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# Building Upon Everyday Play

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**Abstract**

Most of today's video game strategies are based on a static set of game controls and player actions that remain oblivious to the player's context and own creativity. Building Upon Everyday Play is the result of a collaboration of Control Freaks, a pervasive gaming experience project, and Exemplar, a toolkit that uses programming-by-demonstration to author sensor-based interactions. In combination, Building Upon Everyday Play furthers a pervasive gaming experience through appropriation of objects in the player's environment and enables new ways to play.

The project consists of a combination of a portable, wireless motion-sensing clamp that can be attached to everyday objects to turn them into game controllers by proxy, and a programming-by-demonstration system that translates sensor data reported by the controller into game events. In the demonstration, participants will be able to play custom video games projected on a large 2D screen by attaching the clamp to their bodies or provided household objects, and to invent their own moves to control the provided games.

**Keywords**

Pervasive games, programming by demonstration

### ACM Classification Keywords

H.5.2. [Information Interfaces]: User Interfaces — input devices and strategies; interaction styles;  
K.8.0. [Computing Milieux]: General - Games

### Introduction

Play can enable its participants to break free from social convention and see the world with new eyes; its undertaking has the potential to change our frames of reference, and can subvert what we take for granted. However, traditional video games have adopted a fairly narrow and prescribed perspective on what games can be. A large section of the video game market has ossified around a fixed hand-held multi-button controller paradigm. Such games fail to engage the players' physical bodies and are oblivious to the players' context. While some games now feature novel input controllers that require creative movement, *e.g.*, floor mats for dancing [4] or props that resemble musical instruments [5], the use of such inputs is still predetermined and does not engage the larger environment in which play takes place. The introduction and success of the Nintendo Wii gaming system – which focuses on physical manipulation of a dedicated controller object – paves the way for new physical gaming paradigms.

Building Upon Everyday Play offers a new way to enable pervasive gaming experiences through *appropriation of objects in the player's environment*. Here, game play spreads into the real world, old contexts adopt new meanings, and opportunities arise to effect the transformation of everyday life.

Building Upon Everyday Play is the result of a collaboration of Control Freaks [10] and Exemplar [6].

Exemplar is a research toolkit that uses programming-by-demonstration to aid designers in understanding and mapping continuous sensor data to high-level events. Control Freaks is an interaction design project exploring new gaming experiences that fold the world around us into the play itself. Control Freaks are physical play instruments that attach themselves to common objects, turning those objects into controllers for game play. This enables new play patterns around the acts of appropriating existing objects for play, inventing new forms of play, and turning play itself into a social performance. Through this collaboration, we introduce a combination of a portable, wireless game instrument (the Control Freaks clamp) that can be attached to everyday objects, with a programming-by-demonstration system (Exemplar) that turns the sensor data reported by the Control Freaks clamp into game control events.

Building Upon Everyday Play further pursues the Control Freaks model of utilizing existing artifacts, environments and situations around us to turn them into game play objects and opportunities. It reintroduces the important aspects of invention [2] and appropriation found in childhood play into digital games for grown-ups.

In collaborating with Exemplar, Control Freaks can benefit from a technical platform that enables rapid and easy prototyping of new play patterns. By working with Control Freaks, Exemplar can test itself in terms of real-world applicability outside the confines of a research and teaching tool. This has resulted in a robust gaming platform and games that further explore the concepts behind *appropriation through attachment*.

In the proposed demonstration, participants control a video game projected on a large 2D screen by attaching the Control Freaks clamp to their bodies or provided household objects (appropriation), and invent their own moves to control the provided game (invention). Two new play patterns are introduced in the demonstration games. In one, players are asked by the game to attach the Control Freaks clamp to their bodies for a jumping motion, and an office chair for a swinging motion. Each action takes them through a level of the game. Players must negotiate the physical world as part of the game, and their actions, because of its unfamiliar or exaggerated use of familiar objects, becomes a public performance in the process. In the second game, players are presented the opportunity to attach the clamp to other objects, people, or themselves and invent movements to correspond to game events. Players then have to coordinate how their demonstrated movements map to game actions, turning each play session into a novel, unique exploration. Again, play extends beyond the screen to the physical world where players struggle to choreograph their movements according to the game.

