasks. The many design choices [they] made, for example to block or disguise utilitarian functionality, helped to articulate [their] emerging understanding of ludic design." (Gaver et al.)

BrainBall is a game for two players (figure 67). Electrodes fastened to the frontal lobes of the players are connected to a biosensor system that registers electrical activity in the brain, specifically Alpha and Theta waves. The brain activity is graphed on a diagram and is also linked to the movement of a ball on the table at which the two players sit. The player who relaxes more, wins the game (not a simple task given the crowd of fans watching). [2]

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[2] The *BrainBall* was developed by the Smart Studio at The Interactive Institute in Stockholm, Sweden. Information on the commercial version *MindBall*® is available at http://www.mindball.se
Thanks to bloggers from http://wemakemoneynotart.org for pointing out this example.

Figure 67. Brain Ball (1999-2000). Retrieved in 10 March 2006 from
http://smart.tii.se/smart/projects/brainball/index_en.html

Tidy Table *(Katazukue)* is a table which has the 'final word': it always stays clean. The table has a pair of powerful, integrated conveyor belts that periodically move, and objects fall from the table to the floor (figure 68).

Figure 68. Crispin Jones, *Katazukue: The Tidy Table* (year of making not available). Retrieved on 20 October 2005 from http://www.mr-jones.org/katazukue/index.html#vidimg. Thanks to Brian Whitman for pointing out this example.

The ***Horse Table*** (figure 69) built by Douglas Repetto, was part of the show "Come Home Charley Patton" by the choreographer / director Ralph Lemon. In addition to its occasional walks, the table mainly functions as a regular table during the show. Repetto says that "[i]t's not easy being a walking table. But [this] little table was brave, and with a lot of hard work it learned to walk, and even to lie down and fold itself up."

Figure 69. Douglas Repetto, *Horse Table,* 2002-04. Thanks to Brian Whitman for pointing out this example. Retrieved on 10 November 2005 from http://music.columbia.edu/~douglas/portfolio/horse_table/
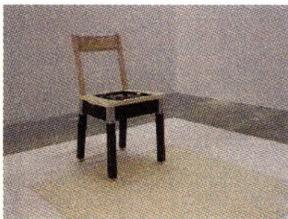
The Chair, a project by Max Dean and Raff D'Andrea, is a robot-chair that falls apart in five pieces and then puts itself together (figure 70).

Figure 70. *The Chair,* Max Dean and Raffael D'Andrea (2006). Retrieved in May 2006 http://www.mae.cornell.edu/raff/InteractiveDynamicArt/InteractiveDynamicArt.htm Image published with permission from the authors.

Magical: *Actuated Workbench*

In Gian Pangaro's[3] *Actuated Workbench,* a grid of electromagnets is placed under a tabletop (figure 71). Turning on and off the individual electromagnets can result in two-dimensional movement of objects placed on the tabletop. Objects can be moved between neighbouring electromagnets by varying the strength of the magnetic fields.

Figure 71. Gian Pangaro, *The Actuated Workbench,* 2002-03.

Clothed: *History Tablecloth* (Equator) and *Interactive tablecloth (Culinary Art)*

The *History Tablecloth* (figure 72) is a table cover that starts to glow beneath objects placed on its top. The glow slowly disappears while traces of the objects linger a while after they have been removed. According to Gaver et al, "*Tablecloth* highlights the flow of objects over surfaces in the home." [4]

Figure 72. *History Tablecloth,* Equator project (2002). Gaver, Boucher, Law, Pennington and Walker. Goldsmiths College, University of London. Images published with permission from the authors. Top image retrieved on 6 July 2005 from www.interaction.rca.ac.uk/equator/weight_furniture.html.
Bottom image retrieved on 4 May 2006 from www.equator.ac.uk/index.php/articles/710.

The *Culinary Art* project was inspired by the rituals of eating and cooking. The project was 1998 collaboration between Philips Design and Philips Domestic Appliances (DAP). The team envisioned scenarios of the near future, focusing on preparation, eating and serving food. *The Interactive Tablecloth* concept / prototype (figure 73) provided inductive, cable free power supply for appliances such as lamps, or to maintain the temperature of food served in special plates.

Figure 73. *Interactive Tablecloth,* Culinary Art project. Philips Design, 1998. Image retrieved on 4 May 2006 from http://www.design.philips.com/about/design/section-13616/index.html. Image published with permission from Philips Design.

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[3] Pangaro, Gian. *The actuated workbench: 2D actuation in tabletop tangible interfaces.* Thesis (S.M), MIT School of Architecture and Planning, Program in Media Arts and Sciences, 2003.

[4] Quote retrieved http://www.equator.ac.uk/Projects/DomesticEnv/weightfurniture.htm

Imagined: *The Meaning of Life, American Beauty, Brazil, Kitchen Stories*

Although imagined scenarios like movies may seem peripheral to the core body of related examples, these examples inspire discussion on social dynamics, obsessive attachments to furniture, power dynamics at work, and user observations. Moreover, designers are in practice in which they first 'imagine' objects before producing them.

Scenes in movies address family get-togethers and conversations at tables, and all the awkwardness that comes when one either does not have much to say or wants to say more than the others want to hear. An alternative to the experience of an uncomfortable dinner silence is suggested in the scene *Mr. Hendy takes a conversation card*[5] (figure 74) from the movie **The Meaning of Life**. Here, Mr. and Mrs. Handy choose what to talk about from a menu with conversation topics that even includes a "special of the evening", a conversation about minorities.

Figure 74. Terry Gilliam and Terry Jones, *The Meaning of Life,* 1983.
The restaurant scene *Mr. Hendy takes a conversation card.*

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[5] Excerpt from **Mr. Hendy takes a conversation card**

WAITER:	Good evening! Uhh, would you care for something to... talk about?
MR. HENDY:	Oh, that would be wonderful.
WAITER:	Our special tonight is minorities!
MR. HENDY:	Ohh, that sounds real interesting.
MRS. HENDY:	Um, what's this conversation here?
WAITER:	Uh, that's, uh, 'football'. There you can talk about the Steelers-Bears game this Saturday, or you could, uh, reminisce about really great World Series.
MRS. HENDY:	No, no, no, no.
MR. HENDY:	What is this one here?
WAITER:	Uhh, that's 'philosophy'.
MRS. HENDY:	Is that a sport?
WAITER:	Aah, no, it's more of an attempt to, uh, construct a viable hypothesis to, uh, explain the meaning of life. (cont.)

The *dinner scene* from the movie **American Beauty** also takes place at the dining table (figure 75 left). The scene is a sad example of interactions in a dysfunctional family at moments when the family comes together.

Figure 75. Sam Mendez, *American Beauty*, 1999. Left: *The dinner scene.*
Right: *The sofa scene* with Lester and Carolyn. Notice the bottle that Lester holds in
his right hand; the spilled beer 'danger' becomes the source of argument.

The sofa scene from the same movie illustrates obsessive attachments that some people develop for their material possessions (figure 75 right). Lester (Kevin Spacey), the main character of the movie, tries to revive his marriage with his estranged wife Carolyn (Annette Bening). Unfortunately, his attempt to seduce her takes place on the expensive Italian sofa in the living room. This sofa is precious for Carolyn, and she launches into a neurotic recollection of memories (lengthy search, anticipation and maintenance) about this piece of furniture thereby thwarting Lester's advances.

The movie **Brazil** by Terry Gilliam (1985) contains a pivotal scene involing a table. At his first day at work Sam Lowry, the main character of the movie, moves into his new office. He soon
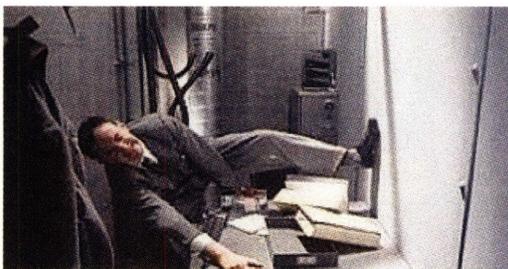
discovers that he shares the other half of his table with the person in the next-door office. Sam and his colleague start an angry tug of war, pulling the table back and forth (figure 76). This scene is symbolic of territoriality behavior present in office spaces and negotiations of power dynamics at work.

Figure 76. Terry Gilliam, *Brazil*, 1985. Sam Lowry's first day at the office.

The movie **Kitchen Stories** is a bitter-sweet comedy that pokes fun at the ins and outs of user observations. The story follows Folke, one of many Swedish scientists (figure 77). The scientists are headed to rural Norway to study the daily kitchen behaviours of single, elderly Norwegian males. Equipped with observational chairs with long legs, and logbooks for their observations, a caravan of small living trailers driven by Folke and his colleagues travel to rural Norway (figure 77 center). Folke parks his trailer in front of the home of his subject Isak. He sets on the difficult task of observing Isak without befriending him and jeopardizing the results of the study (figure 77 right).

Figure 77. *Kitchen Stories (Salmer fra kjøkkenet),* Bent Hamer (director), 2003. In the image on the right, Folke, the user study scientist, sits at his high chair 'observing' his subject Isak.

