Future of Food in the Digital Realm

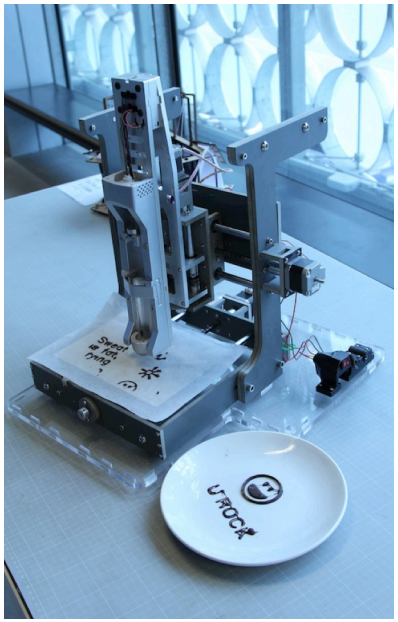

Figure 1: Food printing turns digital designs into edible artifacts and offer opportunities for exciting interaction experiences.

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CHI'17 Extended Abstracts, May 06-11, 2017, Denver, CO, USA
ACM 978-1-4503-4656-6/17/05.
http://dx.doi.org/10.1145/3027063.3049283

Abstract
In recent years, Human Food Interaction (HFI) as a field of research has gained currency within HCI with a focus on how we grow, shop, cook and eat food using digital technologies. Advances in food printing technologies add an extra dimension to these established practices. Research is needed to understand how food printing technologies may affect our practices and relationship with food. This SIG meeting is structured to give HCI researchers an overview of current food printing practices and to discuss grand challenges associated with digital food. Our aims are to develop a stronger community surrounding digital food technology and Human Food Interaction (HFI) and help to move these fields forward via timely discussion and the sharing of successes and challenges. Participants will also engage in playful activities around food and will have an opportunity to create and taste 3D printed chocolates, helping them learn and debate the opportunities that exist with digitally printed food.

Author Keywords
Food printing; human food interaction; vision-driven research; critical food design.

ACM Classification Keywords
H.5.2

Food printers:

[1]ChocEdge http://chocedge.com
[2]Bocusini http://bocusini.com
[3]Foodini
http://naturalmachines.com

Other important websites:

[4]3D food printing conference
https://3dfoodprintingconference.com/

[5]3Digital Cooks (food printing community)
http://3digitalcooks.com/

[6]Smoothfood.
http://smoothfood.de/

[7]Cultivator
http://ig.hfg-gmuend.de/Members/aaron_abentheuer/meine-projekte/cultivator

[8]Edible Growth
http://www.chloerutzerveld.com/#/edible-growth-2014/

Introduction & Background

Food is one of the fundamental ingredients of life. We cannot go a day without it before experiencing discomfort. Food also has a rich cultural and social history. Its preparation as well as consumption provides opportunities for bonding and interaction among individuals [5,7]. How we grow, cook, eat and dispose of food are therefore some of the important questions actively discussed within the HCI research community [1]. Advances in food printing technologies [9] add an extra dimension to these established practices and offer opportunities for new interaction experiences. Research is needed to understand how they may affect our practices and relationship with food.

Food printers are a special form of 3D printers that allow creation of edible artifacts from digital designs. Current food printers[1,2,3] use viscous materials (e.g. cheese, marzipan, dough and chocolate) and powdered substances (e.g. sugar) to fabricate food. Food printing offers benefits in terms of customization, convenience and novelty. For instance, food printing can potentially connect cooking with digital information, so that traditional recipes can be replaced by 3D print models. One day, supermarkets may offer digital sketches of food recipes that users can download and print at home using a food printer, rather than selling prepared food products. People have also identified food printing's potential for contributing to food sustainability[7,8], personalized nutrition and the alleviation of world hunger by reducing food waste and using materials that would otherwise not be eaten, such as algae and insects. [9]

Food printing is relatively new, costly and often a bit clunky. Attempts are currently being made to improve the efficiency and usability of food printing techniques [4,5]. Researchers are also exploring application domains to which food printing can contribute. For example, food printing has been used to create easy-to-eat food for the elderly[6] and to offer personalized activity treats from data [8]. Despite these efforts, food printing is still confined mostly to hacker and makerspaces and many identified uses of fabricated food are still in the development or visionary stages. Further HCI research has the potential to provide therefore a better understanding concerning how to accommodate a future with digital food.

Addressing this issue and using food printing as an exemplar of the digital food movement, we have structured this SIG meeting on the topic of the future of food in the digital realm. We aim to use this SIG to bring together researchers and practitioners from multiple disciplines including personal fabrication, design and creative practice, quantified self, food design, health and nutrition, and physical visualization, in order to:

1) Develop a mutual understanding of competing/related issues around digital food.
2) Discuss potential solutions and concepts that contribute to future research directions and requirements.
3) Help shape the research community within HCI centered on food based technology design.

This SIG meeting would be divided into three parts.

HCI Challenges:

1) Printing with multiple foods

2) Tensions around individual's perception of digital food and food creativity

3) Effect on traditional culinary practices

4) Personalized nutrition

Figure 2: Food printing affords turning of digital data such as someone's heart rate into edible artifacts.

SIG meeting Schedule

Part 1: Introduction to food printing (20 Minutes)
We will start the SIG with a technical introduction to food printing. We will sketch out details on the tools currently available and also plan to conduct a short hands-on demonstration with a food printer[1] that we will bring along. Seeing the printing in situ will also help participants to gain insights on the limitations and benefits around different parameters of food printing e.g., temperature of food material, the time needed to print the model etc.

