

# The Flo)(ps: Negotiating Between Habitual and Explorative Gestures

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## ABSTRACT

The perceived affordances of an everyday object guide its user toward habitual movements and experiences. Physical actions that are not immediately associated with established body techniques often remain neglected. Can sound activate those potentials for action that remain latent in the physicality of an object? How can the exploration of underused and unusual bodily movements be fostered? This paper presents the *Flo)(ps* project, a series of interactive sounding glasses, which aim to foster social interaction by means of habitual and explorative sonic gestures within everyday contexts. We discuss the design process and the qualitative evaluation of collaborative and individual user experience. The results show that social interaction and personal use require different ways of transitioning from habitual to explorative gestures, and point toward possible solutions to be further explored.

## Keywords

sonic interaction design, gesture, habit, exploration

## 1. INTRODUCTION

What we know how to do strongly affects what we do, what we perceive and what we are willing to do [?]. Given a glass and a pitcher filled with water, we will most likely pour the water into the glass, although its shape suggests many other movements, such as rolling and throwing the object. The latter actions, however, are neglected because we do not associate them with a range of past experiences of using a glass. Abandoning such functionality of an everyday object in the name of exploration and play may be suitable within contexts in which social interaction is at the focus, such as in bars or clubs. How can these existing social experiences be extended by through explorative sonic actions?

As witnessed by our past research [?, ?], the unusual objects within public setting, such as new musical instruments, attract and engage the user in an explorative discovery of its potential for action. In contrast, the use of an everyday object results in the most obvious and expected gestures which are often exploited for engaging interaction. For example, in the *musicBottles* project, the user can play a song by removing the cork from the bottle, providing her with

the sensation of freeing music from the object [?]. Using the bottle as a sound container, the user expression is limited to acting with its cork as an on-off switch. A more explorative sonic interaction with an everyday object can be found in the *Audio Shaker* project where sounds can be mixed by interacting with an ordinary looking cocktail shaker [?]. Users can speak into the object to record sounds, close and shake it to re-mix them and then literally, pour out the sound mix. The potential of the object and its affordances challenge the user's preconceptions about the purpose of the cocktail shaker through an unusual sonic feedback. While the continuity of *Audio Shaker's* feedback allows for a more explorative interaction than the discrete responses of the *musicBottles*, both interfaces engage habitual actions such as opening the bottle or pouring the sound. But how can an everyday sounding object guide the user toward the space of unusual and explorative gestures?



Figure 1: Luminous Flo)(ps glasses with Martini cocktail drinks.

The exploration with novel musical interfaces can be engaged by shaping the coupling between action, sound and object. The material aspects of an interface, such as its shape, weight or texture, afford an energy transfer between the body and the instrument [?]. When interaction with a novel instrument is designed around such physical qualities and without reference to another known object, the user has to explore its potential in order to learn how to generate sounds (for example, see project such as [?]). Such process of learning and discovery is enabled by coupling action to sonic feedback in expected and natural ways as well as in unusual and novel relationships [?]. The individual repertoires of expected couplings are defined through shared, culturally encoded movements and shaped by specific personal skills, such as knowing how to skate or to play an instrument [?]. This existing bodily knowledge may serve as a starting point

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for unusual and novel embodied experience.

## 2. FLO)(PS CASE STUDY

*The Flo)(ps* are a set of interactive glasses designed to explore habitual and explorative sound gestures with everyday objects, and their impact on social and personal interaction within an existing situation (See Figure ??). These glasses sonically respond to habitual actions such as cheering and drinking, but are also activated when certain unusual gestures are performed. Different glasses can establish connection among each other if synchronously moved in a similar manner. Their connectedness is manifested through sonic and light responses which signal to the users that they are affecting the behavior of others glasses. The goal of such performative connectedness is to make strangers play with each other through an everyday object in an embodied, dance-like way.