Etiquette and politics

The successor of Josef Stalin was **Nikita Kruschev** (figure 78), a politician well known for his unpolished manners. During the *Kitchen Debate*[6] at the UN Assembly in New York on 29 September 1960, a comment from the delegate from the Philippines enraged the USSR president. Kruschev yelled: "We shall destroy you from within!" and started banging his shoe on the table. A UK delegate asked that both Kruschev's comment and his shoe-banging be translated. By beating his shoe on the table Kruschev asserted dominance of the Soviet Union and belittled the value of diplomacy.

Figure 78. Kruschev with his shoe at the table. UN Assembly in New York on 29 September 1960. ©The New York Times Photo Archives. Image printed with permission from New York Times.

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[6] Excerpts from this debate are available at http://www.mp3.com/albums/345618/summary.html. Retrieved in October 2004.

A2

LOAD CELL CIRCUITS, FURNITURE EXPLORATIONS

This appendix includes drawings of the circuits used to process the signals from the stealing table load cells. Three additional projects are included in this appendix. These projects point to uses of light in furniture, treatment of tabletops and ideas about composite materials.

Circuit designed by Simon Schiessl, 16 May 2005.
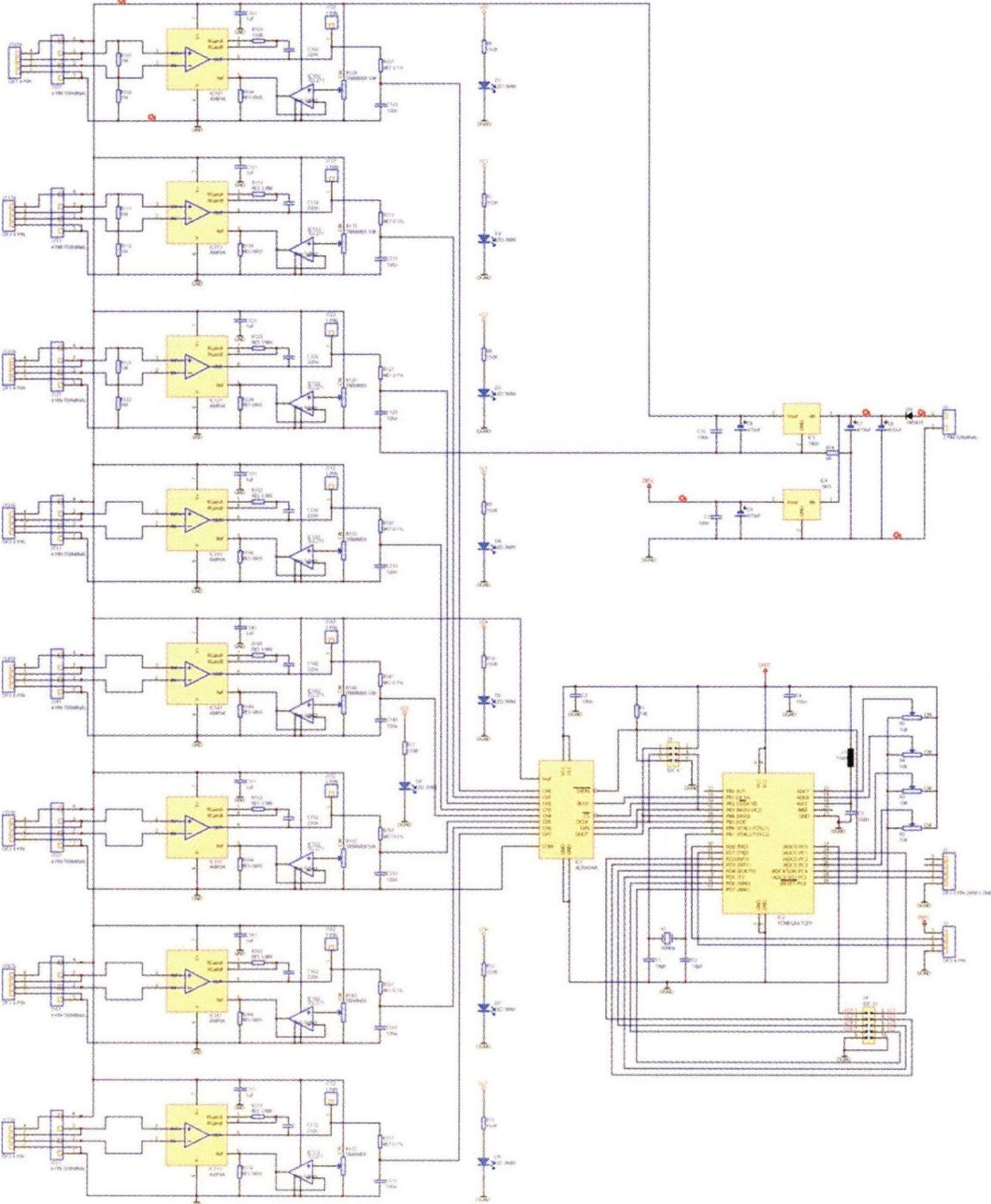
Figure 79. Circuit diagram of load cell amplifiers.

APPENDIX 2.2   ADDITIONAL FURNITURE EXPLORATIONS

CARDBOARD STOOLS

Project description

The *cardboard stools* were an unpremeditated bi-product. Their making was stimulated by the many pieces left-over from cutting cardboard for the tables. They were constructed by placing 12" cardboard rings one on top of the other, using a 1" plexiglas tube as a stacking rod (figure 80). A small, battery-operated circuit with one ultra-bright red LED was placed inside the plexiglas tube.

The stools were imagined to be used in places such as clubs or restaurants at night. The 'light dots' (diodes embedded into the stools) could inform if any seats are available, or if one's favourite area of the club is busy.
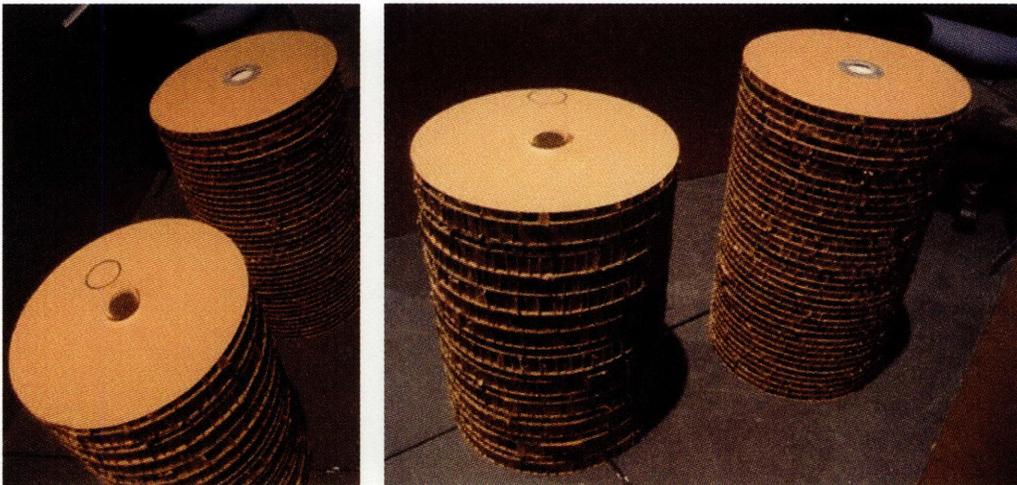
Figure 80. Cardboard stools with Plexiglas stacking rods.

Materials
- ½" and 1" honeycomb cardboard; the cardboard rings are cut on a laser cutter
- 1-1/4" plexiglas tube, used as a stacking rod
- ½" aluminium rings cut on a water-jet cutter
- vellum as diffuser

The electronics consist of:
- small circuit with switch and 2 AA batteries and 1 ultra bright red LED

CHERRY BOWL TABLE

Project description

This project further explores the (seemingly neutral) tabletop surfaces and placing objects on tables.

The initial idea was to use silicon as a flexible top surface on which one can even serve food; the surface would 'assume' the shape of the served food. Subsequent sketching (figure 81) went into direction of table surfaces that were carved, cut out, or added (i.e. as containers or small gardens for herbs or flowers, etc.) The final decision was to merge a wooden bowl with the surface of the table.
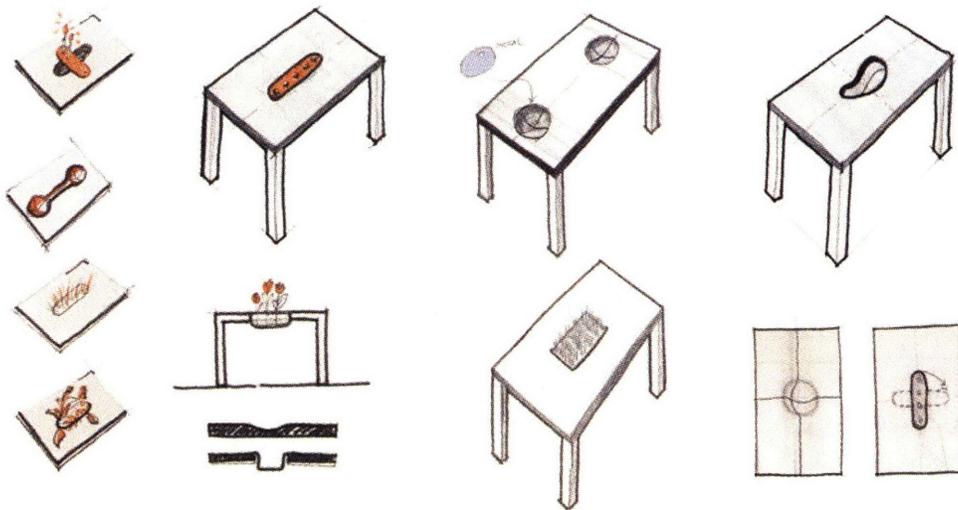
Figure 81. Early sketches of tables with carved and cut-out surfaces, and containers used for variety of purposes (herb gardens, vessels for flower, candles etc.)

