

The Design and Study of a Reflective Object: Questions of Agency, Relationship, and Control

by

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Abstract

The division between subject and object, agent and non-agent, has consistently been dubious philosophically, with physical manifestations of automatons the exception rather than the rule. Now we are increasingly faced with computational objects and relational artifacts that put into question cherished notions of human agency and intentionality. I describe one such object, *syngva*, a creature that develops through evolutionary processes idiosyncratic movements in response to singing. *syngva* serves two parallel roles. For the user, *syngva* enables a form of non-linguistic reflection, serving as a catalyst for novel vocal behaviors provoked by the motions of the object. For myself, *syngva* acts as a sociological probe, allowing me to study *in-situ* relationship formation, agency, and control in response to an “intelligent” creature. I describe an evaluation approach that draws heavily from actor-network theory (ANT), a methodology that in part places objects on the same ontological level as human agents. This re-centering of agency intimates a different way of looking at the person-object dyad that focuses on the interactions themselves without reference to pre-existing theories.

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Setting the Stage: An Introduction

Philosophically, the division between subject and object has always been muddy. Yet it has only been recently that in our day-to-day lives, with the proliferation of computational objects and relational artifacts, that we personally witness situations that upset the seemingly clean distinctions between subject and object, agent and non-agent. The place of agency in the human is slowly being joined by a type of agency (or at least presumed agency) in the object itself. While newborns, toddlers, and children have always had a fungible boundary between what is alive and what is not (Piaget 1929), betwixt what can have its own thoughts and what cannot, adults are increasingly faced with similar questions as they interact with not only robotic creatures, but other objects infused with computational abilities as well. From the Aibo to Paro, ubicomp and situated technologies, a better understanding is needed of how we interact with objects with (presumed) overt agency. Questions arise as to the nature of our relationship with these new objects.

Where does this leave the psychoanalyst, the designer, or the anthropologist as each tries to make sense of these ontologically novel objects? How can each respond to the challenges posed by interactions with and development of relational artifacts? This thesis aims to offer some potential avenues to follow, suggesting ways in which a *perturbational design* approach can create situations of interest to all parties mentioned. The method is by definition interdisciplinary, and thus this proposal delves into a number of fields to describe complementary but separate approaches that will develop in parallel. From one perspective, I approach this as a psychological research question: how do people deal with these new things with “intelligence”? In what ways are their own behaviors influenced by the actions of another object? From the point of view of a designer, I ask: in what ways can I create an object with certain behaviors that influence a human to explore other manners of experience? How can I design the object such that I do not create another form of dependency on a non-human entity? From the anthropological viewpoint I question: in what ways can I observe or take note of a person’s actions in order to discover the influence of my designed probe or catalyst? What methodology is most appropriate for studying these new types of artifacts?

Later I will outline my development of *syngva*, a non-anthropomorphic and non-zoomorphic object designed for personal psychological reflection and used as a probe of how people deal with objects that possess presumed (or actual) agency.

A more thorough review of psychological relationships with objects will have to wait for the thesis document itself, but I want to raise some motivating references. From psychoanalysis comes object-relations theory¹, most notably from Freud’s “Mourning and Melancholia”. Here Freud describes how melancholics come to internalize the object of their loss as a way of dealing with it, “devouring” the object, swallowing the loss: “The ego wants to incorporate this object into itself and, in accordance with the oral or cannibalistic phase of libidinal development in which it is, it wants to do so by devouring it.” (Freud 1915, 250) Freud’s observation that an exterior object

¹Somewhat paradoxically, *object* in this case refers exclusively to a human rather than a non-human, non-animate thing. However, I want expand “object-relations” to encompass the more common definition of the word “object”.

becomes an internal representation, becomes a part of the person's self, forms one basis for thinking about our relationships with objects of importance.