The concept for connected glasses was one of the results of basic design research in which we explored the relationship between action and sound in the use of mechanical kitchen tools [?]. Our exploration was directed toward revealing the existing action-sound relationships and informing the design of new computational artifacts that produce sound. The results of this research were then applied within the context a project on intimacy in public space, resulting in an ecology of interactive cups that can engage strangers in non-verbal communication [?].

A simplified version of *The Flo)(ps* interface was used in psychological experiments on the emotional impact of sound during the performance pouring task [?]. While within this controlled setting only one action-sound relationship was studied, that of dropping the invisible ice cubes out of the glass, the full version of the interface presented in this paper consists of eight additional action-sound couplings, and added sensing and actuating elements. Also, the focus of this research is the design of the habitual and unusual sonic gestures and the evaluation of their impact on individual and social interaction.

### 2.1 Design

There is a number of multitouch products that exemplify the potential of interactive technology within bar setting [?, ?]. In addition, the robotic glasses presented in [?] showed how the autonomous behavior of an everyday object can engage social interaction. Similarity with the technical and design solutions of *The Flo)(ps* can be found in [?] where the glasses are used within the telepresence application. Other colleagues explored the sonification of kitchen actions including pouring and stirring and argued for the continuity of sound feedback as a key element for engaging embodied interaction [?].

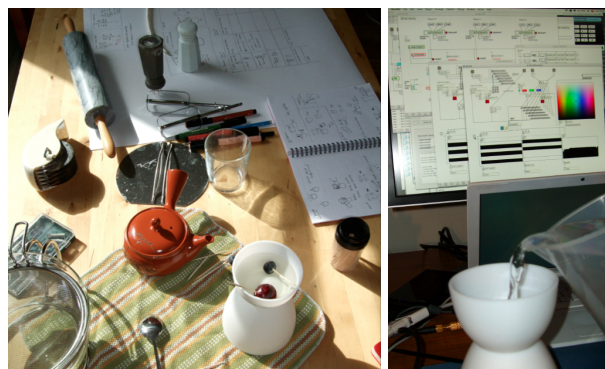
#### 2.1.1 Technical Aspects

The shape of *the Flo)(ps* glass was designed comfortably fit in the hand and intuitively allow for a range of movements such as twirling. The form was modeled in 3D software and extruded with 3D printer (Dimension BST 768) in non-toxic ABS plastic. The lower part of the glass contains the electronics: the Arduino BT board with its shield hosting an RGB LED and three sensors, and the lithium batteries. An analog devices ADXL 320 3-axis MEMS accelerometer captures movements performed with the glass. A piezo-microphone is glued to the shell of the glass in order to capture surface interactions such as the impacts and the scratching. Finally, the Capacitive Sensor Board - AD7746 Breakout measures the level of the water and communicates when the glass is filled with liquid. The sensor data is sent through Bluetooth connection to a remote computer where

it is processed and the real-time sound is synthesized in Cycling'74 Max/MSP. The sound is played back through speakers positioned in the proximity of the glass and embedded in the bar where the drinks are served.

#### 2.1.2 Action-Sound Couplings

The design of action-sound couplings took place through sonic bodystorming where we explored sonic gestures using different objects and materials (See Figure 2). We continued testing our decisions tacitly throughout the design process. In addition to individual use of the object, we also explored the interaction between two people such as throwing the sound toward someone. This helped us decide which habitual and non-habitual gestures should be identified from sensor data and how these should be mapped to different sounds.



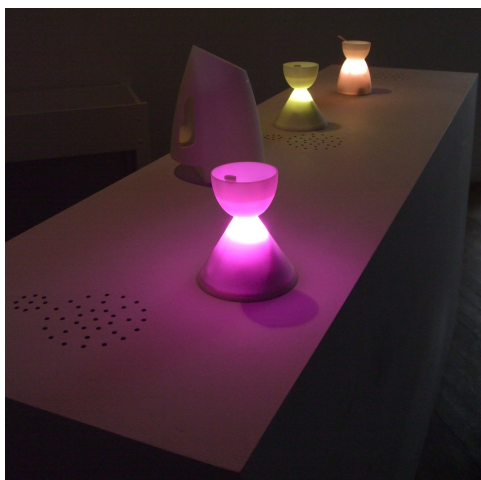
**Figure 2: Sonic Bodystorming: Probing sound concepts by the use of digital and analog means.**