A colleague who saw the photos of the carved surface remembered 18th century tables from German villages. These tables had carved-out places for food, possibly because people were poor and didn't own dishes. The carving of the tabletops did not seem intentional and may have been result of eating food directly from the table.

The table is built from cherry wood, 1" and 2" boards. The bowl in the center of the table was carved out from the centrally placed 2" board. The tabletop surface was screwed onto the bed

of the computer numerically controlled (CNC) router, where bowl was roughly carved out. The bowl was finished using a hand sander. The cherry wood was finished with a coat of linseed oil and two coats of non-glossy polyurethane.
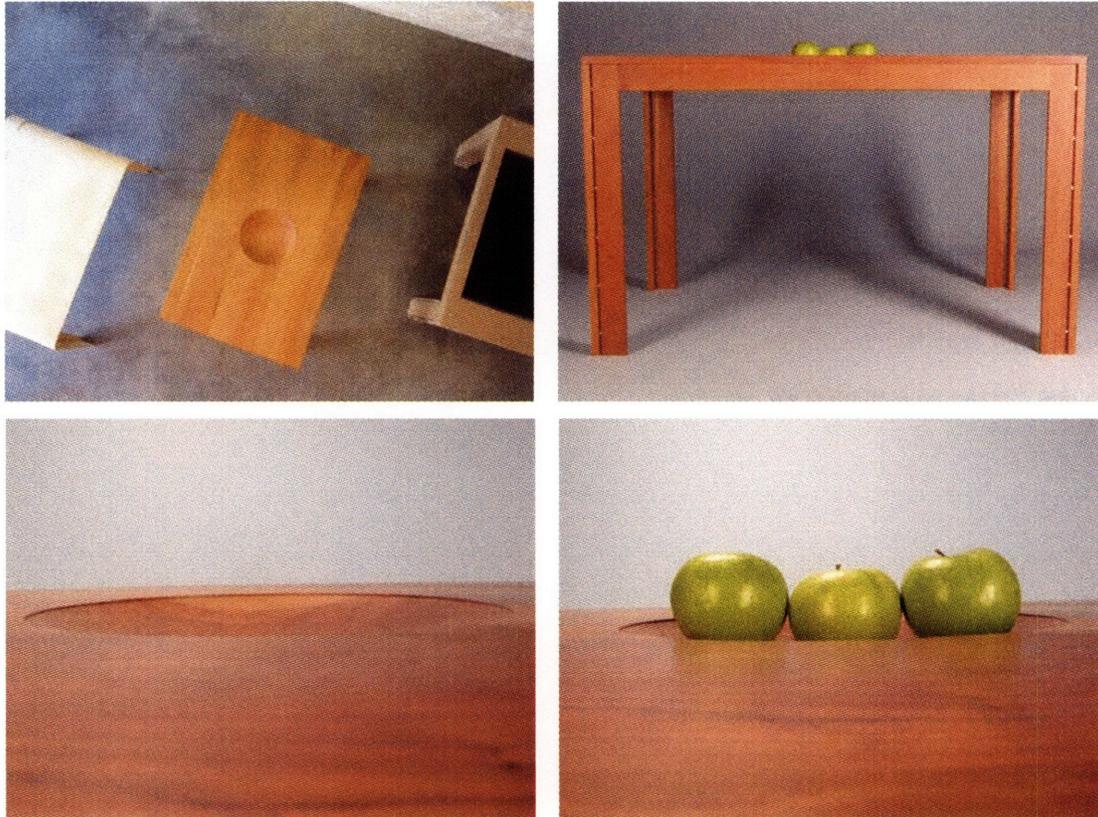
Figure 82. *Cherry Bowl Table.* Photos by Lira Nikolovska (top left) and Kate Kunath, December 2005.

The size of the table is H 29", W 31", L 48".

Materials

- *1" and 2" cherry wood boards*
- *¼" aluminium pipes used in the legs*

PLY PLAY TABLE

Project description

This project was developed when thinking about a permanent and inexpensive version of the cardboard tables. The idea was to use a single piece of ply, cut it in four places, bend the middle part as a box for the electronics and the side parts as legs (figure 83).
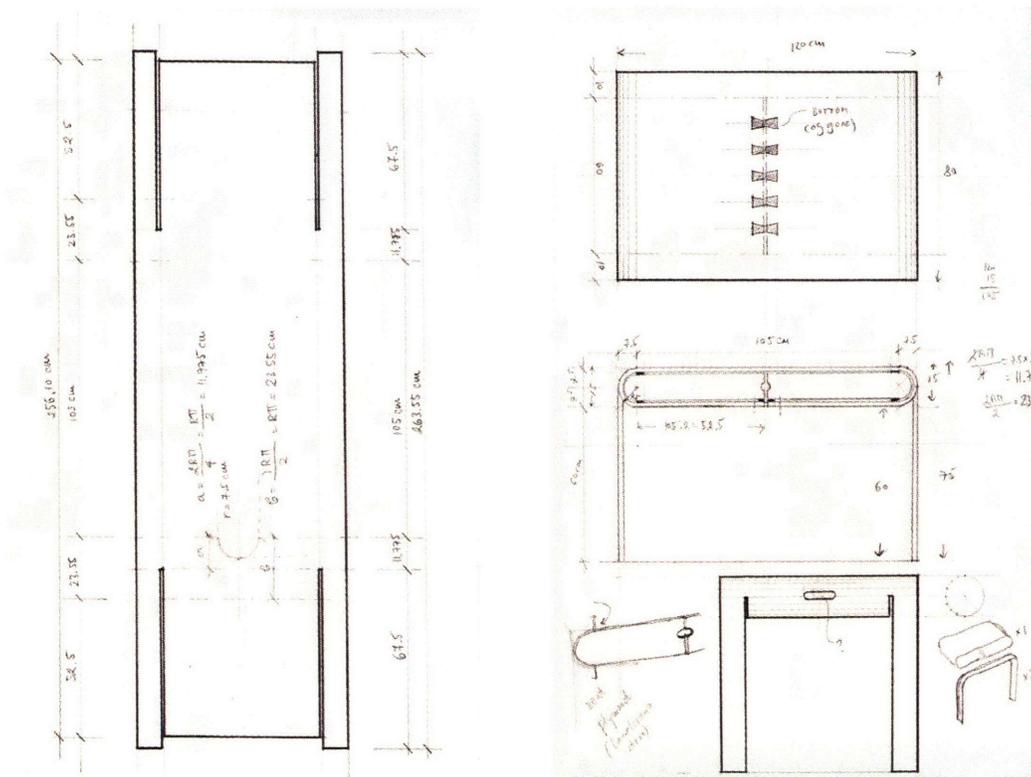
Figure 83. Sketches of the plywood table.

Large and expensive 8-foot pieces of ply can be found at marine lumber yards. Instead, this project used inexpensive Baltic birch plywood that comes in sheets of 150x150 cm (6' x 6') for $9 per piece. Instead of bending a single piece of plywood to make the table, it had to be assembled from six bent pieces. The moulds for bending 3 layers of 1/8" ply were made from 2" piece of foam. Vacuum press bag with compressor was used for the bending.

