Ontological Instrumentation in Architecture

A Collection of Prototypes Engaging Bodies and Machines from the Inside Out

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This paper provides a theoretical discourse on ontological instruments in design by exploring the ways in which design and technology might help get us back to an understanding of our own humanity. The intent of this theoretical discourse is to illuminate the possibilities of what can be, by looking at history as a way to see the world with perspective and as a predictor of what may happen. Another objective is to demonstrate the proof of those possibilities through the presentation of two design research projects which actualize those ideas. The first project is a prototype for an interactive chair that explores the calming effects of conscious and synchronized breathing. The second project is a reinterpretation of the veil and explores the relationship between the individual and the public. Both projects are artistic and performative in character and are embedded in a theoretical discourse on ontological instruments and investigate the opportunities of interaction of the human body with the environment moderated by technology.

Keywords: prosthesis, cyborgs, robots, technology, humanity, culture

INTRODUCTION
Architecture has a long history of body-centered designs, evident from antiquity through modernism, with Vitruvius and Le Corbusier using an ideal figure as a scalar reference to proportions. Walter Gropius similarly implores, “The size of our body (of which we are always conscious) serves as a yardstick when we perceive our surroundings. Our body is the scale unit, which enables us to establish a finite framework of relationships within the infinite space” (Gropius 1955). However, today common body related discourses in architecture range from the anthropocentric to the post human. Within this spectrum, we see the work of Karen Franck’s socially engaged practice, which focuses on the prioritization of human needs, on one end, and Antione Picon’s theoretical stance on the cyborg, as an exemplar of digital culture, on the other. The key components drawn from these discourses, for the sake of this paper, are the notion of the body as a guide for prioritizing humanity in architecture and the awareness of technology radically affecting the way we inhabit our environments.

Observing the spectrum, the research outlined here draws on both ends. Important to human centered design is Franck’s understanding of the investigation of bodies as both objects and subjects. She explains to design for the body as an object, is to step outside the body and view it from the outside,
as done with the Vitruvian Man or Mies’s idea of the ideal posture in his design of the Barcelona chair. However, designing with an understanding of the body as a subject, requires one to be within it, feeling, sensing, and engaging its experiences (Franck 2001). Not forgetting this notion of engaging the body as both object and subject, nor blindly moving forward without considering technology, the suggestion within the research is to question how design and technology might help get us back to an understanding of our own humanity by exploring opportunities for ontological instrumentation in architecture.

**WHAT IS AN ONTOLOGICAL INSTRUMENT?**

Relative to Heideggerian notions of “readiness to hand,” the body can seamlessly expand to engage with tools without noticing, thus creating a condition where tools themselves are amalgamated extensions of the mind and body (Heidegger 1962). The Greeks understood this relationship between tool and body in that they had one word for organ and tool, *organon*, which literally translates to “that with which one works” (1). Georges Teyssot further explains this relationship of tools, bodies, and environments, when he writes:

“The relation between organ and tool, attested to by etymology, history, and theory defines our action on space, on the environment, on the world we inhabit. Such a relation can ‘unfold in the space created by our technologically supplemented bodies, not merely that of our natural flesh.’ The first task architecture ought to assume, therefore, is that of defining and imagining an environment not just for ‘natural’ bodies but for bodies projected outside themselves, absent and ecstatic, by means of their technologically extended senses. [...] We must conceive tool and instrument ‘like a second sort of body, incorporated into and extending our corporal powers.’ It then becomes possible and even necessary to logically invert the terms of our proposition on the role of architecture. The incorporation of technology is not effected by ‘imagining’ a new environment, but by reconfiguring the body itself, pushing outward to where its artificial extremities encounter ‘the world’” (Teyssot 1994).

Teyssot argues we no longer perceive or engage with our environments directly through our bodies, but instead it is through technology that we experience the world. Therefore, architecture encases bodies “prosthetically expanded and articulated through tools and media technologies,” suggesting there is no ontological separation between our bodies and our instruments (Velikov 2016). Marshall McLuhan in his work, *Understanding Media: The Extensions of Man*, also reiterates how media acts as technological amplifiers and extensions which alter our perceptions, which often happens without notice or re-
sistance (McLuhan 1994). From these etymological and theoretical observations lies the premise of ontological instrumentation. For clarification, an ontological instrument, for sake of this research, is defined as a device, which mediates between bodies and space, and provides unique ways of engaging the world through technology.