In total eight different gestures were extracted from sensor data. The habitual gestures included filling the glass with liquid, raising the glass, stirring the liquid, drinking and toasting, and the unusual gestures comprised twirling, moving the glass very slowly and shaking the glass. Habitual gestures generated sound of liquids such as pouring or splashing while strange movements opened up unexpected sonic spaces such as the sound of the wind or the rain. The movement of the glass continuously changed the qualities of the sound in order to give the user the feeling of an “ecologic experience”, in the sense of cause and effect behavior found in physical phenomena. For example, tilting the glass would make some virtual water come out and than stop until the user inclined the glass more in order to pour out the remaining water.

#### 2.1.3 Experience Design

The glasses respond to the user only when they are full, and otherwise sit quietly waiting to be filled with the liquid. Once filled, the glasses start to pulsate luminously and emanate the sound of water drops, each in its own rhythm: faster and irregular, slow and in patterns or slow and regular. Different responses aim to communicate specific identity of each glass - one is energetic and nervous, one is slow and relax, one is determined and clear. Their behavior is intended to attract the visitors: as they approach the glass the volume of the sound increases, and once the glass is grasped it fades out. The habitual actions, which are expected to be firstly performed, activate cartoonified liquid sounds or “sounds that caricature some aspects of the events while omitting others.” ([?] pg 14 ). Starting from such existing action-sound repertoires, the user is guided into new movement spaces. For example, twirling the glass activates the sound of the wind. The wind sound grows louder and

more complex if the user continues to twirl the glass.



**Figure 3: The Flo)(ps setup at Oboro gallery with loudspeakers embedded inside the bar.**

The *the Flo)(ps* glasses can affect each others sonic properties when gestures are performed simultaneously. When the movement is synchronous, same light and sound patterns are displayed. The aim of using the light feedback is to establish visual link when users are too far apart from each other. The connective sound responses would become stronger as the users move in the domain of non-habitual movement with the glass. In this way, the users may influence each other's movements through the sonic and light response of the glass. The goal of connected behavior of *The Flo)(ps* is to allow the users to collectively perform and "to dance" with each other encouraged by the response of interactive glasses. For the video presentation of the project please visit the website [?].

## 2.2 Evaluation

Considering that the main goal of the project is to connect strangers through performative acts with everyday objects, the evaluation aimed to reveal the social potential of the system and to gain understanding into individual experience of using *the Flo)(ps* glasses within public setting.

### 2.2.1 Context

The artifacts were exhibited at the Oboro center in Montreal, Canada over three-week period at the International Design Biennale, St. Etienne, France over four-week period. The Oboro exhibition allowed the users to drink beverages from the glasses whereas this was not possible at St. Etienne Biennale due to the large number of approximately 85.000 visitors. Thus, the main evaluation was undertaken by analyzing data collected during the Oboro exhibition.

In this installation, each of the three glasses was associated with an area of the bar below which the speaker was located and chairs were used to keep the visitor's interaction bounded to that designated bar area (Figure 3). Although the exhibition was opened every day, the drinks were served in the late afternoon and evening of each weekend, at the exhibition opening, special events such as Journées de la Culture and special organized visits (e.g. a group of students). These events lasted from two to five hours.

### 2.2.2 Methods

As we have shown in the past, the range of social experiences that emerge within public installations in large part cannot be predicted [?]. Thus, we preferred to qualitatively

evaluate user's natural interaction with the system without any previous instructions, rather than basing evaluation on a specific task which could be quantitatively measured. In order to collect data about the user experience, we deployed questionnaires and direct observation including participant observation, design-adopted video ethnography and the informal interviews [?]. These methods were applied sequentially in order to avoid guiding user experience through questions. Firstly, the visitors interactions were video recorded; then participatory observation combined with informal interviews took place; and finally, the questionnaires were provided after the groups of visitors finished interacting. Thus, the data collected included more than six hours of video recordings, seventeen filled questionnaires and notes from the participatory observation and interviews with participants during the installation.