Figure 84. The making of the table: bending ply in vacuum press bag, individual table elements. April 2005.
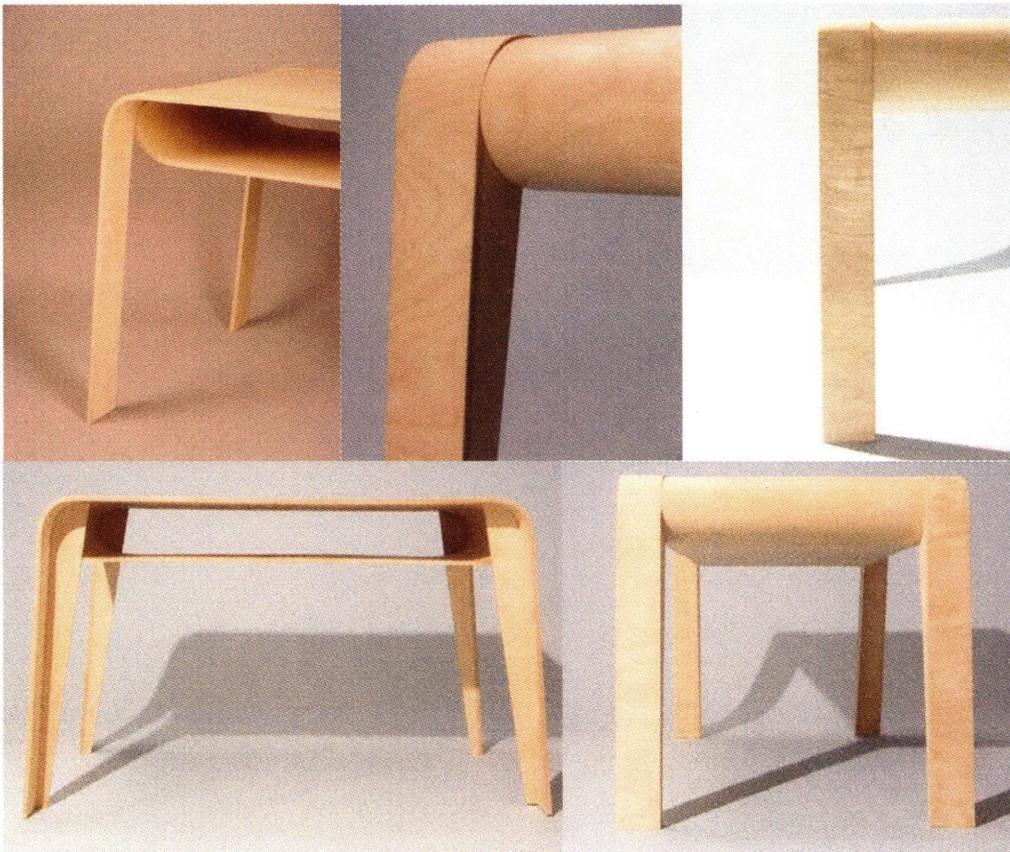
Figure 85. Elevations of the table and details of the leg joints. Photos by Kate Kunath, December 2005.

The inner radius of the table box was 6", which was complicated to bend given that the available technology was a vacuum press bag. Multiple tests showed that the setting time of regular wood adhesive was very short, and the plywood cracked during attempts to place it into the bag and seal it. Instead, plastic resin adhesive was used. The setting time of this adhesive was sufficient

for all the manoeuvring needed for placing the mould and plywood into the vacuum press bag. The cleaning of plastic resin adhesive after the pieces were glued was long and tedious. It was during that time that an idea emerged: the layers of plywood can be also covered with conductive threads and components. The individual layers would be insulated because wood is not a conductive material. Also, the surfaces of the plywood can be painted with conductive paints, providing connectivity possibilities for various applications.

The legs of the table, as they were, did not provide sufficient rigidity. One possibility was to use carbon fiber bandages (CFB) and strengthen the legs by either making new legs and layering CFB in-between the layers of ply, or adding CFB on the bottom side of the already made legs. Instead, 3/8" flat ply pieces were added at the joint between the leg and the box, to prevent axial movement and to stiffen the legs.

The size of the table is H 29", W 31", L 48".

Materials

- *6 x 1/8" sheets of Baltic birch plywood, 150 x 150 cm*
- *Plastic resin glue*

A3

USER STUDY MATERIALS

This appendix presents the overview of the user session protocols and ethical dilemmas given to the subjects for discussion. The final section of this appendix includes the transcripts from the user study interviews.

APPENDIX 3.1:   CONVERSATION TOPICS

The below instructions (text in italic) were read to the subjects during the user studies. The four conversation topics were then handed to the subjects.

TASK   **Ethical dilemma**
OBJECTS   plain table, conversation table
PROPS   conversation topics

I would like to ask you to please read these four topics. They are ethical dilemmas selected from "The Ethicist", a section from the Sunday NY Times.

Negotiate among yourselves to decide which one you will talk about. You can talk about more than one topic.

Talk about your opinions on the pros and cons of certain arguments presented in the topics.

Have you done anything like that? What would you do if it happened to you?

Come up with a list by collaborating with your colleague / friend. Please use the provided paper and pencil.

1 I was at the counter of an Amtrak cafe car when a man entered, saw the very long line and announced that he would pay $5 to whoever would buy him two beers. A woman in line just behind me started to accept when I told this man he should wait like the rest of us. He turned and walked out, either to the back of the line or to parts unknown. Was I right, or was his offer legitimate? Anonymous, New York

2 I am a paramedic. Many of my patients suffer from ailments that are not strictly medical: hysteria, hypochondria or simple loneliness. If I give them a few milliliters of salt water by mouth and tell them that it is a powerful medicine, their symptoms often resolve quickly, sparing society the expense of an ambulance ride and freeing me to tend to genuine emergencies. Is it ethical to fool my patients with this placebo? Anonymous, Oakland, Calif.

3 About two years ago, I purchased a car from a friend who did not know its value. When she offered it for what she had yet to pay off on her car loan, I agreed, knowing it was worth two or three times that. Soon I hope to sell the car, still worth more than I paid. My friend could use some extra cash. Should I send her any profit I make? Was I wrong to accept the low offer in the first place? Anonymous, San Francisco

4 For a while, the wireless Internet connection Christine and Randy Brodeur installed last year seemed perfect. They were able to sit in their sunny Los Angeles backyard working on their laptop computers. But they soon began noticing that their high-speed Internet

access had become as slow as rush-hour traffic on the 405 freeway. "We didn't know whether to blame it on the Santa Ana winds or what".

The "what" turned out to be neighbors who had tapped into their system. The additional online traffic nearly choked out the Brodeurs, who pay a $40 monthly fee for their Internet service, slowing their access until it was unusable.

Piggybacking, the usually unauthorized tapping into someone else's wireless Internet connection, is no longer the exclusive domain of pilfering computer geeks or shady hackers cruising for unguarded networks. Ordinarily upstanding people are tapping in. As they do, new sets of Internet behaviors are creeping into America's popular culture. "I don't think it's stealing," said Edwin Caroso, a 21-year-old student at Miami Dade College, echoing an often-heard sentiment. "I always find people out there who aren't protecting their connection, so I just feel free to go ahead and use it," Mr. Caroso said. He added that he tapped into a stranger's network mainly for Web surfing, keeping up with e-mail, text chatting with friends in foreign countries and doing homework.

As high-speed Internet service evolves from a luxury to an expectation, many cash-strapped students are beginning the school year looking for ways to acquire it at a reduced cost – or no cost at all. Students have also turned to building cantennas – antennas made of empty Pringles potato-chip cans or coffee cans – which allow them to pick up wireless network signals several blocks away that would otherwise be out of range.

Many who piggyback say the practice does not feel like theft because it does not seem to take anything away from anyone. One occasional piggybacker recently compared it to "reading the newspaper over someone's shoulder."

Have you ever piggybacked onto someone's wireless internet? Is that ethical or not?

APPENDIX 3.2: INTERVIEW TRANSCRIPTS
INTERVIEW TRANSCRIPT #1
THURSDAY 16 March 2006

TWO FRIENDS
FRIEND (A)   MIT undergrad, course 6 student, African American (female)
FRIEND (L)   MIT undergrad, course 1 student, Caucasian American (female)
INTERVIEWER (LN)

STEALING TABLE   TASK 1: Personal object
CONVERSATION TABLE   TASK 2: Ethical dilemma

INTERVIEW
1. Did you have any initial thoughts when you sat at the tables?

L   My thoughts were... what is the table going to do... (both laugh). Light here and movement over there.
A   I guess my thoughts were... what are we going to have to do actually...

2. What do you think the tasks were about?

L   Seems like there is some sort of observation... seems like the sensors, maybe... I don't know. I don't really know. But it seems like you were observing our speech somehow.
A   This one (points at the conversation table) is sending some kind of signal... depending on the side.
L   But it only does it sometimes.
A   How do you mean only sometimes? Maybe you weren't speaking loud enough? I don't know. (leans closer to the table) Hello... yeah. I just don't talk loud enough.

3. Do you think the objects in any way influenced your social interaction?

L   I think initially it threw me off a bit, but then I forgot about it. I was more interested in what I was talking about. (both laugh)
A   I thought it was really cool. I mean, when it first started, I thought, wow, why is this happening... why are there lights flashing on the table... then I figured out that they were going in the opposite direction, depending on the side where we were seated.

LN   How about the other table? (ref. to stealing table)

A   The other table? We didn't put anything on the table, but it seemed kind of, like it was randomly moving... And I had no idea what that was about.

4. Did the objects raise any emotions with you? If so, what kind of emotions?

L   (looks down at the conversation table) I felt pretty safe, I didn't feel scared or anything. (both laugh). Mostly I felt curiosity.
A   Yeah... curiosity. I thought it was cool. I thought: what is happening here? (tries to look below the table)
L   (laughs) She is course 6, so... (MIT Computer Science)
A   Right (both laugh)
L   I am in course 1 (MIT Civil Engineering)

5. What does this object remind you of? Does it remind you of anything or anyone, animate or inanimate?

L   The only thing I can think of is that this (points down to the table) seems to be sending signals to her as I am talking to her.

A   Why are there two? (direction gesture, back and forth motion of the lights)

L   Because we are talking at the same time.

A   I didn't realize there are two.

A   It doesn't remind me of any person. It sort of like... you know when you play a stereo and it sort of plays the signal. It reminds me of that.