In a complementary vein Winnicott examined those objects of an infant that are first recognized as being separate from the infant: the first “not-me” object. He describes these objects as *transitional objects* and the experiences as *transitional phenomena*, the “designation of the intermediate area of experience, between the thumb and the teddy bear”. (Winnicott 1971a, 2) Transitional objects in childhood enable cultural experience in adulthood: “The place where cultural experience is located is in the potential space between the individual and the environment (originally the object).” (Winnicott 1971b, 135)

This Winnicottian potential space can be experienced, in part, through the the creation of *uncanny* situations. For Freud the uncanny is “that species of the frightening that goes back to what was once well known and had long been familiar”. (Freud 1919, 124) But the uncanny is not always frightening: it can also represent a resemblance to something we know but can not entirely remember. This concept directly informs the visual design of *syngva*. Designing for the uncanny also suggests designing for the non-instrumental unmet *needs* of a person, rather than for culturally proscribed *wants* (Papanek 1985).

From the Past: Prior Work in Understanding and Creating Relationships with Objects

The study of personal interactions with computationally enhanced objects and artifacts is a path well-traveled. Important is Turkle's early work in *The Second Self* detailing the impact of early computational objects—programming languages, video games, and physical objects such as the PDA—on personal understanding of the self (Turkle 1984). In *Life on the Screen*, she extended this inquiry into the on-line world, showing how people, children and adults alike, question notions of aliveness, gender, and identity through virtual environments and artificial agents (Turkle 1995). More recently Turkle has explored *in-situ* studies of what she calls “relational artifacts”: robotic objects such as Paro and My Real Baby that raise troubling questions about love, projection and agency in both children and the elderly (Kidd, Taggart, and Turkle 2006; Turkle 2006). These sociological studies of human-made artifacts present results that suggest alternative design realities, but also express an evaluation methodology that does not focus on standard HCI practices such as the user study.

Obviously relevant is the work in sociable robotics, notably that of Breazeal (2002). As I detail below, although my goal is less the creation of behaviors that mimic or resemble infants or adults, the insights of Breazeal into a socially situated robotics informs my desire for *in-situ* experiences. As well, Dautenhahn and Billard (1999), following developmental psychological studies from Piaget and Vygotsky, suggest means for robotic learning that is situated in a social context.

While much academic and commercial robotic and agent work focuses on instrumental uses of the technologies, artistic practice does not follow the same disciplinary mores. A piece such as *Petite Mal* by Simon Penny (1997) directly confronts the

viewer's perceptions of agency and intention through the motions of a non-linear, dynamical system. Marc Böhlen's *Whistling Machines* suggests a non-logocentric, non-iconic means of interaction with an agent-based system (Böhlen and Rinker 2005). Max Dean's and Raffaello D'Andrea's *The Table: Childhood* engages the gallery visitor by having a common household item, the table, "select" one person for attention and tracking through movement of the table. Outside the realm of robotic art, but still considering notions of agency and relationships, is the Placebo Project of Anthony Dunne and Fiona Raby (2002), a consideration of our founded (but not always rational) experience with electromagnetic radiation. Recent projects of Kelly Dobson, including *Machine Therapy* and *Wearable Body Organs* (Dobson, Whitman, and Ellis 2005; Dobson 2005) suggest alternative ways of relating with the plethora of machines around us as well as creating new objects to help one deal with the mechanical world.

The ground on which this thesis walks is that of *critical technical practice* (Agre 1997). My attempt to articulate an alternative role for agents and robotics and their joint relevance for humans owes much to the pioneering work of Agre.

syngvan: A Creature for Reflection

Recalling my stated desire to make this a truly multi-disciplinary endeavor, I will describe the products that result from two of the disciplines that I embrace: that of the designer and of the sociologist.

The Design of syngvan

At the most base level, syngva² is a creature you sing to. Yet this description belies the subtlety and intricacy of my desired interactions. As an object, syngva is not anthropomorphic; it is not zoomorphic. The first version was blobular with one end "thicker" than the other.³ The motion and (perceived) agency is simple: as your singing pitch increases, syngvaa moved forward; as your singing pitch decreases, syngvaa moved backward. Amplitude determines whether the movement is in a straight line or curved. Technical problems related to wireless instruction transmission and pitch tracking caused the movements to not always follow the programmed patterns. Even in this simple formulation people's behavior was modified *unconsciously* by syngvaa: in a number of interactions, when syngvaa stopped moving, the person stopped singing, even though there were no instructions to do so and there was no reason to do so, other than the influence of the creature's actions on the persons behavior.