## 2.3 Analysis and Findings

The average interaction with the glasses took fifteen minutes, although many visitors spend more time within the installation while chatting with friends and drinking from *the Flo)(ps*. The participants statements quoted in the text below are accessible here [?].

### 2.3.1 Social Interaction

Overall, the findings about the social dynamics emerging around the objects proved to be best defined from the analysis of the video material and the insights gained through informal interviews. A number of patterns were seen to emerge and some of the social phenomena that were noted include:

- *Mirroring and Synchronizing*: Participants were observed to mirror each other's movements, especially when someone discovered a new sonic behavior, as if learning from each other.
- *Non-verbal Communication*: Overall, the glasses succeeded in enhancing non-verbal communication. One visitor wrote that: "It is socially engaging because you don't have to talk to connect with strangers since you are already linked by the sound you are making and also the gestures". Another visitor described sound as "an extension of body language";
- *Collaborative Music Performance* was observed, as groups of three participants aimed to collaboratively compose sounds. This often led them to ignore the programmed sound and light connections as they focused on musical improvisation;
- *Simple Sonic Play* such as creating sound of clinging glasses by toasting was repeatedly performed. Participants appeared to enjoy the simplicity and predictability of the direct feedback. However, this sometimes appeared to limit further exploration of interactivity;
- *Curiosity and Discussion*: Participants proposed different interpretations of the objects and explanations for their use. Discussions about using the object to simplify the work of the waiters or as a seduction tool arose;
- *Ambient Display*: During the play and performance with the objects, participants would stop to talk to someone while enjoying their drinks. The glasses would fade into the background until the user's attention was drawn back to their responses.

These observations show that the installation forged interaction between strangers, by engaging them with sonic and light gestures. The light feedback appeared to have a stronger connection effect than the sound response which often appeared to be too complex to interpret. The use of light feedback rhythmically varying in color and luminosity had an important role in establishing contact and was necessary when the surrounding soundscape grew louder.



Figure 4: The empty Flo)(ps used as a musical instrument, without reference to habitual gestures.

### 2.3.2 Individual Experience

The subjective aspects of the experience were best described within the questionnaires and in participants reflections collected during the informal interviews. The following findings emerged:

- *Expressive Solo Performance:* Most visitors experienced the object as an expressive instrument that engaged playful interaction. However, when they interacted alone, the rhythm of the performance slowed down and they were able to more carefully explore the behavior of the object;
- *Exploring the Unusual:* Participants found it difficult to link unusual sounds such as those of the wind to the glass. However, they were satisfied that the sound continuously responded to their gestures and created new unusual experience. One visitor wrote: “swirling it in a slightly less habitual and functional manner, it opens up an unusual sonic space. The splashing sound seems to gain in resonance. Soon after a deep howling, evocative of a storm, becomes amplified.” [?];
- *Limited by Habits:* Few participants stated that certain assumptions about what should be done with the glass affected their experience. One participant wrote: “I was more focused on solitary interaction. I guess I assumed that all that could be done with the glasses could be done alone.”. Small deviations from habitual events, such as toasting with glasses of different materials (i.e. plastic glass with the sound of crystal one), were well accepted by the participants, but may have limited their explorations;
- *More Dynamics:* Visitors who played for a short time period said that the sounds should evolve or change more often. The sounds did not evolve sufficiently if only habitual gestures were performed;
- *Introspection and Intimacy:* Many visitors who were alone in the installation used the glass as a kind of relaxation tool. They were observed to stare at the drink being illuminated by the light or to slowly twirl

the glass while listening to the sound of the rain or the wind. One visitor wrote: “They remind me of candles. It would be cool if they reacted to the stress in your palms.”;

- *Strangeness:* Several comments suggested that the sounds confer the sense of strangeness. Participants associated sounds to “an imaginary chemistry lab”, “stalagmite space”, “a damp basement” and “outer space”. Others however linked them to personal memories such as “Playing in bath as a kid” or sensations like “the sounds make me feel like I am underwater”.

