EdiPulse: Turning Physical Activity Into Chocolates

Rohit Ashok Khot
Exertion Games Lab
RMIT University, Australia
rohit@exertiongameslab.org

Ryan Pennings
Industrial Design,
RMIT University, Australia
s3378565@student.rmit.edu.au

Florian 'Floyd' Mueller
Exertion Games Lab
RMIT University, Australia
floyd@exertiongameslab.org

Figure 1: EdiPulse turns heart rate data into a chocolate using a chocolate printer.

CHI'15 Extended Abstracts, Apr 18-23, 2015, Seoul, Republic of Korea
ACM 978-1-4503-3146-3/15/04.
http://dx.doi.org/10.1145/2702613.2725436

Abstract
We present EdiPulse that creates 3D printed chocolates displaying cheerful messages using the heart rate data of physical activity. Our work expands the view on representing physical activity data through the use of edible materials such as chocolates, which additionally serves as a hedonic reward for doing the physical activity. Ultimately, with this work, we aim to inspire and guide design thinking on food printing, which we believe opens up new interaction possibilities to support the physical activity experience.

Author Keywords
Physical activity; edible representations; food HCI.

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

Introduction
With rapid advancements in sensing technologies, we are witnessing a growing interest in using technologies to support health and wellbeing. Supporting this trend, various self-tracking devices have emerged in recent years that track previously invisible data such as bodily responses to physical activity for the purpose of self-monitoring and reflection [7]. However, most of the physical activity data such as heart rate is abstract in

nature and do not hold a one to one mapping with any real world object. As a result, it becomes the responsibility of designers to create appropriate visual mappings for such data so that the end users can easily grasp this information and make this gained knowledge actionable towards their health or fitness related aims.

Previous works in the field of HCI have looked at different visualization techniques [4,7,8], however, their emphasis on using such data has been on increasing awareness of the users about their physical activity and motivating them to achieve their set goals. Additionally, these systems have predominantly used the screen as a medium for communicating information. For example, Polar heart rate monitors [11] offer numerical and graphical representations of one's physical activity data through a mobile app. In academia, Consolvo et al. [4] have used the smartphone home screen to visualize individual physical activity in the form of a garden that flourishes with increased physical activity; Lin et al. [8] has created a virtual fish tank on a public shared screen where the step count of every individual is mapped to a specific fish and the fishes get healthier based upon the individual activity.

Although screen has benefits of real time updates and easy affordability, however, its two dimensional input and output unit limits the interactive capabilities of the user to just reading the information; thus deserting other human senses. Additionally, as self-tracking devices are becoming pervasive in everyday context, what we design with them should not be limited to just increasing awareness about individual's physical activity levels. We believe that there is a need to approach visualization from a different angle, giving users the opportunity to utilize the collected personal data for variety of other purposes. Our exploration start by asking the question, Can we cook our food based on how much we have exerted during a day? If yes, how would such a food influence the user experience with physical activity? Motivated by this idea, we present *EdiPulse*, a system that transforms heart rate data of physical activity into 3D printed messages made up of chocolates. This work extends our previous work [6], where we explored representations of physical activity data using 3D printed material artifacts. In this work, we use edible materials such as chocolates, which additionally serves as a hedonic reward for doing the physical activity. Moreover, we believe that using food will enhance the user engagement with physical activity as it offers a multisensory experience combining vision, touch, smell and taste [9].

Opportunity with edible mediums

In recent years, "Human Food Interaction (HFI)" [3] is becoming a popular field of research within HCI community. Majority of the existing works focus on different food practices (such as how we grow, shop, cook, eat and dispose food) and how such practices are related to physical health [2,3,14]. However, the use of food as an edible representation of physical activity data has not been explored much; thus opening up new possibilities of interactions and engaging experiences. Recent advancements in digital fabrication technologies with devices like food printers and laser cutters provide a good starting point to create digitally enhanced food [13]. These devices use food as a material to create edible artifacts from digital designs. For example, Fukuchi et al. [5] invented laser cooking that uses laser cutter and image processing techniques to cook food according to the shape and composition of ingredients

Figure 1: Each zone maps to a different thickness value for the printed letter.

Figure 3: EdiPulse prints cheerful messages to positively enforce participation in physical activity.

allowing new tastes and textures to emerge. Qkies [12] is another system that embeds QR codes on cookies, while Wei et al. [15] created a system that supports food-based messaging between friends and loved ones.

We find quantified self technologies and food printing as an intriguing combination where the first provides information about how much of energy has been expended in a physical activity, while the later focuses on the novel ways of producing food (energy). We believe that it holds an exciting premise for supporting physical activity experience. As a starting point, we choose to create edible representations of personal data using material such as chocolate. We use chocolate because it is "*culturally understood as the symbol of love, packaged with high emotions to inspire feeling of self indulgence and hedonistic ecstasy*" [9]. Owing to its high calorie and sugar content, some may argue against using chocolates as a reward for physical activity, however, we feel that this fact makes our research more intriguing in understanding how users will react to and accept such representations, e.g., will users eat it or throw it away or give it to someone as a token of their heart?