Ontological instrumentation correlates to the context of the cyborg and prosthesis in architecture as seen in the work of Haus Rucker Co’s Environmental Transformer and Yellow Heart, Han Hollein’s Mobile Office, Coop Himmel(l)au’s Heart Space-Astro Balloon, Walter Pichler’s TV Helmet (portable living room), and Diller Scofidio’s Braincoats (Cummins 2012). Donna Haraway, in her “Cyborg Manifesto,” uses the cyborg as a figure, which blurs the relationship between human and machine and moves beyond traditions related to gender promoting feminism (Haraway 1991). From Haraway to Hollein, these examples challenge the way humans interact with their environments through instrument-enhanced bodies. Madeline Schwartzman’s, Seeing Yourself Sensing, provides a more detailed survey of projects where designers view bodies as “sites for unimaginable interventions many of which blur the boundary between humans and machines” and where “the architecture of the body is not simply something to behold, but rather something to analyze and explore from the inside out” (Schwartzman 2011). Inside out also being two key words in the title of the book, Architecture from the Inside Out, co-written by Franck, which focuses on designing architecture which exists for people with emotional and physical needs and relationships to one another (Franck and Lepori 2007).

While the cyborg has a history of many dystopian fictions associated with it, the collection of projects presented in this paper steer away from such anxieties and embrace technological prosthesis as a design method for appropriating computation and technology to explore “newfound intimacies with our selves, each other and the world around us” (Velikov 2016). The research focuses on a set of questions, which ask, what are the possibilities of using technology to enhance the effective qualities of architectural spaces? How have technologies opened possibilities for how our bodies communicate with our environment? How might technology remind us of aspects of our own humanity? How might we embed environments with technological bias for enhanced life? In response to these questions, this paper outlines two projects, which focus on prototypes to study how ontological instrumentation affects our experiences and interactions. The first project, Synchronous Rhythms, engages the body through an interactive family of chairs, which use conscious breathing techniques to transfer user experiences. The second project, Kinetic Veil, is a transformable structure, which draws on the traditions of a veil, has the capacity to cover and uncover, and can attach or detach from the body.

SYNCHRONOUS RHYTHMS
Synchronous Rhythms is a family of furniture that synchronizes with rhythms of the body, specifically by looking at the positive calming effects of conscious breathing. It includes the development of prototypical responsive pneumatic chairs, which encourage synchronization in breathing patterns. Drawing upon the idea of ontological instrumen-
tation, this project tries to expand the possibilities of using technology to mediate psychological and physiological states in spaces for beneficial ends. It asks, can technological devices re-introduce aspects of our own humanity by providing an opportunity to feel, experience, notice, and then begin to interact with one’s body and physical sensations in an agentic and possibly self-soothing way?

The research method involves the development of taxonomy pairing kinetic responses to rhythms of the body and later the development of small-scale models and full-scale prototypes (see Figures 1, 2, and 3). The models explore design options, materials, and actuators. These models include ideas for rocking chairs, which rock according to the rhythm of a user’s breath and inflatable chairs, which inflate and deflate relative to patterns of inhaling and exhaling. The prototypes not only test the feasibility of a device, but also provide a means for testing ways to encourage synchronization of breath and provide calming effects.

The full-scale prototypes use fans and air pumps controlled with Arduino. Drawing from epistemic observations in Ant Farm’s Inflatocook Book, the inflatable models used polyester fabrics and polyethylene (Lord, et al 1973). Integrating piezo vibration sensors into an interface directly in front of the user’s mouth and nose provide an input to inform the system when the user is inhaling or exhaling. This input activates a relay circuit to turn on or off in order to correspond breathing patterns to the inflating and deflating of the chair. A set of tests informed the rate of inflation or rocking in order to match the rate of breathing measured in breaths per minute. The first full-scale prototype takes in a single user and develops an inflating chair, which synchronizes in real time with the breathing pattern of that one user (see Figure 4). If the sensor was not picking up a normal respiratory rate, which is twelve to eighteen breaths per minute for an adult, the inflation would change in the chair to the ideal rate to encourage normal breathing patterns (2).