²A note on naming: The word "syngva" comes from Old Norse meaning simply "to sing". I see this project taking a number of forms as it develops. Rather than enumerating each new revision with the suffixes "Version 1.0", "Version 2.0", and so on, I have decided to add letters to the end of the word instead, moving to the next letter of the alphabet with each new revision. Thus the first version is "syngvaa", the second is "syngvab", and so on. For the remainder of this document, however, I use "syngva" to refer to the project in general.

³Indeed, this shape already provoked interesting responses, with disagreement as to which end was the "front".



The first version,
syngvaa

I want my design for the next version of the creature, and the physical deliverable of this thesis, to live in the interstices of determinism and automation, of the instrumental and the artistic. To do this I have to consider alternative modes of both motion and action. While the syngvaa moved on wheels, what would it mean for the next version to “waddle” in response to your singing? If extra “appendages” came out of the “body”, changing the center of mass and thus its motion? If these appendages undulated while you held syngva in your lap? This is merely one example of a possible motion system that moves beyond hegemonic wheels.⁴ The creature is more than its motion, of course, and thus just as I require a special motion system I require a special agent system. Here I draw from Phoebe Sengers’ work on “anti-boxology”; that is, an active aversion to creating behaviors that live in conceptual and programmatic boxes with impenetrable walls (1998). While there is certain knowledge that every embodied agent must know (such as its orientation and position of appendages), as well as common behaviors (such as movement towards a “goal” and repetition of a desired action), the division between knowledge about the world and the transition between behaviors does not have to be a chasm. Beyond the requirement that the agent (the creature) responds only to singing and not to the voice (a signal processing problem, complicated somewhat by tonal languages), I want a system that learns something about a *particular* person’s vocal patterns, about her way of expressing herself. I want to create a bounded blank slate from which the agent, in response to regular interactions with the human, launches into idiosyncratic behaviors partially created on the fly. I will use techniques from evolutionary robotics (Nolfi and Floreano 2000) to develop control mechanisms that reflect the individual characteristics of each person’s singing.

Outside of the laboratory context there must be a reason for someone to want to continue to interact with the creature. I see the syngva project as a way to encourage non-linguistic reflection. Given the open-endedness of the interaction, and the design that does not demand the creation of a creative *product*, syngva will encourage exploration of non-standard means of expression. syngva decontextualizes personal experience, creating an uncanny situation where the action of singing is strangely familiar, with the outcome (the behavior of syngva) providing a unique situation. syngva requires a continual semiotic process that barely touches on existing knowledge. While a user can call forth concepts such as “front” and “back”, my conscious choice to not make reference to animals or humans forces the user to create, develop, and refine links between the signifier (the observed actions of syngva) and the signifieds (the human’s internal representations). By carefully constructing a bounded blank slate I hope to find projective mechanisms in the person’s descriptions of their interactions.

Aside: Whither Designer Ethics?

Whither ethics when the designer can create an object that modifies the user’s behavior without her knowledge? This aspect of my project is troubling and can only be faced through the development of the object itself. As a designer I must be aware of the projective mechanisms at work, continually raising questions as to how this

⁴See the work of Hod Lipson and colleagues (Bongard, Zykov, and Lipson 2006; Lipson 2006) for evolutionary motion and control systems that provide idiosyncratic movement profiles. Additionally, I would like to consider evolution of creature morphologies, similar to the Golem project of Lipson and Pollack (2000).

object could *adversely* affect the user. This is all the more important when creating interactive objects that have the potential to pull our evolutionary strings (Thrift 2004; Turkle 2006).

in-situ Understanding of syngva

“If this is an awful mess . . . then would something less messy make a mess of describing it?” (Law 2004, 1) John Law, a sociologist of scientific knowledge, is describing a juxtaposed drawing: images, geometric shapes, text, lines. No “order”, as we would usually understand it. His use of the graphic illustrates the messy situations of contemporary sociological studies of technology. When you consider the variety of actors in any one technological artifact, the incongruence of each with the other becomes apparent: graduate student, advisor, data sheets, assembly code, institution, users, local community, conference paper, *etc.* Would a framework that attempts to smooth away the differences between each of these actors merely “make a mess” of the situation? Would purification into the oft-mentioned spheres of nature and society (Latour 1993) really give us a better understanding of these novel experiences?

