Gestures of In-Kindness

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Figure 1: Devices that respond to gestures in-kind.

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Abstract
We present "Gesture of In-Kindness," an interactive art project comprising four household devices that respond in-kind to observers' gestures. These devices include a fan that blows air at the observer only when the observer is actively blowing his or her own air at the device, as well as a blender that only spins its blades in circles when the observer is spinning his or her body in circles.

We discuss the project's influences, which include past work utilizing either household devices for artistic expression or gestures for interactive control. Furthermore, we outline the technology underlying the project's implementation, identifying major hurdles overcome to enable devices to communicate wirelessly, process inputs from a variety of sensors, and to have the appropriate electronics embedded inside.

Author Keywords
Household Devices, Gestures, Arduino, Interactive Art

Introduction and Overview
"Gestures of In-Kindness" is a suite of household devices and appliances that respond in-kind to gestures the observer makes. For instance, the project includes a fan that can only be "blown" on; when the observer blows air at the fan, the fan responds by blowing air at the observer.

Once the observer stops blowing his or her own air, the fan also stops. Similarly, there is an oven that can only be operated by applying heat, such as the flame from a lighter. Only then will it apply heat to your food. A lamp that only turns on when light is applied and a blender that only spins its blades when the observer spins in circles rounds out the suite of devices. All devices operate over wi-fi, and all of the electronics, which I custom made for this project, are hidden inside the devices.

The interesting aspect of this project is that it leads observers to rethink their relationship with physical devices. In a sense, each device is a magnifying glass, amplifying the observer's actions. This idea is highlighted by the devices' quick response time; once the observer ceases to make the appropriate gesture, the device also turns off. Having this synchronicity, despite differences in scale, draws the observer towards the relationship between gesture and reaction.

Artistic Process

On a conceptual level, my project draws inspiration from a number of other artists' projects that have used household devices in an interactive way. One of my most direct influences is Scott Snibbe's *Blow Up* [6], which is a wall of fans that is controlled by human breath. The idea of using a human characteristic, breath, to control devices that project the same behavior back at the observer on a larger scale was the starting point for my concept. While I really like Snibbe's project, I preferred to have a one-to-one relationship between gesture (blowing into one anemometer) and response (one fan blowing back). I also preferred not to have an option to "play back" past actions since I wanted a real-time gesture-and-response behavior. However, I thought the idea of using breath to control a fan perfectly captured the relationship between observer and device, so I stole this idea to power my own fan and kickstart my own thought process. I then created a series of other devices with analogous relationships between gesture and device reaction.

Chambers and Judd's *The Attenborough Design Group* [2], a series of devices that exhibit survival behavior, is an additional influence. For instance, a halogen lamp leans away from the observer to prevent touching since the oils from human hands shorten its life. Similarly, a radio blasts air to avoid the build-up of dust. In some sense, this project explores the opposite end of the spectrum from mine. Whereas their devices avoid humans to humorous effect, my devices respond in-kind to humans in a more empathetic manner. I want the observer not to laugh, but to think about their relationship with these devices on a gestural, magnifying level.

Kelly Dobson's *Blendie* [3] is, of course, also an influence. Her project, in which a blender responds to a human yelling by turning on and trying to match the pitch of the yelling, interestingly frames humans' relationship with objects. I really liked the noise and chaos a blender causes, which led me to include a blender in my own project. However, while her blender responded to gesture in a divergent, yet interesting, way, I wanted to have a tighter relationship between the observer's action and device's reaction. Therefore, I decided to have my blender controlled by a human spinning.

The use of gestures in Alvaro Cassinelli's *Invoked Computing* [5] also influenced me. His work lets an observer answer a telephone with the gesture of picking up a phone, yet using a banana. Similarly, gestures on a pizza box can be used to control a laptop. The idea of an appropriate gesture causing the associated action in an unexpected way is echoed in my work.

Figure 2: This series of images shows a number of the primary artistic influences for this project. From top to bottom, these are *Blendie*, *Blow Up*, and *Invoked Computing*.

Other influences came from this Interactive Art and Computational Design class. For instance, my classmate Deren created devices that respond to actions, such as a cutting board that screams [4]. While I really liked her project, I wanted my devices to amplify the observer's actions on a larger scale. For his final project, my classmate Kaushal [1] made a camera that operates only through gesture; when the participant makes a motion that looks like a camera taking a photo, a photo is taken using computer vision techniques. Having these influences led me both towards the ideas of using household devices in art, as well as using appropriate gestures for control.

Technical Implementation

A substantial amount of my time on this project was spent ripping apart devices and figuring out how they worked. Once I spent a few hours with a multimeter uncovering how blenders and ovens function, as well as ripping apart a light and a fan, I had a good understanding of how I would control devices. Steps in this process of ripping apart the devices can be seen in Figures 3-6.

Inside each device, I've inserted quite a bit of electronics: power regulation, an Arduino microcontroller, a WiFly wi-fi adapter, and a solid-state relay. First, after opening up the devices, I isolated where power is sent to the device's output (for instance, the oven's heating elements or the blender's motor) and cut the hot wire. Then, I started to insert electronics. As power came from the wall, I inserted a DC power regulation circuit that I ripped from a 9V DC Adapter purchased from Sparkfun; I could now power an Arduino microcontroller off of the electricity the device already had flowing into it. Then, I inserted a solid-state relay into the device (20A for the oven and blender, and 2A for the fan and lamp). An Arduino Uno R3 controls the relay, and a WiFly wi-fi adapter sits on

the Arduino to provide wireless capability. I programmed these devices to connect to a wireless router, and communication to devices occurs over this channel.