### **Control Freaks and the Design of Play Experiences**

Control Freaks, developed as a Master's thesis by Haiyan Zhang while at the Interaction Design Institute Ivrea [10], looks at how technology can enable new ways to play by making everyday objects the hosts for game control (see Figure 1). Control Freak is a sensor based peripheral that attaches, like a clamp, to any host object such as a sliding door, an office chair or even a person. The host's movement, vibration or sound is translated through the peripheral into control input for a game platform (such as a portable

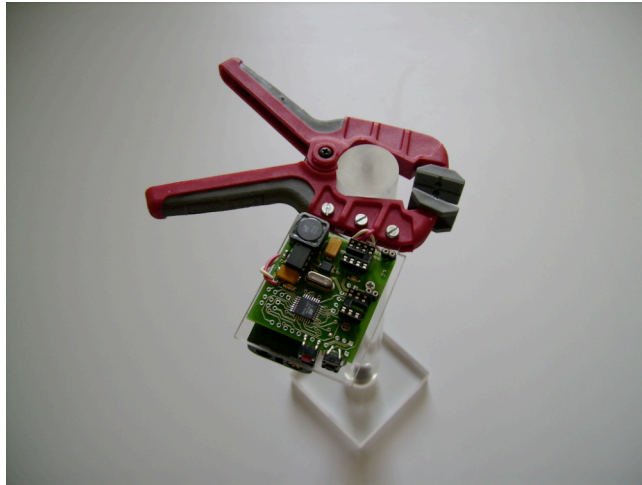


**figure 1.** Player appropriating an office chair to play games.

gaming device, or a projected display) that the peripheral is networked to. The situation, location and behavior of the host, are all enablers for opportunistic play experience. Control Freak interprets the host's behavior (a door opens, a chair coasts on wheels) into the input capability of the game. In doing so, the host's behavior and its manipulation becomes an integral part of play adventure.

In the first iterations of the Control Freak clamp (see Figure 2), accelerometers were integrated with a custom RF transmitter to send sensor readings to a computer. Firmware for the embedded microcontroller was written with Arduino [1]. The circuit board was mounted on a clamp device enabling attachment. The receiving computer translated these readings into game events and displayed the game on a large 2D projection screen. In our current iteration, multiple channels of orientation data are simultaneously sent through a

Bluetooth link, which offers higher data rates and better compatibility with consumer devices.



**figure 2.** First iteration prototype of the Control Freak clamp.

This project was first exhibited at the graduation show for Interaction Design Institute Ivrea in June, 2006 and at UbiComp 2006. The initial set of games focused on the experience of players seeking out specific objects requested by the game. Through current collaboration with Exemplar, new play experiences have been developed around the play pattern of players inventing their own movements for game play, along with more robust motion recognition.

### **Exemplar and Programming by Demonstration**

Exemplar is a software tool that enables designers to rapidly specify the relationship between sensor input and application logic through programming by demonstration [6]. Programming by demonstration

(PBD) is the process of inferring general program logic from observation of examples of that logic [3]. Exemplar frames the design of sensor-based interactions as the activity of performing the actions that the sensor should recognize. Exemplar offers an authoring environment that enables game designers to demonstrate a sensor-based interaction, *e.g.*, she shakes an accelerometer, and export it as a game event during early game design. During authoring, Exemplar graphically displays incoming sensor signals in real time (see Figure 3). The designer edits the visual signal representation by highlighting action regions, and saving those regions as events. The designer can instantly review the result by performing the action again and observing the recognition feedback. Through iteration based on direct manipulation of event parameters, the designer can refine the recognized action and, when satisfied, export this sensing pattern as a game control action. Exemplar supports mapping of uni- or multi-dimensional continuous sensor signals into discrete events through filtering, thresholding, and pattern recognition techniques.