The second deliverable of this thesis is the *in-situ* evaluation of syngva. Beyond the preliminary laboratory studies I want to present syngva to a handful of people for at least one-week periods. My approach to analysis of these situations is to work from an actor-network theory (ANT) point of view. Less a theory and more a methodology, ANT, among other things, considers the objects of study to be on the same ontological level as the subjects, the humans interacting with the objects (Latour 2005, 63–86). In science and technology studies this representations a radical shift in point-of-view (see Latour and Woogar (1986)). For my purposes, this aspect of ANT is especially relevant when we consider objects, such as syngva, which *can* act on their own and which do have at least presumed agency.

In addition, ANT challenges Western metaphysical assumptions about reality: that we assume reality is “out-there”, independent of our actions, that it precedes us, that it is definite, and that it is the same everywhere (Law 2004, 23-26). Law shows in a number of examples that even if there is a reality “out-there”, it is not independent of our actions (our measurement equipment, what he calls *inscription devices* influences the types of data we obtain), that it does not precede us (knowledge about a transcription factor only exists *after* we have discovered it), that it is not definite (forms are fluid depending on points of view), and finally, that it is multiple (different accounts of the same event can exist at the same time).

What does this mean for my thesis evaluation methodology? I will go into my observation of interactions of people with syngva without a framework in mind, without any prior desire to reduce my eventual space of observations to n points, where n is small. Rather, following the expositions of Latour and Law, I will look for assemblages, for multiple realities, for creations of new social groups by the actors in the situation. I will observe how syngva, *as an object*, creates a new reality for the user, how syngva enables the expression of alternative forms of reflection. I will look for situations where the object has left traces of its influence on the person. As an example, a recent paper examined people’s reactions to the Roomba, a robot developed by iRobot for cleaning purposes (Forlizzi and DiSalvo 2006). Without remark, they

reproduced the following quote: “I [*sic*] made me think it was a little bit pathetic, because it would sorta near-miss all the time, you know, slam into things by a quarter to an eighth of an inch.” (Forlizzi and DiSalvo 2006, 261) Rather than observe that the informant was *pitying* the robot for its stupidity, they chose instead to refer to how people were “pleasantly surprised” when using the Roomba. My hope is that interactions with syngva provoke these sorts of responses, situations where I can see how interactions with the object have modified people’s descriptions about themselves and the object.

My choice of not coming into these situations with a prior framework in mind will hopefully prevent me from reporting the previous quote without comment. Since my only guiding principle will be to follow the data, to follow the accounts of my informants, I will be able to see how their personal, idiosyncratic way of relating to syngva develops over time. Only “mere descriptions” in the words of Latour (2005, 136–140)

I understand that this methodology is non-standard and presents a challenge to the prevailing ways of evaluation. Yet when we decide to investigate in detail a new field, a new means of interaction, I believe it is best to keep our options open, to not close off potential avenues of exploration *a priori*.

Aside: Questioning Instruments and Instrumentalists

The basis of this thesis came in an early pilot study of people’s relationships with their musical instruments. Already, in a small set of conversations (Knouf 2006), I have investigated how, for example, a harpsichord performer must continually recreate her relationship with the instrument due to the practicalities of physical transport. Rather than knowing in-depth about the idiosyncrasies of a single instrument, she must learn anew at each performance. In her situation, the relationship with the harpsichord as an abstract entity is deep, but fleeting for any specific harpsichord.