The second full-scale prototype draws on the notion of empathy and experience transference; it takes input from two users and attempts to encourage synchronization of breath between both users. In this scenario user one sits in the inflating chair while a sensor takes in the breathing pattern of user two and causes a corresponding inflation. This became a testing ground for understanding how technology might play a role in encouraging empathy and enhance shared relationships between people. In robotics today, Japanese researchers are rapidly developing systems for elderly care giving robots. However, what they are realizing is that while the devices are providing assistance with basic daily care the problems remains that people do not want empathy from machines, but want empathy from other people. Engaging ideas of instruments that are fundamentally related to aspects of our being and life, these prototypes question how design and technology might allow for the further exploration of the human condition and promote mindfulness.

While the synchronous rhythms research draws from psychological studies of the positive effects of conscious breathing and heightened intimacy of synchronized breathing, the intent for the research is to
explore shared languages and encourage new forms of communication through technology by mediating between our bodies and environments. The research acts as an evocative model of strategies for embracing the immeasurable and encouraging the integration of qualitative and human-centric attributes in our machines and devices. It specifically does so by reengaging the chair, which Galen Cranz articulates as a crucial part of our culture and environments. She further explains this importance when she writes, “We spend much of our waking lives in a chair [...] We touch chairs not just with our hands but with our whole bodies. Yet despite their intimate place in our lives, we know little about them and their effects on us, physically and mentally. Without a doubt, their efforts are profound. What is true of the chair is true of all the artifacts we create. We design them; but once built, they shape us. As sitting in chairs spread to the common person over the centuries, it left its mark on the human body and human consciousness. The chair offers a glimpse into our collective ideas about status and honor, comfort and order, beauty and efficiency, discipline and relaxation. As our ideas change, so do our chairs.” (Cranz 2013).

**KINETIC VEIL**

Engaging technology as an extension of the body, the kinetic veil project does not respond by developing an architecture for a man-machine amalgamation, but instead looks at ways to reconfigure the body itself by designing really close to the skin. It draws upon Gottfried Semper’s idea that clothing was the first mediator between bodies and environments by providing an immediate means of protection. The research explores the body as a site for architectural intervention and looks for ways to redesign our technologically enhanced bodies through the development of a second skin (see Figures 5 and 6).

The project creates a reinterpretation of a veil, which is no longer about morning, but operates under a new social manifestation. This reinterpretation deals involves the design of an exoskeleton, which has the capacity for hiding as a way of revealing and tries to be provocative by extending out into and claiming public space. Drawing from tradition of covering and understanding the importance of providing the capacity to cover and uncover, the veil is capable of opening and closing based on the control of the user and allows for the joining and linking together with other kinetic veils. Either as a singular or joined exoskeleton, the veil defines a spatial configuration based on intimacy by creating a private room within a public space.
cating connections made from a delaminated module to appropriate the bending range of the material (see Figure 7). The connection between two single ply ends of the module allows for a flexible connection while the connection between two double ply ends creates a rigid connection. Through this series of details, the transformable geometry is able to open and close while also changing the range of aperture and allowing for visibility through a physical barrier. The configuration of the flexible system results in a dome structure surrounding the upper portion of the body from the waist up altering the scale of the body and creating a unique spatial awareness (see Figure 8 and 9). The lightness of the structure also allows for a flow and rippling across its surface which corresponds to the rhythmic movement of walking. The project intent is to evoke the imagination of new environments based on how architectural prostheses engage, encounter, and affect our experience of the world and it does so by blurring conditions between public and private, intimate and social, and natural and artificial.

CONCLUSION

Marshall McLuhan writes, “During the mechanical ages we extended our bodies in space. Today after more than a century of electric technology, we have extended our central nervous system itself in a global embrace” (McLuhan 1994). Ontological instrumentation in design explores these changes and seeks to investigate “the contours of our extended being in our technologies” and their implications on our experience of the built environment (McLuhan 1994). This small collection of research outlined attempts to find resolutions between man and machine, organic and mechanical, and the computable and in-computable. It ask, as our buildings, cities, and bodies are retrofitted with technology, how might designers respond with visions of new modes of research and practice? If we look back at industrialization in modernism we see a history of the epistemic changes in architecture and redefinition of its effects (Picon 2014). This paper similarly calls for a redefinition of architecture in a digital culture and argues it must go beyond the fixation with data driven design, the metrics of simulation, and the appropriation of industrial robots. It instead calls for the re-statement of the qualitative, the immeasurable, and the subjective through the appropriation of ontological instrumentation in design, which requires us to imagine human-centric design sensibilities and opportunities for intervening between bodies, technology, and space.

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