A Feast for The Eyes:

Representing Synesthesia through 3D Printed Artefacts

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Figure 1: 3D-printed visualization of flavour-to-vision synesthesia. Left to right: Synesthetic Cappuccino, Synesthetic Cranberry Sauce, and Synesthetic Chili Mac.

ABSTRACT

Synesthesia is a neurological phenomenon still largely unknown to and misunderstood by many. This project aims to gain an insight into the perceptual experiences of those diagnosed with synesthesia, focusing specifically on flavour-to-vision synesthesia, which cause a person to see abstract shapes, colours, or textures whilst tasting the flavours of food and drinks. In this research, we have developed an original method in 3D design, creating an artefact as a collaborative practice-based research output between synesthetes' sketches and artistic interpretation. By exploring 3D sculpting techniques and treatments of printed materials, we produced a set of three physical artefacts to represent synesthetic perception (see Fig. 1).

CCS CONCEPTS

• **Applied computing** → Arts and humanities; Fine arts.

KEYWORDS

Flavour, Perception, Synesthesia, Sculpture, 3D Printing

ACM Reference Format:
Meijia Wu and Oliver M. Gingrich. 2020. A Feast for The Eyes:: Representing Synesthesia through 3D Printed Artefacts. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference Posters (SIGGRAPH '20 Posters), August 17, 2020, Virtual Event, USA.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3388770.3407429

SIGGRAPH '20 Posters, August 17, 2020, Virtual Event, USA

ACM ISBN 978-1-4503-7973-1/20/08.
https://doi.org/10.1145/3388770.3407429

1 INTRODUCTION

Synesthesia is an uncommon neurological anomaly where one sensory stimulus (e.g flavour) triggers another unrelated sensory experience (e.g vision) [Novich et al. 2011]. The focus of our project is flavour-to-vision synesthesia, this is a rarer subtype of synesthesia allows many synesthetes (people with synesthesia) to become great chefs [Spence et al. 2015; Day 2011]. To date it is still not clear what exactly causes synesthesia [Hupé and Dojat 2015], but synesthetic visions are often compared to the 'Bouba-Kiki Effect' which suggests that humans have innate ability to associate the sharp sound of the word 'Kiki' to a spiky shape, and the deeper sound of 'Bouba' to a more rounded shape [Gallace et al. 2011; Ramachandran and Hubbard 2001]. However, we know that synesthetic experiences are involuntary, immediate, consistent, and idiosyncratic – meaning that the resulting experiences are different for everyone [Cytowic 2003].

2 OUR APPROACH

To understand the perceptual experiences of synesthetes we recruited three qualifying participants locally and online, and conducted 2-week studies involving explorative interviews and visual diaries with three participants. From the sketches provided by the participants we found that all participants synesthetically experience flavours in vastly different ways (see Fig. 2).

We decided to develop multiple designs to emphasize the idiosyncrasy and the possible wide spectrum of synesthetic experiences. For example, based on participant B's results we designed a spoonful of cranberry sauce where the condiment blends into a zig-zagged shape as perceived through Participant B's synesthetic perception.

Inspired by two related works on the representation of synesthesia [Bompas & Parr 2013; Terri Timely 2009], we decided to make use of 3D printing in combination with real props to produce the final artefact, as we believed that a tangible artefact could provide a more intimate and believable experience, and allow more freedom in designing abstract structures. The same artefact design could

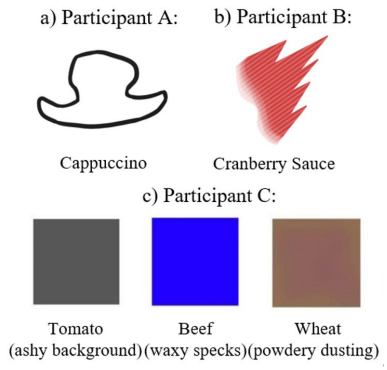

Figure 2: Visual flavour depictions by three synesthetes.

also be easily reproduced for artistic experimentations and improvements – in the case of this project, we were able to try out various printing and painting techniques for comparison, until we arrived at the desired results. For example, we found that glossy spray paints gave the printed models highlights that are similar to grease, while resin produced the most reflective coating that look similar to liquids (see Fig. 3). By creating a combination of these different levels of reflectivity, the sculptures looked more believable.

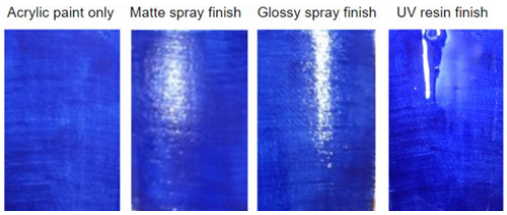

Figure 3: Surface treatments (from left): No surface coating (printed PLA surface painted in blue acrylic paint); coated with matte surface spray; coated with glossy surface spray; coated with resin.

3 IMPLEMENTATION

We began by studying surface textures of real food, and applied them to the design during production through 3D sculpting techniques in Zbrush, as well as Ultimaker's 3D printer settings. In the example of Synesthetic Cranberry, we also applied a gradient between lighter and darker red colours to mimic translucency (because the printed sculpture itself was non-opaque) and subsequently coated its entirety in resin for a jam-like reflectivity (see Fig. 4). Finally, we fitted the sculpture onto a real silver spoon that could be found at home – this would not only reduce the amount of printing time and material cost, but also create a suspension of disbelief with the use of real props.

The same design and production approach were used to produce three different artefacts, representing three different types of flavour-to-vision synesthesia (see Fig. 1 and Fig. 5). The end result is very close to our intended designs, which demonstrates 3D printing's ability to accurately materialise conceptual designs. Through novel methods of 3D design, 3D printing, and surface treatment techniques, we arrived at a tangible and believable representation of a complex perceptual phenomenon.

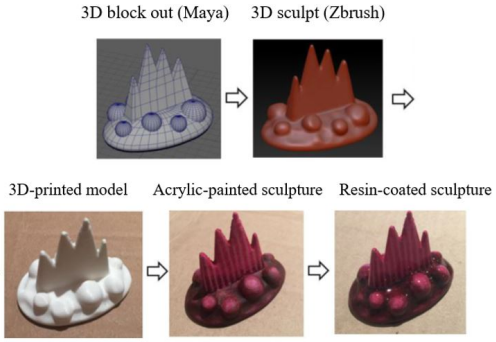

Figure 4: Making of an artefact: combining a participant's synesthetic depictions with the real appearance of its corresponding food item.

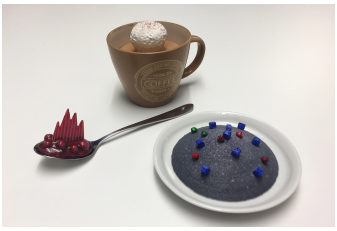

Figure 5: Final artefacts - 'A Feast for the Eyes'.

4 CONCLUSION

The goal of the project was to conceptualise flavour-to-vision synesthesia and find a way to creatively visualize the abstract phenomenon in a way that would be accessible to the general public. We identified the idiosyncrasy of synesthetic experiences and chose to design multiple artefacts based on characteristics found in each participant's visual diary. To our knowledge, we have managed to conceptualise for the first time a 3D-printed, synesthetic flavour-to-vision representation as a practice-based research output. We have represented initial artefact designs with a high fidelity. This research points to future applications in abstract representation of perceptual experiences such as synesthesia.

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