Interviews will continue throughout the thesis. While indeed they will be instructive in considering the multiplicity of relationships with instruments, more importantly they will serve as the beginning of the exploration of an heretofore unexplored area of musical experience.

Aside: Creature Introduction

How I introduce the creature, whatever its form, will undoubtedly influence the user’s interaction with it. Since a goal of creating these creatures is novelty, it necessarily follows that not only will the creature be novel to me, the designer, it will be novel to people interacting with the creature as well. The fact that the object does not exist out-there for the participants raises questions of power when it comes to introduction of the artifact. As a member of the technocracy, what role do I have in presenting it to to people for the first time? Why would they be interested in interacting with it, with keeping it in their homes for an extended period of time, excepting the novelty factor? These questions raise not only practical issues (what is the mechanics, procedure of introduction) but ethical issues as well (how do I ensure

that I do not reinforce the impression of the designer-engineer coming down “on high” and presenting this new object to them).

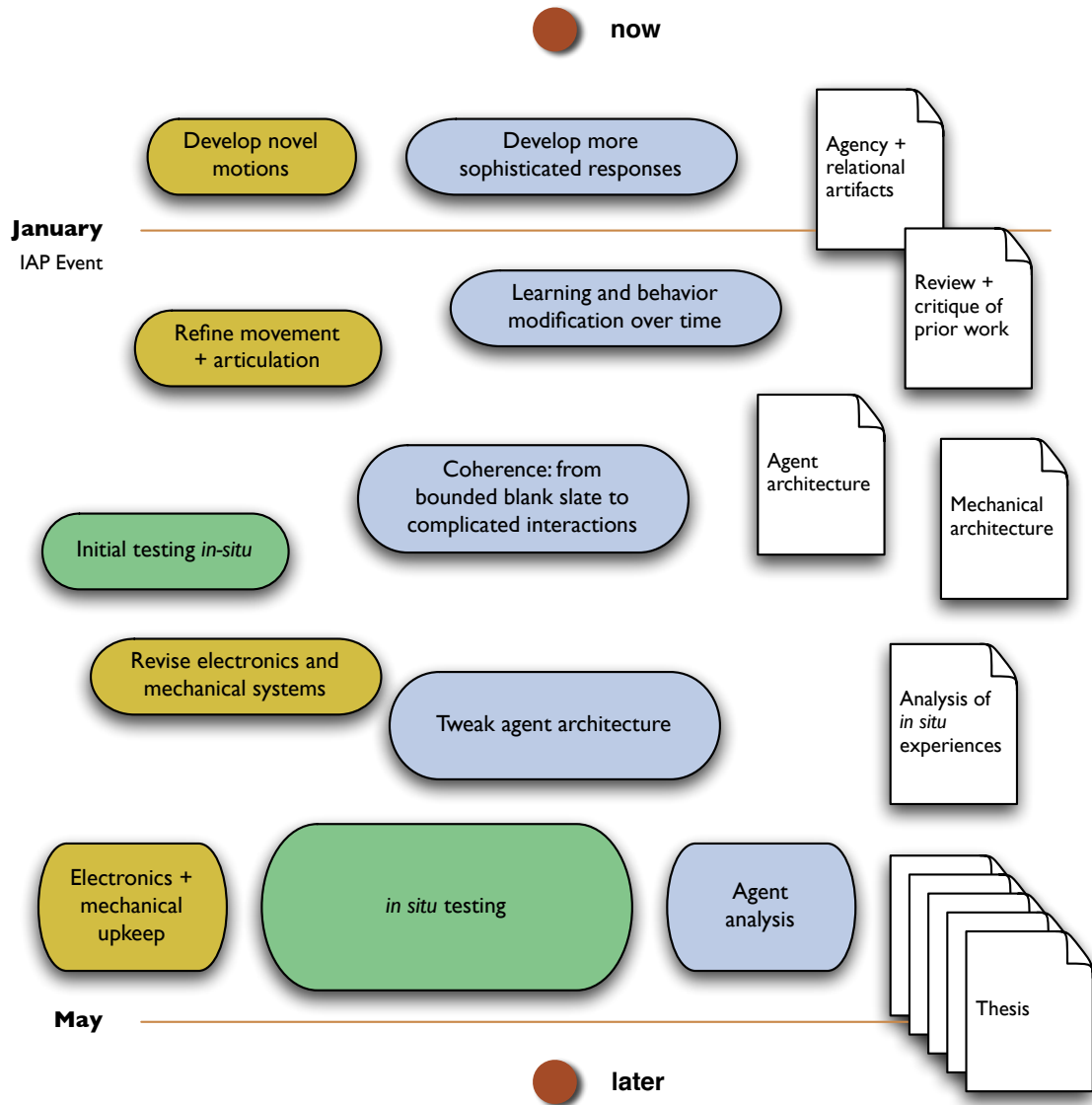
Requirements and Desires: Resources for the Project

