TastyBeats: Making Mocktails with Heart Beats

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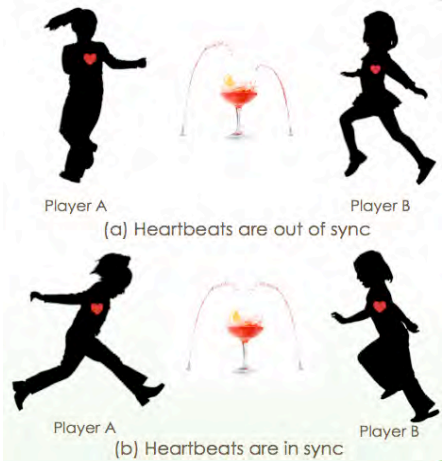

Figure 1: *TastyBeats* runs through the heart rate value of the players: The height of the fluid stream depends on the heart rate value of the player.

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Abstract
The heart not only represents love and emotions. Its measurement is also essential to evaluate fitness. However, visualizing heart rate so far has been limited to virtual screens with restrictive interaction, thus providing us an opportunity to develop a new interactive visualization scheme. With the PumpSpark Fountain Development Kit, we see an opportunity to create a personalized drink using the measured heartbeat data of an individual during physical activity. We describe a prototype system called TastyBeats where one or two participants engage themselves in a fluidic spectacle of creating a mocktail that matches their heartbeats. Our work expands the view of visualizing physical activity beyond virtual screen by providing a real-time and interactive visualization of heart beat data. The TastyBeats induces an active engagement of the player with representation of personal heartbeat in the form of a mocktail created by mixing different flavors together.

Author Keywords
Physical activity; biofeedback; fluid interaction.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

With the rapid advancements in sensing technologies, there has been a growing interest in using technologies that sense and collect bodily responses to physical activity to support self-monitoring and reflection on physical activity [5]. For example, devices like heart rate monitors inform users about their exercise intensity by measuring the heart rate during a physical activity session. However, most of these devices utilize the virtual screen based output for communicating the measured bodily response (biofeedback) to the user. For example, most of these devices send the measured data to applications installed on the phone. These applications then provide user with a portrayal of physical activity using various information visualizations techniques [2,5,6]. The virtual medium is beneficial for data visualization because of its interactive capabilities (such as zooming into data) and support for dynamic updates on the data. However, the "picture under the glass" effect [11] caused by flat 2D display surface of the virtual medium limits the experience, as argued by Vande Moere [11]. Ullmer and Ishii [10] argue that the virtual mode of information entirely focuses on the visual form and neglects other senses. Ishii reminds us that "*our visual and auditory sense organs are steeped in the sea of digital information, but other bodies remain imprisoned in the physical world*."

In this paper, we advocate fluidic representations of physical activity, supported by Microsoft PumpSpark Fountain Development Kit [8] to exemplify this thinking of going beyond virtual representation. We present a system, *TastyBeats,* which creates a unique personalized drink by using the measured heartbeats of an individual engaged in physical activity. Rather than simply mixing different flavors together based on one's exertion (efforts), with Microsoft PumpSpark FDK we see an opportunity to create a fluid spectacle that celebrates the experience of being physically active. Additionally, a fluid fountain is more public and visible and also can be touched, explored, and even tasted; thus confirming the essential aspects of materiality with physical activity [4]. As a consequence, we believe, this public rendering of the physical activity data could reveal new aspects of engagements with physical activity and thus could encourage designers to ponder upon new forms of interactions supporting the experiences of physical activity.

Related work

In the past, there have been few attempts of utilizing fluid interfaces to support various interactions. For example, Wantabe [12] created Vortexbath that utilizes tangible interactions with water in common areas like kitchens and toilets to enable playing videos and browsing photos on a water-based interface. A similar idea was proposed by Mine *et al.* [7] to control the interaction and blending of multiple video streams through the physical mixing of water at different temperatures. An exhibition, "The Water Table", a water channel display of variable speed water flows allows children to interactively play with a stimulating display [9]. There also exist playful fluid interactions [3]. Inspired by these approaches, we got motivated to create a fluidic representation of physical activity – to allow user to ponder upon physical activity and also to explore the opportunity to create and taste a drink based on one's own heartbeats.

TastyBeats: Proposed system

TastyBeats is water fountain installation where the heartbeat patterns of individuals engaged in a physical

Flavor	Heart rate zone and range
Green (Pineapple)	Recovery zone (40 - 80 BPM)
Yellow (Mango)	Aerobic zone (81 -120 BPM)
Blue (Aqua)	Anaerobic zone (121 – 160 BPM)
Red (Cranberry)	Speed zone (161 – 200 BPM)

Table 1. The flavors are decided based on the heart rate zones.