Part 2: HCI challenges for food printing (40 Minutes)
As a second part, we will outline some challenges and expected trends with regards to food printing. An intensive discussion of the requirements, trends, and challenges in printing food will help researchers to gain a suitable overview and may provide the basis for new research ideas and projects. The key challenges that we will discuss during this SIG are:

1) Printing with multiple foods: Food printing is still difficult. Further efforts are required to make food printing user-friendly. Printing with multiple food materials is also a challenge. Printing with one kind of food material — for instance, chocolate — is fine, but when we aim to mix different foods as we do in a traditional cooking, the process is far more complicated. It becomes difficult to predict how different foods will fare when combined, because cooking times and temperatures can vary across different food materials.

2) Tensions around individuals' perceptions of digital food & food creativity: Food printing can alter the shape, texture and flavor of food in unique and creative ways, but these changes do not necessarily contribute to palatable or attractive-looking food or an edible item that is considered socially or culturally acceptable to consume. For example, Lupton and Turner [8] found that the unknown nature of 3D food printing inspires suspicion on the part of consumers. Because they associate 3D printing technologies with inedible substances, the idea of fabricated food can be strange and difficult to accept. Such food is considered unnatural, and therefore, unacceptable to eat. Critical design projects such as Edible Growth[8] attempted to ameliorate these preconceptions by 3D printing meals from healthy and sustainable ingredients. However, further efforts are needed to confront and extend people's perceptions of printed food while being creative in the offerings.

3) Effect on culinary practices: The rise of food printing as a means of cooking food is also of major significance. For some people, a food printer might be a welcome addition to their kitchen, while for others it might not be. How and in what ways food printing may affect traditional culinary practices is an important point to consider.

4) Personalized nutrition: The amalgamation of food printing technology with quantified self (QS) technologies offer interesting new opportunities to define the future of our meals and dining experiences. For instance, food can be printed based on one's measured energy expenditure (Figure 2). The nutritional value of food can also be customized to a macro level, allowing users to individualize the amounts of protein and carbohydrates in their meals [2]. However, there are still considerable barriers in social and cultural access, usability, and implementation of

such novel technologies into the everyday life of common consumers.

Part 3: Hands-on food printing (20 Minutes)
We will conclude the SIG with a fun hands-on activity around food. We will bring printable food items and involve participants in mimicking the process of food printing by hand. By engaging participants in this hands-on activity, we aim to unveil new ideas and tactics that might test or outstretch the capabilities of the existing printing technologies.

Learning Objectives

This is the first time that we are consolidating knowledge on the food based technology design. We are a cross-disciplinary team with expertise in related areas of interest to food printing. We have also previously led SIG [3, 4] and workshops of this kind at CHI, which attracted full houses. By the end of the SIG, participants will have an understanding of current research and open challenges in food printing within HCI. Participants will be able to take this understanding forward to their own research practices, potentially starting their own research projects on food printing. We will create a blog that will serve as a platform to deliver updates on the recent advances in food printing. We will also invite weekly or monthly write-ups on the blog from participants to maintain their interest as well to create a digital archive on digital food technologies.

References

1. Rob Comber, Jaz Hee-Jeong Choi, Jettie Hoonhout, and Kenton O'hara. 2014. Editorial: Designing for human-food interaction: An introduction to the special issue on 'food and interaction design'.*Int. J. Hum.-Comput. Stud.* 72, 2, 181-184. http://dx.doi.org/10.1016/j.ijhcs.2013.09.001
2. Marketa Dolejšová. 2016. Deciphering a Meal through Open Source Standards: Soylent and the Rise of Diet Hackers. In Proc. *CHI EA '16*. ACM, 436-448. DOI: http://dx.doi.org/10.1145/2851581.2892586
3. Florian "Floyd" Mueller, Joe Marshall, Rohit Ashok Khot, Stina Nylander, and Jakob Tholander. 2016. Jogging at CHI. In *Proc. CHI EA '16*. ACM, 1119-1122. DOI: http://dx.doi.org/10.1145/2851581.2886435
4. Florian Floyd Mueller, Joe Marshall, Rohit Ashok Khot, Stina Nylander, and Jakob Tholander. 2015. Understanding Sports-HCI by Going Jogging at CHI. In *Proc. CHI EA '15*. ACM, 869-872. DOI=http://dx.doi.org/10.1145/2702613.2727688
5. Andrea Grimes and Richard Harper. 2008. Celebratory technology: new directions for food research in HCI. In *Prov. CHI '08*. ACM, 467- 476. http://doi.acm.org/10.1145/1357054.1357130
6. Rohit Ashok Khot, Ryan Pennings, and Florian 'Floyd' Mueller. 2015. EdiPulse: Supporting Physical Activity with Chocolate Printed Messages. In Proc. CHI EA '15. ACM, 1391-1396.
7. Deborah Lupton. *Food, the Body and the Self*. London: SAGE Publications Ltd., 1998.
8. Deborah Lupton and Bethaney Turner 2016. Both fascinating and disturbing': consumer responses to 3D food printing and implications for food activism. Digital Food Activism. London: Routledge, in press.
9. Rich McEachran 2014. Food of the future: what will feed 7 billion people? https://www.theguardian.com/global-development-professionals-network/2014/aug/12/insects-algae-lab-meat-food
10. Jie Sun, Weibiao Zhou, Dejian Huang, Jerry YH Fuh, and Geok Soon Hong. 2015. An Overview of 3D Printing Technologies for Food Fabrication. *Food and Bioprocess Technology* (2015), 1–11.