Requirements can be broken up into a number of categories. Electronics resources: accelerometers, pyroelectric sensors, microcontrollers, wireless microphones, and bluetooth wireless modules. Mechanical resources: motors, gears, rapid prototyping materials, metal/wood. Computation resources: small-form-factor computer (either PC or Mac Mini, for *in-situ* studies) with plenty of memory and storage. Institutional resources: COUHES approval of *in-situ* studies.

Desires: While I could probably develop the physical part of the thesis without assistance, the support of a mechanical engineering UROP would be immensely helpful and would likely speed up the development process. (Someone who has already taken a robotics class such as 2.007 would be ideal.)

Aside: While it is possible for me to achieve partial success in this thesis through the use of an off-the-shelf robotic platform, such as the Roomba, my desires for special movements and shapes suggests that an entirely custom platform is necessary. This does indeed increase the workload dramatically, however I am confident that the end result will be worth it.⁵

⁵It is comforting to realize, nevertheless, that in case of major mechanical issues down the road I can turn to an existing platform if necessary.



Timeline

Reader Biographies

Hod Lipson

In 2001 Hod Lipson joined the departments of Mechanical & Aerospace Engineering and the faculty of Computing & Information Science of Cornell University in Ithaca, NY. He is also a member of the Computer Science and Computational Biology graduate fields at Cornell. Prior to this appointment, he was a postdoctoral researcher at Brandeis University's Computer Science Department and a Lecturer at MIT's Mechanical Engineering Department. He received his PhD in 1998 from the Technion - Israel Institute of Technology. Before joining academia, he spent several years as a research engineer in the mechanical, electronic and software industries.

Sherry Turkle

Sherry Turkle is Abby Rockefeller Mauzé Professor of the Social Studies of Science and Technology in the Program in Science, Technology, and Society at MIT and the founder (2001) and current director of the MIT Initiative on Technology and Self, a center of research and reflection on the evolving connections between people and artifacts. Professor Turkle received a joint doctorate in sociology and personality psychology from Harvard University and is a licensed clinical psychologist.

She is the author of *Psychoanalytic Politics: Jacques Lacan and Freud's French Revolution* (Basic Books, 1978; MIT Press paper, 1981; second revised edition, Guilford Press, 1992); *The Second Self: Computers and the Human Spirit* (Simon and Schuster, 1984; Touchstone paper, 1985; second revised edition, MIT Press, 2005); and *Life on the Screen: Identity in the Age of the Internet* (Simon and Schuster, November 1995; Touchstone paperback, 1997).

Professor Turkle is currently completing a book on robots and the human spirit and editing a three volume collection on the relationship between things and thinking. The first two volumes, *Evocative Objects: Things We Think With* and *Objects in Mind: Falling for Science, Technology, and Design* will be published by the MIT Press in 2006. The third volume, *The Inner History of Devices* will follow in 2007.

Professor Turkle has written numerous articles on psychoanalysis and culture and on the "subjective side" of people's relationships with technology, especially computers. Profiles of Professor Turkle have appeared in such publications as *The New York Times*, *Scientific American*, and *Wired Magazine*. She is a featured media commentator on the effects of technology for CNN, NBC, ABC, and NPR, including appearances on such programs as *Nightline* and *20/20*.

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