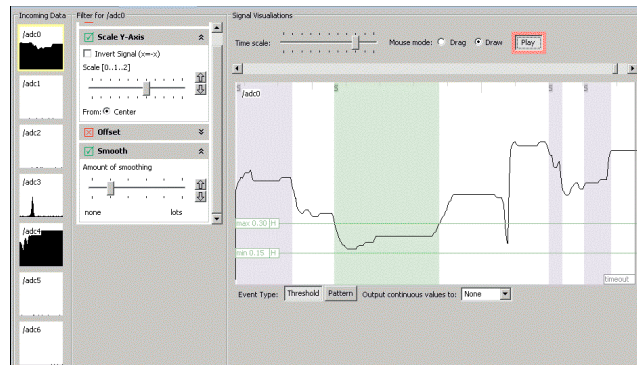
To let game players invent their own motions in our second play scenario, the Exemplar pattern recognition engine is integrated into the game application. In this case, Exemplar's interactive graphical editing interface is not available; the game's interface prompts players to demonstrate actions and uses the Exemplar engine to map these to game controls. To ensure accuracy in this process, the game will prompt the player to perform a small number of identical actions and, through the on-screen dialogue, suggest types of actions that are more robustly recognized than others.

### Details of Collaboration

Control Freaks contributes the framework of games that appropriate objects found in a player's environment, as well as the games themselves. Exemplar [6] contributes the back-end software architecture that allows designers as well as players to rapidly and reliably map actions sensed by the Control Freaks hardware into control events. The combination was motivated by noting the symbiotic relationship between the conceptual emphasis on flexibility and exploration offered by Control Freaks on one hand, and the practical emphasis on exploration through authoring sensor-based interactions by demonstration embodied in Exemplar.

### Play Experiences

Building Upon Everyday Play offers two kinds of novel play experiences with the found environment. Both



**figure 3.** Exemplar enables designers to turn physical actions performed with the Control Freaks clamp into game events through programming by demonstration. In Exemplar's authoring environment, designers mark up examples of performed actions in a timeline visualization of sensor data.

make use of a repositionable, wireless game instrument that can be clamped on to other objects; both also use 2D bitmapped displays and sound effects as the game output. In the first play pattern, the player is asked by the game to attach the clamp to their hip and jump in the air. After a few training jumps, this is mapped to the movements of an on-screen avatar and the player must jump to negotiate obstacles in the game. On reaching the second level, the game asks for the clamp to be attached to a chair, where swinging in the chair effects on-screen action in the new level.

In the second scenario, players are asked to invent the physical actions that should be tied to game controls themselves. Here the game instructs players when to perform the motions for certain game actions, for example, spinning around or jumping up, and each action is assigned to a game control, for example shoot, or move. The player can then play the provided game with the moves she just made up on the spot.

### Intended Audience

Building Upon Everyday Play seeks to create a gaming platform and associated games that are accessible to non-technical players of all ages. The collaboration has also resulted in a simple, intuitive way for game designers to quickly author gesture-driven games.

### Related Work

Our work extends previous research and commercial efforts in two ways: first, by focusing on appropriating existing everyday artifacts as input devices; second, by introducing flexibility in how real-world input is mapped into game events.

The Nintendo Wii [9] introduces motion sensing as part of a gaming platform. With its focus on gesture control, Nintendo Wii still adheres to traditional video game paradigm of manipulating play through an abstract object (the game controller). Our work leverages motion-sensing technology similar to the Wii, but uses that technology to explore the transformation of everyday objects, rather than gesture based abstract control.

The Guitar Hero game [5] uses a physical object that resembles a real guitar to let players enact the kind of engaging performances familiar from rock musicians. Rather than replications real world objects and familiar actions, our work focuses on reappropriating those objects by putting them to unfamiliar uses.

Some research systems have looked at how to turn play into an engagement with our environment, such as PacManhattan [7] or Uncle Roy All Around You [8]. These projects mostly focus on transforming the urban environment and do not deal with a video gaming scenario per se.

### Conclusion

Building Upon Everyday Play represents a new opportunity for game play. Where the player's environment and own creativity is leveraged to create play opportunities outside of the on-screen game. By utilizing motion as the key data input, we take advantage of the player's physical interactions with the

things around them, resulting in a more pervasive gaming experience.

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