LN   How would you compare the two tables? Can you compare them?

A   Well, I think this one (points to the conversation table) is a little bit more interesting... because I figured out what was going on. It sort of like one of those... when you play stereo or something... there is the little signal that goes up and down. It reminds me of that.

L   This one definitively has audio sensors. I wasn't sure if the other had audio sensors. I couldn't tell.

6. What did you think about the motion of the light / planks?

L   I like light better, I don't know why.

A   Depends on what one needs it to do. Maybe if you combine movement and have the lights tell you how you behave... that would be interesting.

7. How do you think tables like this can be used? Why would they be used?

L   I guess if you can't hear yourself, you can probably see this way. Because it seems to be measuring signal. That's one way of using it.

A   Or if somebody else was watching, they could see who is talking. They can see which way the lights go.

L   Yeah, if you are in a closed room.

A   You mean a closed room with a video camera (both laugh).

LN   How about the other one?

L   It kind of swallows objects... it takes them away.

A   I don't really see use for the other table, but maybe my imagination is not...

8. What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do? Why?

L   Like if I was designing one?

LN   Yeah, imagine you had no constraints, what would be your wish list?

L   I guess I would do stuff that moves. That would be cool.

A   I would have a video screen in the table. If you had a video camera somewhere else you could see what's happening and other parts of the building. And there are chairs that give massages...

9. Is there anything else you would like to add?
L+A   –

INTERVIEW TRANSCRIPT #2
THURSDAY 9 March 2006

TWO COLLEAGUES
COLLEAGUE (V)   employee of the MIT tax office, Macedonian, female, mid-40s
COLLEAGUE (J)   employee of the MIT tax office, Caucasian American, male, mid-40s
INTERVIEWER (L)

STEALING TABLE   TASK 1: Personal object
CONVERSATION TABLE   TASK 2: Ethical dilemma

INTERVIEW
1.   *Did you have any initial thoughts when you sat at the first table and then at the second table?*

J   I was just a little anxious. But I wasn't worried.

L   *Why were you anxious?*

J   I don't know. You got the camera, this is MIT thesis, so that's pretty important. I didn't want mess it up for you (laughs).

L   *No, you are not messing anything up. Please feel free to speak up your mind.*

J   OK.
V   Well, I went to the exhibition and knew some of the work. I didn't exactly know what to expect. But, for example, I knew what would happen eventually (points at the conversation table lights). But I have say that before coming over here, I was a little bit anxious just because we didn't know what to expect. And that anticipation was a little bit...

L   *It didn't hurt, right? (both V and J laugh)*

V   Not yet!

2.   *What do you think the tasks were about?*

V   I thought they were about method of communication, or one goal may have been communication. That came to my mind first. Interaction... maybe specifically at a table.
J   At a weird table. (both laugh)
V   A different one.
J   You were trying to see... whether we were paying attention to this (points at the table), or at each other, or to our objects. I don't know.

3.   *How do you think the furniture in any way influenced your social interaction? Diminished or supported it? What kind of social interactions? How did it influence it?*

V   I think they supported it in a way that we had something concrete to start to talk about. Maybe if you sat us down instead... OK, we can talk, it may have been a little bit difficult to find a topic, but we had something concrete to talk about. And as silly sometimes those conversations were maybe, or if they felt silly – we were talking about a wallet or a knife – they did support it

	because we had concrete objects to talk about. Or in this case (touches the conversation topics)...
J	Yeah. But we can talk about anything now. (both laugh)
V	Particularly me!
L	*How about the tables? How did the tables influence your social interaction? The first one (stealing table) and then this one (conversation table)?*

J	It was a little bit distracting (points to the stealing table). I wasn't sure it was supposed to be doing, or what it's for. It took my mind of what I was talking about a little bit. And at this one (points at the conversation table) you start looking at the dots.

L	*Were you trying to concentrate on the tasks?*

J	Yes, I was. But in same time I was trying to figure out why you have these dots on the table.
V	To me it was a little less distracting. It wasn't very distracting other then when I was trying to put one object at the table, almost to see what will happen. Because John was so curious what was happening. But it wasn't very distracting at all.

4. *Did the tables raise any emotions with you? Which/what kind of emotions?*

J	(rubs the top of the table) I like cardboard. I thought it was interesting that you made your tables out of cardboard. They have these braces so I don't think they are totally made out of cardboard. There is no metal inside this one? (touches the conversation table)

L	*This one is made from cardboard pieces held together by small metal angles.*

J	Yeah, that's really neat. That's what struck a cord with me, the actual table itself.

5. *How about the lights or the motion of the lights? What did you think of that?*

J	It was pretty different. I don't know... it would be hard to eat on a table like that (points at the stealing table), when the top moves and the stuff starts falling in. That may not be the best for eating. I am sure it's not a dinner table.
V	Maybe convenient for my daughter, she keeps on avoiding her food. (both laugh)

L	*How about you? Did the tables raise any emotions with you?*

V	For me, as far as emotions... I think I was excited to see that we are going to do something with the tables. Again, not knowing or debating what we are going to do. I was excited and curious how they function.

6. *Did the tables remind you of anything? Or anyone, animate or inanimate?*

J	This one (conversation table) reminds me of alien landing strip in New Mexico, you know, those people put those strips for the aliens to come and land. Other than that... and it was my father and grandfather used a lot of cardboard when they were building stuff. It is a very useful material. It sounds weird but it is.
V	To me, more than anything, these tables remind me of my husband because he makes lots of projects with his hands. He is actually planning to build a table. So anyway... Not necessarily because the material was cardboard but because it was project that you did. You made it with your own hands and it feels great to be able to sit at it.

L	*You mentioned cardboard as material. What do you think about using alternative materials? Or alternative interactions?*
J	Humm...
V	Maybe playing a game. A game where you can talk. Well I guess at any game you can talk.
J	I guess you can make this out of lot of different things. Plastic or wood or metal. I guess you could make a game out of the planks turning, too, guessing which one will turn. Or you can do something with these dots, I am just not sure what.

7.	**This leads me to my next question. How do you think these tables can be used? Why would they be used?**
J	If you were deaf... If someone was deaf, they could tell who is talking by seeing the lights, in addition to focusing on the lips.
V	I am not sure now, it may be almost like cheating, but some of the games in large auditorium have multiple tables and... well, it's easy to hear each other even without, but with a microphone inside, a lot of people that are playing, could be able to communicate with each better. That's for this table (conversation). For the other table (stealing)... I don't know.

8.	**What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do and why?**
V	If somebody can build a table that self cleans itself after dinner (both laugh), collects the dishes... like a robot going on the top. You said no constraints, right?
J	I would like my chair to be heated. I would like lumbar support automatically, also to support me with wireless access to the Internet, so you can, sort of, maybe put your keyboard on your arm rest and you could surf or do stuff just from there. Of course you will have to have a monitor somewhere...
V	Maybe it can pop-up. (gestures, something popping up from the surface of the table)
J	Yeah, that's a good idea. Or it can just be in sort of space, I am sure you guys are working on that, too. Holographic video, where there is no actual monitor and you still have the three dimensions.
V	Just another, kind of a silly thought, again I am thinking more of a dining table. Having a small child, maybe a table where all the chairs are at a same height, but a table where parts of the top can drop down or go up, depending on the height of the person.
L	*How about embedding technology in furniture, but doing something for a person that you don't like?*
V+J	(both laugh)
J	So, like having a strap, to strap them down? (laughs) To keep them down?
V	Or maybe you want to keep them out (laughs)
J	Ejections...
V	Tickle them.
J	Just have that table there (stealing table), every time they try to eat something, have a plank open and the food goes down. That would be nice. I usually don't spend much time with people I don't like.
V	Or a chair that folds around the person, and eats you (laughs). Temporarily, not really. And then spits you up (laughs)
J	Recycles you into cardboard. Like that "feed me" plant, I can't remember what it is called. Or something to shock you.
V	Or something to embarrass you. A chair that opens...
J	Yeah, a "whoopy" cushion. A built-in "whoopy" cushion.
V	"Whoopy" cushion? What is it?

J	It makes a noise.
V	Aah... OK, I see.
J	It makes an embarrassing noise. (both laugh)

9. *Is there anything else you would like to add?*

V   As I told you earlier, I audited the COUHES last year. And it was interesting to participate in one COUHES study. And it was an interesting experience. Next time we won't be nervous. This was fun. (both laugh)

INTERVIEW TRANSCRIPT #3
THURSDAY 9 March 2006

TWO ACQUAINTANCES
ACQUAINTANCE (R)   MIT Alumna, architect, female, Lebanon, 29
ACQUAINTANCE (D)   MIT visitor, pianist, female, USA, 40
INTERVIEWER (L)

CONVERSATION TABLE   TASK 1: Ethical dilemma
STEALING TABLE   TASK 2: Personal object

INTERVIEW

1.   *Did you have any initial thoughts when you sat at the tables?*

R   At the first (conversation) table, I was wondering if there were microphones and if the lights were catching our voices, trying, you know, to simulate something. But I couldn't figure it out because it was off when we started and then at some point the lights started moving. I thought something will happen as we started talking. It didn't so I thought maybe it's not related to the voice. And for this one (stealing table), I was like, wow, what is this one going to do. I initially thought it's going to glow or something. But it didn't. I wasn't expecting it to be like this.