On the sensor side, I have a separate Arduino that reads the sensor inputs. For sensing breath, I used an anemometer from Modern Devices. For sensing temperature, I used a digital temperature sensor; for sensing light, a photocell did the trick. Finally, to sense spinning to control the blender, I used a triple-axis accelerometer from Sparkfun. Since I wanted to avoid wires, I connected this Accelerometer to an Arduino Fio, which has a built-in port for XBee (802.15.4) chips. This rig was powered by a small Lithium Ion battery. At my computer, I also had an XBee connected via USB, enabling communication from the accelerometer.

I wrote the code for all Arduinos (those inside the devices, the Fio for the accelerometer, and the final Arduino that connects to all the sensors), as well as Processing code to parse the messages from the sensor Arduino and accelerometer. In this Processing code, I was able to adjust the thresholds for the sensors on the fly without reprogramming the Arduinos. Furthermore, in Processing, I opened sockets to all of the devices, enabling quick communication over the wi-fi network.

Conclusions and Future Work

"Gestures of In-Kindness," which debuted at the Spring 2012 CMU Interactive Art and Computational Design course exhibition, allows observers to interact with household devices that respond in-kind. Therefore, the only gestures that operate the devices are micro-scale versions of the action that the devices performs, such as spinning around to operate a blender or applying heat to operate an oven.

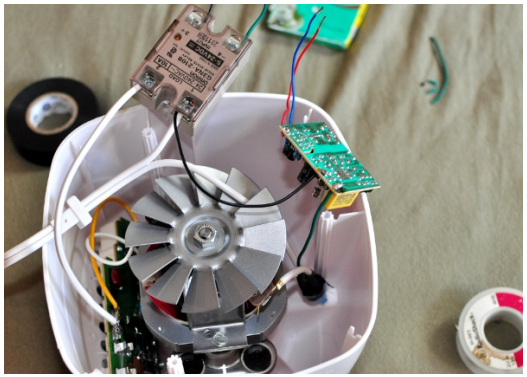

Figure 3: The innards of my hacked blender, with a relay and DC power regulation inserted.

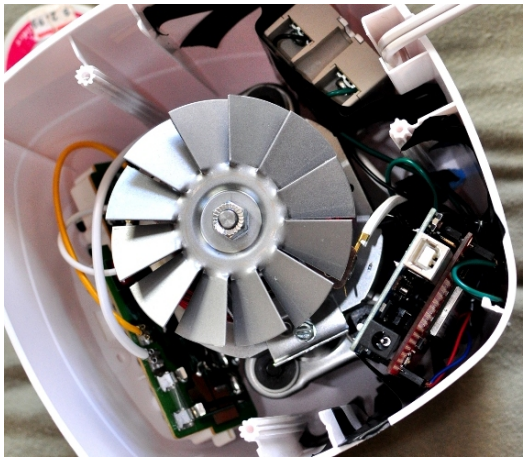

Figure 4: The blender with the full complement of electronics inserted, but before the bottom of the case was reattached.

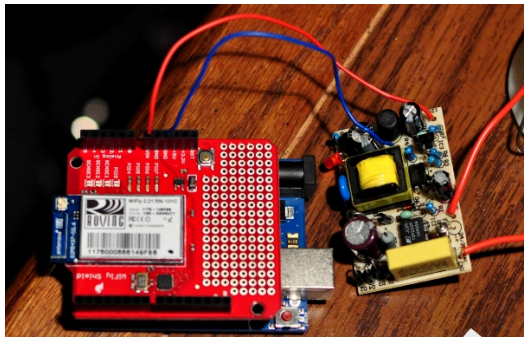

Figure 5: An example of the circuit from a 9V DC adapter powering an Arduino microcontroller, with a WiFly wi-fi adapter attached. These components form the basis of the control system for devices.

Figure 6: The inside of the lamp, with electronics visible.

Through my observations of participants' interactions with the devices at the course exhibition, I noted that attendees did seem to feel a connection to the devices on a physical and gestural level, accurately capturing the artistic expression that formed the basis of my concept. To this end, I feel that my artistic expression succeeded in eliciting the desired reaction from observers.

As future work, I hope to create a household full of these devices. For instance, a coffee maker operated by a pouring action and an alarm clock whose alarm is operable only by screaming are two potential devices for the next iteration of the project. Furthermore, I wasn't quite happy with the location of the sensors. My initial concept for the project included placing sensors on the devices themselves. However, I departed from this vision since this design would likely result in a feedback loop due to the in-kind gestures. That is, once a small light activated the lamp, the light sensor on the lamp would be activated by the lamp itself. Similarly, heating the oven would turn it on, and the heat produced by the oven in its normal cooking operation would prevent it from being turned off. Therefore, I physically separated the sensors from the devices. However, after seeing the final version of the project, I plan to spend significant engineering effort in the next iteration collocating the sensors with the devices to clarify the intimate connection between the gestures being sensed and the actions being produced by the device.

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