When performing individually, the participants were more attentive to sensuous responses of the system. They engaged more deeply with exploring the transitions between habitual and unusual gestures while providing different interpretations for the sonic and luminous behavior of the glass. The results show that the distribution of the attention of the user is the key to moving between different types of interaction offered by the system. Although the user interaction cannot be predicted, the spaces in-between the solitary and collective performance and between habitual and unusual gestures should be better choreographed.

### 2.3.3 Discussion

The presence of liquid in the glasses showed to be highly significant in affecting and constraining the way in which users interact with the glasses, and the ways in which they perceive them. In the setting where the glasses were activated even when no liquid was in them, the glass was immediately interpreted as a musical instrument, a toy or a magical device (See Figure 4). This raised a question of how to balance the expressivity and the existing functionality of an everyday object.

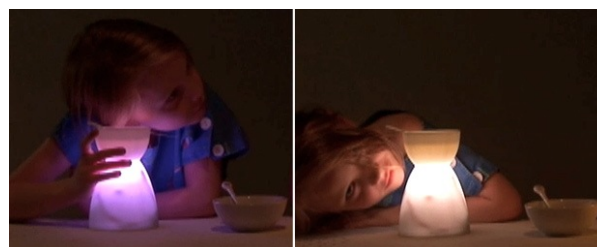


Figure 5: A girl listening to the sounds.

The usability issues emerged when too many people were present in the location as the participants could not hear the sounds well (See Figure 5). Also those who left the bar area that was linked to their glass had difficulty hearing and associating the sound source to the actions they performed. However, they continued to play by relying on the light feedback. The integration of the speaker in the body of the glass is necessary in order to improve usability and to conduct exploration within real-world context such as a dance club or a cafe.

Some visitors expressed desire for simpler and clearer sound responses. The clarity of interaction may be improved by reducing the number of gestures and by using simple gestures such as rhythmical patterns or large movements such as raising the glass, both of which showed to be preferred by the participants due to their clarity. However, prudence is required as reducing the temporal evolution of sonic feedback to direct responses only may lead to on-off behavior which could quickly bore the user. In fact, those participants who had interacted alone desired to hear more complex sonic behaviors. Thus, one solution to be tested is

to apply simple behaviors when more people are using the glasses and more complex ones when a solo interaction take place.

### 3. CONCLUSION

We have described the design and the qualitative evaluation of the use of *The Flo*(ps interactive glasses that aim to stimulate connectedness among strangers through sonic movement. The goal was to explore the space in-between the habitual and unusual action-sound interactions with an everyday object. We observed that using a familiar object such as a cocktail glass may facilitate the first exposure to its interactivity, but it may also limit the exploration of its behavior due to the assumptions about their use. Our findings show that such objects can engage users in non-verbal communication, especially if the action-sound relationships are simple. Strategies for the transition between habitual and experimental actions still remain to be explored. In this direction, the next steps for *The Flo*(ps project will focus on the more abstract sonic feedback for habitual actions in order to break the sonic expectations of the user and facilitate unusual gestural interaction.

Strangeness may be the key to exploring the boundary between the familiar and the unknown gestures, as witnessed by this reflection of one of the *The Flo*(ps users: "As I become immersed in my experimentation with the drinking glasses, their familiarity gradually becomes odd to me, in the way a word can gradually acquire a strangeness if we repeat it over and over again. This turn from familiarity to estrangement allows for a rediscovery" [?]. It is our hope this project raised questions and awareness that such playful and embodied reflection can be stimulated and sustained through novel sonic experiences within our everyday contexts.

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