D   I was wondering what will happen after we sat down. I don't know.

2.   *What do you think the tasks were about?*

R   This one was distracting to me. I was like "wow!" what is going on and why. I don't know. I can't figure out what the tasks meant and why the table did what it did.

D   It made me a bit nervous. When we started passing our stuff at first, and I saw the planks moving, I didn't want to put anything on it.

R   Yeah, maybe it can catch my hand. (both laugh)

D   And I took your wallet carefully and put it over there (points at the edge of the stealing table)

R   Yes, true, exactly. This thing (touches the black surface of the stealing table) creates distance, the other one connects more, I think.

3.   *How do you think the furniture influenced your social interaction? Diminished or amplified it? What kind of social interactions?*

R   Well, I think the first is the question of expectation. I was expecting something when I sat at the first table and I was prepared for something. And this (points at the stealing table), I wasn't prepared. You know, I didn't know what I was going to do here. And it was a distracting object.

D   It is a distraction from the communication in a certain way, because you want to see underneath the edges of the planks and what's inside the table.

L   *What if the planks were more seamless made of the same material as the rest of the table, and, in a way, not so noticeable?*

D   I think this is a kind of thing that I would leave in a house and watch somebody walk in and for certain practical joke I would think what is going to happen when they ... you know. Unlike the other (conversation) table, this choice of surface looks a bit artificial.

R   Right. I mean, we know we are here for an experiment, right? But I think if it was wood, polished, and if we didn't see those things (points to the ball bearings), you know, the mechanical

parts, it will make a big difference. I wouldn't even doubt that there is something interactive or of there is some intelligence embedded in this. I would think it is, you know, just a design.

D   This (stealing table) almost seems like a game, because the way the top parts are moving.

R   It's a rebel table, doesn't want anything on it! But… are w allowed to ask questions?

L   Yes.

R   Are these objects intended to help social interaction or …?

L   *That is what I am trying to find out.*

D   I have a question for you. We were mentioning how, with this (stealing) table in particular, there is a distance. Do you have any settings where people are walking around the table, instead of sitting down? Because this is a different kind connection to the table than it would be if you were standing and there is some movement.

L   *So far this is the experiment that is done, with two people sitting at the table.*

4.   *Did the table or the bench raise any emotions with you? Which/what kind of emotions?*

D   Supposed if we couldn't get anything out of it, it would be frustrating. (both laugh)

R   No emotions really.

5.   *What does this object remind you of? Does it remind you of anything or anyone, animate or inanimate?*

D   It reminds me of water, the way it is now (stealing table). The fact that it is shiny and there are some waves, almost, the way it looks. And water can take the object and make it disappear. It looks fluid to me.

L   *What did the other table (conversation) remind you of?*

R   I don't know really. For some reason, when we were talking at the other table (conversation table), it felt more formal. I don't know why. I think this one is a better ice-breaker (stealing table), it is more informal.

D   Yeah…

R   The other one is more formal. Because I could see… that microphone, and then the light, and as if you were at a meeting table, and this light thing is supposed to say something… and the microphone… I mean, the microphone actually made it suddenly be very formal. I think this is one of the reasons why I wasn't very comfortable at the first table (conversation).

D   The other thing was that there were topics…

R   Yeah…

D   It was more structured.

R   Yes. But even with the light and the microphone, I think of those political meetings and tables. I thought of a table with deputies, I don't know, and then the microphone, and the light like "beep" (touches imaginary button on the table), I am on, I am the one who is talking… You know, there is something there to say to the other. And this (stealing table), when we sat, I was, uuhh, this is more amusing. It is something more playful, something more… it made me think of those tables with handles…

D   Yeah. right, the soccer… the football tables!

R   And it was good that you gave us several conversation topics and that we could agree on one. You know, because if you gave us one, we may have not be inspired with it.

6. *How do you think this object can be used? Why would it be used?*

D   I think the play element of it would be fun for children... I don't know why this came to me, maybe because of the conversation topics about the paramedics. But, if you had a waiting room where children were going for some terrible procedure or tests, they could play with these kinds of tables. It would be fun and they would be distracted while getting ready to do the tests or some medical procedure. Kids would have fun with this.

R   Yeah, definitively. But maybe, if you want to think of something really functional, if we say that this is a kitchen table and you have things on it, and let's say you are done with your plate. You know, you don't want to move the plate to the sink ... the top opens and everything just drops, and then the table is clean. (both laugh)

D   I was even think this can be transferred to a chair. The person comes to sit and all of a sudden, there is no bottom. (both laugh)

7. *What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do? Why?*

R   What about all these chairs for impaired people, that would be great. I took a course when I was student here at Harvard, on product design. And there was this professor at Harvard who was working on a chair, actually a bed that carries stroke patients. It was very interesting because, you know, they studied that stroke patient, the life of stroke patient, depends on time. Sometime a second counts. In some cases if the stroke is not quickly identified and treated, in 3 minutes you can die. And so, they were working on designing this bed with which you are bringing a stroke patient. You put him or her on this bed and then this bed is almost like a mini surgery room. It has everything that you need and at the same time it rolls. So while rolling the patient to go to the surgery room, which, I don't know, it maybe takes 2 minutes to take him from the ambulance to the surgery room, in these 2 minutes you can test if it is a stroke, what is happening, whatever they need to know before the start of the surgery. So by the time he is at the surgery room, he is ready for the surgery. So it was amazing, I thought, to save peoples lives when working with embedded technology in furniture. And I am always impressed with all the chairs and devices made for impaired people, making things that adapt to their body. Besides that, I think, to be honest, that is my perception, to embed technology to make you a more passive human being; I think it's not good. To make a chair that ... and everything comes to you because the chair talks or moves... I wouldn't be interested in those applications.

L   *What would be an area in which you think you would like to be passive? Or lazy?*

R   Oh no, no. I don't even want this thing to be honest (points at stealing table).

D   One thing, a little thing, I think would make a meal better. So often in cold climates as soon as you put the food on the table, it's cold. For you to enjoy it you need to eat it rapidly. Sometimes maybe the table can heat the food. Or something that simple...

R   Yeah, things like that are fine.

D   It wouldn't make me passive but I can enjoy my meal.

R   No, sure. Or the chairs of some cars can heat. Yeah, that's fine. But there is nothing very new or innovative. There are the massage chairs...

8. *Is there anything else you would like to add?*

R   I wish we could be more helpful.

D   I think something which would be interesting, again, getting back to children, because adults would react to these differently. If you would be able to test the tables with children to see how they react. I have a feeling that they are much more imaginative, I have a feeling they would give

you much more feedback about the tables. Whereas adults are more nervous how they are seen, there is a camera there in the corner. I don't know if that is...

R   Yeah, I think you are right. That is a good idea. If you are trying to relate applications to children, there would be interesting things to come out. Maybe children tend to... maybe if there is a cloth in the table or something, or the danger of something falling off the table.

D   They probably would have many amazing ideas about putting technology in furniture because they would come up with this really way out, out of this world kinds of things, which some of us adults wouldn't think of or would think it's impossible. It's true. Kids always have the most fantastic ideas.

INTERVIEW TRANSCRIPT #4
THURSDAY 16 March 2006

WIFE AND HUSBAND
WIFE (J)   Attorney, Asian-American, early 30s
HUSBAND (B)   MIT SLOAN student, Caucasian American, early 30s
INTERVIEWER (L)

PLAIN TABLE   TASK 1: Personal object
CONVERSATION TABLE   TASK 2: Ethical dilemma

INTERVIEW

1.   *Did you have any initial thoughts when you sat at the table?*

J   I thought the table was interesting. I was trying to think what I was going to say about the stuff that I had in front of me.
B   I noticed that the table was from cardboard... and I thought that was neat actually that it is so sturdy... because it was made from cardboard. And then I noticed that it had the metal bolts.

2.   *What do you think the tasks were about?*

J   I don't know... Uhmm... The first task was to describe our objects to one another.
B   I think it was to see how we interacted at this distance, to see how we relate to each other...
J   The second task was more about ethical issues, our opinions and how we would react in these situations and to one another.
B   I think in the second task we were supposed to talk for a while, and then you turned on the light, and you were supposed to see... to see, when the lights were turned on, if that changed the way we talked to one another. Were the lights always red, or were they white?

L   *They are red.*

B   When you first turned the table on they flashed white.

3.   *Did you experience that you could influence the table in any way?*

J   Well, I thought so at first when we talked, as it went that way (points to the other end of the table), but then it didn't do anything, so ...
B   It did it sometimes (back and forth gesture with his hands). And sometimes when we both talked at same time you could see the lights crossing.

        (they both start talking at the same time to see how the lights behave when they both talk)

B   I think there is delay in it. It seems to work every other second.

4.   *How do you think the objects influenced your social interaction?*

J   When we had the objects, we leaned in, we talked closer to each other. Without them we had a lot more space.
B   And we would focus on the objects. We would look at them and point at them.
J   And for the second task, I don't think the lights had any effect on me.
B   Yeah... I noticed them. It didn't really change what we were talking about.