Figure 2: A user receiving a mocktail as a reward for her interaction with the TastyBeats system.

activity are utilized in the creation of mocktail drink. The details steps are as follows.

We first select four flavors (Green, Yellow, Blue and Red) each representing a one heart rate zone as shown in Table 1. Currently PumpSpark FDK is not food rated, so we are using food colors and a simulation of the drink instead). The chosen flavors are then inserted into the four containers each representing a different zone of the heart rate. An empty glass is kept at the center. The user, involved in a physical activity, provides his heartbeat value by interacting with the pulse sensor device for 1 minute. The pulse sensor device follows a thumb-based interaction and provides momentous value of the heartbeat. The user is free to perform any sort of physical activity, ranging from exercising to playing to being involved in physical interaction with her loved ones, which results in a variation of her heartbeat value. The recorded heartbeat value is then mapped to a specific fluid stream based on the heart zone it falls in. As her heart rate changes and shifts among the zones, drink from the corresponding container in pumped into the glass as shown in Figure 3. The process stops after a minute when the glass is full User can enjoy her personalized drink based on her heartbeat (See Figure 2).

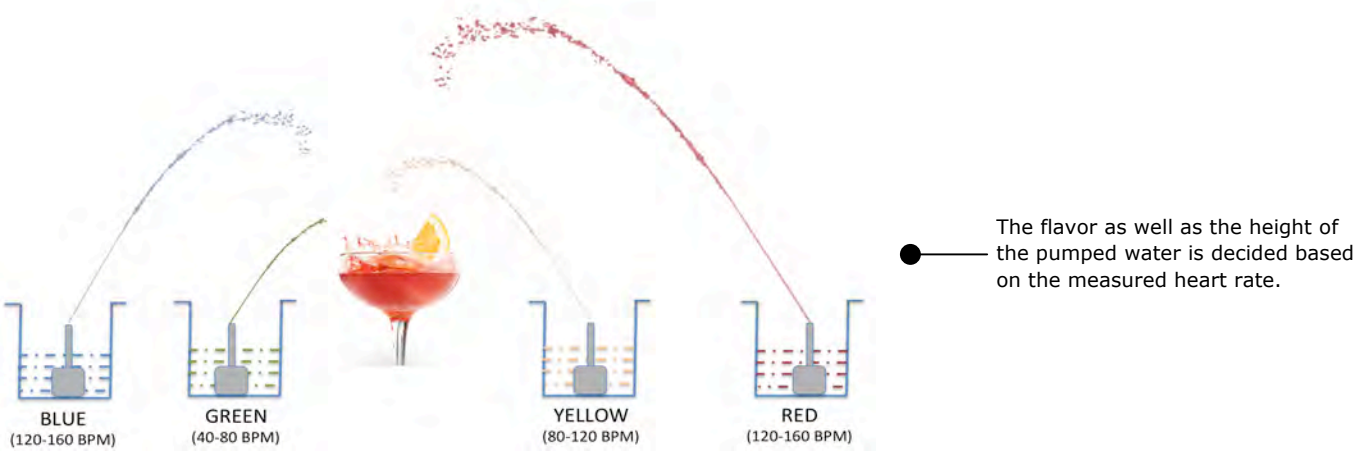

Figure 3. In TastyBeats, user creates a mocktail drink by mixing different flavors together, using his heart rate as control parameter.

Envisioned interaction

We envision the following modes of interaction with TastyBeats.

Personalized energy drink for increased recovery

Energy drinks are often used to replenish lost energy during/after an exercise. Using TastyBeats system, an athlete can prepare an ideal energy drink where the ingredients are decided based on different factors (such

Figure 4: An athlete can prepare a personalized drink using the TastyBeats system that helps to replenish lost energy during physical activity. The ingredients will be based on the amount of physical activity measured using heart rate.

as intensity, type and duration) of physical activity she was involved in (see Figure 4).

Shared spectacle of heartbeats

Friends can engage themselves in a game of creating a drink that matches their chosen flavors (see Figure 1). Each player first chooses her favorite drink and fills the container with it. A glass is placed at the center and each player then tries to fill the glass with her selected drink. The fluid flow from the container is based on the measured heart rate of the player. If the player's heart rate is high, more drink will be pumped from her container into the glass. The players who empties her container first, is declared as the winner.

Visualizing heartbeats in a fluid form

TastyBeats can also work as a real-time fluid visualization of heart rate data. Users who practice exercises such as yoga and meditation can get benefit through the TastyBeats system: its calm fluid interface could allow deeper reflection on their thoughts and activities for rest of the day. A constantly flowing water fountain can represent the variations in the heart rate, e.g., a user when relaxing during a physical activity would see the water fountain reacting accordingly with decreased water intensity being pumped out in the air. This provides an analogy of bodily energy released in the form of water intensity of the fountain and a reflection of self-activity to the user.

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