What is EdiPulse

EdiPulse is a 3D modeling system that transforms heart rate data of physical activity into a cheerful 3D printed message in the form of a chocolate. The printed message in chocolate acts as a hedonic reward to positively reinforce participation in a physical activity. The duration of physical activity will define the message length, while the intensity of physical activity defines the thickness of the letters in the message. For example, for an active day, the system will print a longer message with thick letters such as "well done, champ!" or "U rock!" (Figure 3), while for a sedentary day, the system will print messages composed of thin letters such as "never mind". In the current prototype, we maintain a database of such cheerful messages of length up to 20 letters. The working of the system is as follows:

Before starting a physical activity, the user wears a Polar H7 heart rate monitor around her chest and starts the Polar Beat app on her mobile. This app records the heart rate data and saves it to the Polar website from where we download the data in XML format. The EdiPulse application (written in JavaScript) then parses this XML data and identifies a heart rate zone pattern in which the recorded heart rate values fall in. We have used four heart rate zones, each corresponding to a different level of exercise intensity. These zones are: 1) recovery zone with heart rate value in the range 50-80 beats per minute (bpm), 2) Aerobic zone (81-120 bpm), 3) Anaerobic zone (121-160 bpm), and 4) speed zone (161-200 bpm). We discard the heart rate values below 50 bpm and above 200 bpm as they rarely occur. Based on the duration of the physical activity, the system randomly picks up a message from the database and prepares a 3D model of it using OpenJSCAD [10]. The identified pattern of heart rate zones in the measured data then defines the thickness of each letter in the chosen message. Each zone has a different thickness value corresponding to the number of chocolate layers to be added, while 3D printing the letter on the print bed (as shown in Figure 2). For example, zone 1 (recovery zone) having a thickness value 1 will add one layer of chocolate, whereas zone 2, 3 and 4 will respectively add 2,3 and 4 layers of chocolates on the letter. The prepared 3D model of the message is then printed using a Chocolate Printer [1].

The user is free to taste or share the printed chocolate with someone else. In EdiPulse, the user receives a chocolate reward along with a cheerful message even though she has not performed much of a physical activity. However, as user performs various physical activities, the amount of reward increases. In order to get rich amount of chocolate as a reward, the user might get inspired to do exercise differently and to try out new forms of exercise. For example, user might be interested in figuring out how the pushup exercise would reflect in the design as compared to jogging? What message would I get? We believe such questions would inspire the user to exercise more and be creative with her exercise. As a result, we envision that it would lead to an engaging experience.

Interactive Experience at CHI

At CHI 2015, we will invite participants to create their own version of 3D printed chocolate displaying the message "CHI 2015", which will be given to the attendee as a souvenir.

References

[1] Choc Edge, http://chocedge.com.

[2] Choi, J., Linehan, C., Comber, R. and McCarthy J. Food for thought: designing for critical reflection on food practices. In *Proc. DIS '12*, ACM, 793-794.

[3] Comber, R., Choi, J., Hoonhout, J. and O'hara, K. Editorial: Designing for human-food interaction: An introduction to the special issue on 'food and interaction design', *IJHCS*, 2014, 72(2), 181-184.

[4] Consolvo, S., McDonald, D. and Landay, J. Theory-driven design strategies for technologies that support behavior change in everyday life. In *Proc. CHI'09*, ACM Press (2009), 405-414.

[5] Fukuchi, K., Jo, K., Tomiyama, A., and Takao, S. Laser cooking: a novel culinary technique for dry heating using a laser cutter and vision technology. In Proc. workshop on Multimedia for cooking and eating activities (*CEA '12*). ACM, 55-58.

[6] Khot, R., Hjorth, L. and Mueller, F. Understanding physical activity through 3D printed material artifacts. In *Proc. CHI '14*, ACM (2014), 3835-3844.

[7] Li, I., Dey, A., and Forlizzi, J. Understanding my data, myself: supporting self-reflection with ubicomp technologies. In *Proc. UbiComp '11*, ACM Press (2011), 405-414.

[8] Lin, J., Mamykina, L., Lindtner, S., Delajoux, G. and Strub, H. Fish'n'Steps: Encouraging physical activity with an interactive computer game. In *Proc. Ubicomp'06*, Springer (2006), 261-278.

[9] Lupton, D. Food, the Body and the Self. London: SAGE Publications Ltd., 1998.

[10] OpenJSCAD, http://openjscad.org.

[11] Polar heart rate monitors. http://polar.com.

[12] Qkies; http://qkies.de.

[13] Schoning, J., Rogers, Y., and Kruger, A. Digitally Enhanced Food. *IEEE Pervasive Computing*, 2012, 4-6.

[14] Spence, C. and Piqueras-Fiszman, B. Technology at the dining table. *Flavour*, 2013, 2 (1), 16.

[15] Wei, J., Ma, X., and Zhao, S. Food Messaging: Using an Edible Medium for Social Messaging. In *Proc. CHI'14*, ACM (2014), 2873-2882.