5. *Did the objects raise any emotions with you? If so, what kind of emotions?*

J   Maybe in the one about the paramedics, the ethical... It's not that I am really, truly passionate about it... sometimes we don't agree on things.

B   I don't think the topics raise any emotions with me.

L   *How about the table? Did the table raise any emotions with you?*

J   I thought it was kind of cool. I kind of like the material (knocks on the table).

B   We could build all our furniture from cardboard.

J   It's pretty nice.

6. *What do these tables remind you of? Do they remind you of anything or anyone, animate or inanimate?*

J   This one kind of reminded me of a robot. It's space-age-y.

B   I don't think it reminds me of anything. It reminds me of a table (laughs). I mean, it kind of reminds me of a wooden table... because of the colour. But nothing else.

7. *What did you think about the motion of the light?*

J   It was kind of interesting at first. Then I figured how to get it to work, so...

B   Yeah, I figured it out pretty fast. Once I figured it out, it wasn't that interesting.

8. *How do you think tables like this can be used? Why would they be used?*

B   I think they could be used for hearing impaired people. They can see the lights and see who was talking.

J   Yeah... that's a good suggestion. I don't know.

B   Or just the lights going on. You know... as a decoration.

9. *What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do? Why?*

B   TV with a remote control into the arm of the Lazy... the recliner chair. We always loose the remote controls, if they would be embedded that would be nice.

J   How about chairs that move, that walk... so you can stay lazy (laughs). They can help disabled people as well. They could kind of roll... Controlled with a remote control. If you are in it, or if you want it to come to you...

B   There was this great episode of Seinfeld where the guy got a recliner chair that had a refrigerator in the side... so he didn't actually have to get up for the whole day. That would be cool. I don't think I can afford a chair like that.

J   Or maybe a table that brought and cooked food, and you wouldn't need to clean up.

B   Yeah, and maybe had a refrigerator inside. Than you wouldn't need a refrigerator, you would just need this table.

J   Or a table that collapses... well there are tables like that.

B   She means table that can automatically fold down. They fold up pretty easily, manually.

10. *Is there anything else you would like to add?*

B+J   No, not really.

INTERVIEW TRANSCRIPT #5
THURSDAY 16 March 2006

WIFE AND HUSBAND

WIFE (R)	MIT PhD student, Caucasian American, early 30s
HUSBAND (A)	Studying for his GRE, born and raised in Mexico, mid 30s
INTERVIEWER (L)	

PLAIN TABLE	TASK 1: Ethical dilemma
STEALING TABLE	TASK 2: Personal object

INTERVIEW

1.   *Did you have any initial thoughts when you sat at the table?*

R   Not really, but then as we were talking, I realized it was a lot higher.

A   Well, I noticed this thingy… (touches the bag underneath the steal table, and both lean to look below). I didn't notice it immediately, but after a while.

R   I didn't really noticed the [first] table as much as I noticed the … I was looking at the questions. I kind of noticed it because it was sort of rough on my arms. I was leaning on the corner and I felt it on both my arms.

A   Well, I noticed that it was kind of a "special" table. For research or… I saw the little things that are moving (points at ball bearing holders), the little machines.

R   I thought that maybe when we were talking, these things (points at plexiglas planks of the conversation table) would turn and say things to us… Turn up and have phrases. Or say something psychological, like "don't believe anything he says". (both laugh)

2.   *What do you think the tasks were about?*

R   The first one, when we were just talking, or the second one?

L   *Both of them.*

R   I don't know… the first one was just a basic interaction, how people talk to each other, maybe their body language, and how they feel with their position in relation to the table. Or before and after… And how this thing (points at stealing table) changes the way they talk. What do you think?

A   I have no idea. What's the things about… some kind of distracter or something like that. (laughs)

R   The second task was … I don't know… maybe to see if people are willing to put down objects that were important to them vs. objects that weren't important to them. I think I put away all my objects after the first one disappeared (both laugh). I mean, I knew we will get them back, but the first time…

3.   *How do you think the objects influenced your social interaction?*

R   I think it was distracting because we were just talking about something and…

A   Or even emotive… emotional. About the things… the feelings you have for the things and for the other person.

R   Because we know all the objects, we knew where they came from.

A   Yes, and it kind of interrupted the interaction. It distracted.

R   We knew that something is going to happen with the table… so we were less focused on the conversation.

A   … in order to see what is happening.

4.   *You mentioned emotions. Did the objects raise any emotions with you? If so, what kind of emotions?*

A   Well, no. It interrupted our emotions. The emotional connection we were having was interrupted.
R   Like feeling tortured by the table. I guess it kind of felt somewhat menacing.

L   *I hope you didn't get injured.*

R   (laughs) No, no. It was kind of fun because I was wondering what it is going to do. Like when my thing fell down, I was wondering if we are supposed to try and get them, or leave them.

5.   *Did you experience that you could influence the table in any way?*

R   I guess I felt that... definitively the object placement was going to determine... Once I put his wallet over there, it made the things stick open. I thought, I am not putting my wallet there. I didn't want to try and open it up myself, maybe I break it.
A   It can chop your fingers (laughs).
R   Yeah. But I knew that if we put the laptop on there, it wouldn't be able to fall in.

L   *How about you (Aldo)?*

R   Could you influence it?
A   The table? Yes, for example, with the laptop, you kind of block the table. Maybe only small objects fall down. I put this and, I felt, I stopped the table.
R   I was debating at one point if I can go underneath and noticed the zipper. So I was thinking of going underneath to get my things out.

6.   *What does this table remind you of? Does it remind you of anything or anyone, animate or inanimate?*

R   Something animate?

L   *Animate or inanimate, anything.*

A   Or distracting?

L   *Does it remind you of another person, or flower...*

R   It is kind of Dart Vader-ish because it's black. (both laugh) I don't know.
A   It does remind me of... maybe the television. Because it distracts me a lot when it's on. But nothing animate.

7.   *What did you think about the motion of the light? Used materials?*

R   I guess I don't like the materials here (touches the cardboard).
A   The cardboard? How can you not like it? It's cheap material. Can be very low cost table. No? I used to work in the cardboard and paper industry, so I really like it. This is very good cardboard, structural.
L   *How about the motion of the planks?*
R   It was pretty smooth. I was wondering where... Because when it first opened, you were somewhere else and I was wondering if you opened and controlled it remotely, and decided

which ones to open. I pretty much identified that it opens up and swallows things laid on top of it.

8.   *How do you think tables like this can be used? Why would they be used?*

A   Maybe for a game or something like that.
R   Some kind of game or educational tool. Maybe text. When it swallows things, it could rotate and tell you something, conveys a message or… Either about the object itself or the person with whom you are talking to. What else?
A   For a meeting, for example, you put something on the table and you have a projector inside the table. You would use table normally for a meeting, like a table. But for meetings you… (whistles and gestures wide opening his arms).
R   I guess it can have mirrors on the top. That would project something from above.
A   Wow. That is nice idea. A mirror that has an image of the presentation on the table.

9.   *What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do? Why?*

R   I would make chairs more comfortable.
A   Intelligent chairs!
R   Maybe chairs that can sense your pasture… ergonomic chairs.
A   It depends on… if the chair feels that you are very tense.
R   Or it feels that your posture is bad. It feels that you are in wrong position for long time.
A   If you really have…
R   Senses tension and goes and does a little massage. Or like… for me when I was writing my PhD, if you would have a chair that was able to sense… lot of the technology at your computer tells you when to stretch or do your exercises so you don't get carpal tonal syndrome. Like a chair that is able to adjust its position and moves to support you in certain ways, or lead you into better pasture. Or noticed that you have your arms on your desk and that your typing is bad… Maybe put heat and things like that.
A   Maybe a bed or something.
R   With a shock treatment (both laugh)

L   *Can you please explain?*

R   Like a shock treatment to wake us up in the morning. Somehow to wake you up in a more…
A   Stands up (whistles). Like the bed in Wallace and Grommet, yeah.
R   That can kind of wake you up…
A   Shake you up, like an earthquake.
R   Or, have integrated in the bed stand natural light, so it can start putting more natural light on you to wake you up more naturally. Or with music, start putting the music up and be able to sense if you are waking or not. Maybe use a more insistent method and have an artificial intelligence to be able to learn what strategies work with you and not, and after a while it would realize that no longer wakes you up with music because you got used to music. And then it starts to use different strategies. That would be a nice bed. (both laugh)

10.   *Is there anything else you would like to add?*
R   I don't think so.
A   It was great experience.
R   It was fun. I guess I felt more confused about trying to second guess what the experiment was about and what I was supposed to be doing and not doing. And in the second part I was thinking if I should try to get my stuff back. (both laugh)

INTERVIEW TRANSCRIPT #6
THURSDAY 23 March 2006

MOTHER AND DAUGHTER

MOTHER (M)	MIT Alumna, Physicist, French
DAUGHTER (D)	MIT Freshman, French, raised in France and USA
INTERVIEWER (L)	

BENCH	TASK: Personal object (mother wallet, daughter watch)
CONVERSATION TABLE	TASK: Ethical dilemma

INTERVIEW

I.   Did you have any initial thoughts when you sat at the table / bench?

D   This was funny! (points at the conversation table). We were talking and this was like, wow.

M   Yeah, this was definitively... You know I didn't even question it when we sat (points at the conversation table), but then I noticed that was...

L   How about the bench, did you have any thoughts when you sat at the bench?

D   No.

M   (shakes head) I mean I noticed that it was lit, part of it...

D   And like why was it ...

M   Well, before sitting at it, I don't know if you heard me... I said this looks like a trunk of a tree completely cut, it is obvious it's a piece of a trunk. But then I noticed there was light in the junction, but other than that, nothing.

D   I didn't think it was light, it was something faint.

L   Do you think that the materials had anything to do with how you experienced the objects?

M   Yeah, I love solid stuff. And I noticed that that's metal and wood...

D   I like this one (taps the conversation table)

M   For the bench, I thought when I came in, yeah, that's original and good quality... And this one I am thinking, can you imagine, it's cardboard (starts shaking and moving the table), but it's still pretty solid.

2.   What do you think the tasks were about?

M   I have no idea.

D   I think seeing how different types of furniture assist conversation. You just gave us random conversation [topics]...

M   Or encourages...

D   Yeah, encourages different ways of people to sit facing each other, with stuff like this (taps inside the microphone area), how low or high the volume is.

3.   How do you think the furniture in any way influenced your social interaction? Diminished or amplified it? What kind of social interactions? How did it influence it?

D   This one definitively amplified it (smiles and taps inside the microphone area). We were, like, oh, let's make it light up.

M   Yeah, we wanted to talk so the lights go both ways. You noticed what she was saying: But I am talking and nothing is happening, right?

D   Yeah...

M   And then it becomes a competition.

L   *Can you please expand on that? I mean, what you mentioned about competition?*

M   One wants to talk more... not dominate, but have the lights go both ways.

D   Yeah, so the lights show (gestures with her hand, back and forth motion).

L   *I noticed an increase in the volume of the conversation.*

M+D   (both laugh)

M   She was saying, if I am sitting far...

D   Yeah, _it_ won't hear.

4.   *So what did you experience, I mean, how could you influence the object? The table and also the bench. Were there any patterns?*

M   Not with the bench. With the table, we talked more often. And we leaned forward so the table can pick up.

D   Mine was a bit slower. Maybe it was a little bit less sensitive.

M   Yeah, you know we are the kind that doesn't like to raise our voices, you know, you keep the low tone. So we had the tendency to go lower (leans toward the table and the microphone area)

5.   *Did the table or the bench raise any emotions with you? Which/what kind of emotions?*

M   I mean, I love these settings. I must say, we do that all the time. It is part of our daily life. To sit and talk, and especially at the table over food. So these are our favorite settings. Even when we are working.

D   The bench not so much, but this was nice (touches the table).

M   Nothing irritated me, it's the opposite, both settings are my cup of tea. For every day.

D   I prefer this one (touches the table)

L   *Why was that? Can you please explain?*

D   It was like, a more ... (shakes her had back and forth)... interactive thing.

L   *Did you keep on noticing it, once you discovered what it does?*

D   Yeah, I did. I didn't forget it's there. I noticed it, and it made it fun to talk. We just felt like talking more.

M   We tested it, and it became *the* topic of conversation. You know, just for a while... and then we ignored it, once we discovered how it works... Then I noticed that it is just going my way, just one way...

D   Cause I was leaning back.

M   So I told her, do you want to come forward so we can see how it works back and forth, so we can see who is dominating the conversation.

6.   *What does this object remind you of? Does it remind you of anything or anyone, animate or inanimate?*

D	This (points to the bench) reminds me of parks and sitting in parks in the summer, with other people. Having conversations, or ice cream or whatever.
M	(repeatedly raises her eye brows)
D	And this one (points at the table), not so much.

M	But the idea of a table... I just thought of something... oh yes, now I know. At the Media Lab, one student is doing a PhD on social interactions. She called on four people, you know, you didn't have to be affiliated with MIT... to sit, and she gave us things to discuss.

L	*[name] ?*

M	Yes! Do you know her? One of the things was... she was measuring our interaction according to our voices. You know, she had one colour for every person. And she wanted to know whether by watching how it is evolving (gestures in the air), we change our behaviour towards each other. Like, if wanted to be dominating the conversation. The result in my particular group was that, and explained that at a talk at IAP, and people were laughing about my comments on it... One of the participants was a MIT undergrad, extremely loud. She dominated every single thing. If I opened my mouth, she would say "Oh, c'mon!" like only her matters, right. So I decided that I couldn't care less what the people thought about the pattern of the voices was (gestures in the air), I was like, let me go through these 40 minutes... and let [name] have the results of her study, I mean what she needed to find out. I mean it didn't affect my behaviour at all. The other one was dominating, and I thought, let her have her 40 minutes. But that was in our group. In other groups she had different findings. That the older people dominated the conversation, that there was difference between Americans and non-Americans. That was also in our case, because I had someone in my group who was Italian. But that definitively reminded me of this.

D	It is the whole measuring of talking.
M	I think on one to one bases this is more effective than if it is a group setting. Group settings with people from different backgrounds, that's hard to tell. And in this student's work, it was about work meeting, this was much more casual.

7. *What did you think about the lights and the motion of the lights?*

M	I liked it a lot.
D	I think mine was not working as much.

8. *How do you think this object can be used? Why would it be used?*

M	You mean why, towards the purpose that we think?

L	*What purposes would you think of?*

D	In cafes, if you make tables specifically for two people, that would be nice.
M	Why?
D	It would encourage, I think, more talking because people will talk more to each other. Why are you smiling?
M	No, that is because ...
D	People would talk and get to know each other more. They will want to sit at this table. Just, people like bright colors in general (back and forth motions with her hands). Yeah, and it gives something to talk about... for a while.
M	But it doesn't have to be lights, the idea is have something...
D	... have something that gives you feedback based on how much you talk. Yeah, the idea of feedback definitively helps, people like getting feedback. It's kind of nice.

M   But don't *they* control exactly their participation?

D   Yeah, but just anything that gives you some motivation to talk and then you are getting something back.

M   Well it would be nice if it is a device that goes buzzing if you raise your voice. Like, they make you lower it. It could be used like that. That would teach people to talk not loudly, in a reserved way. It's for the volume of speech that is extremely loud. But if there would be something that would keep buzzing in an annoying way (they both laugh), until somebody, you know...

9.   *What do you think about embedding technologies in furniture? If you had absolutely no constraints, what would you do? Why?*

M   Anything? Including taping with camera...

D   No, that's illegal.

M   No, no, again it reminds me of all of these projects at the Media Lab where you wear the electronics stuff.

D   Do you know about TEAL (Technology Enabled Active Learning)? They teach with it at the Physics classes at MIT. Basically, the professor lectures for 15-20 minutes. And the students have laptops and in-class problems, and they vote on the answers and they appear on the screens. It is very interactive and some people dislike is because they are the kind that doesn't like to get involved in class. But if you like to get involved, it's kind of like this, just...

M   They sit up to five...

D   Yeah, up to five [people] at a round table and they talk to each other. They discuss on the table and then vote on the answer. And then on the board, the projection screen shows the percentages of votes. It's really interactive, it feels like you are a contestant on a game show, it's really nice.

M   And the embedded laptops are connected to five screens...

D   More than five, like nine, ten [screens]. You look anywhere and there is a screen, it's a circled shape.

M   Everybody sees the same thing. They see the vote; they see the physical phenomena...

D   It depends on the type of person you are. Some people hate it, some people like to come to class and sleep.

M   But when you asked us about furniture, did you mean in the private residence?

L   *Anywhere, whatever comes to mind.*

M   So the TEAL is one thing where they can use this setting. I thought that embedding in clothing is a genius idea. It's so good. Because I see the application, for example, in documenting things ... in a very tacit, non-obvious way. For example, I can see it documenting abuses in courtrooms, judges bypassing things...

L   *You mean for clothing or in furniture?*

M   I mean in clothing that's what I thought of an application. Now I need to think if it was in furniture, for example...

D   The furniture will belong to the court room so that doesn't help much. They are not going to be, like, excuse me while I bring my chair in... (both laugh)

M   No, but you can imaging for example that wherever you are sitting in the courtroom, there is something embedded that is recording independently from a clerk who is, for example, bribed...

D   But they will belong to whom, once it's embedded in a room and they will be able to broadcast it...

M   Yeah, but for example, they record all hearings in a court room, all hearings are public, but the one who is controlling that is one person... so if you bribe that person, she can take off from the record whatever they think can explosive for the case. The way that I am thinking about it is that

the recording would be generalized in the court room whereas no one person is controlling everything. Because recording will be embedded... in every piece.

10.   *Is there anything else you would like to add?*

D   More of these (laughs and points at the conversation table), they are good.
M   I think all that embedding of technology in stuff is the 21st century. Making it part of the daily living ...
D   Enhancing...
M   For example, one application that I have seen is documenting how people are profiled, for example, at the airport... I doesn't have to be at the airport, but profiling would be good.