# The Future of Food is on the (Capacitive) Table

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Our environment is increasingly filled with sensors, either local in the smart home, or mobile in smart devices. Besides posting pictures of our meals in social media, this increased sensor density and availability has not really changed how we interact with food. Using electrically conductive material, one can built nearly arbitrarily shaped tangible objects that can be recognized by the capacitive touchscreen in a regular smartphone or tablet. The moisture in food makes it possible to recognize and identify, for example, muffins with a specific base. This is only a first step into a world where food can be used as direct means to interact with the digital world.

CCS Concepts: • **Human-centered computing → Interaction devices**; *Touch screens.*

Additional Key Words and Phrases: tangibles, capacitive touchscreens, baking, pastry

## 1 INTRODUCTION

Over the last years, we have been carrying an increasing number of densely packed sensor devices. What started with the smartphone, has now become a body-area network of wearable devices adding fitness trackers, smart watches, or earables. While this has influenced how we interact with our environment, it has had little influence on how we interact with food, except for taking pictures of our meals and posting them to social media. The capacitive touchscreen we find on these devices is actually a powerful sensor. With full access to the sensor parameters, it is possible to detect a number of objects and even their properties, such as how far a cup is filled [4].

To overcome the lack of physical or tactile feedback of a capacitive touchscreen, there are various projects that looked into the creation of tangibles for such screens. These all build on some electrically conductive material to either create artificial touches or to re-locate touches from the tangible's surface to the screen. Typically, the materials used are copper or aluminium tape, conductive foam, or conductive polymers. However, other materials can be used as well, given they are electrically conductive. The moisture in a baked muffin, for example, makes it conductive enough to be turned into a tangible for capacitive screens [1]. By giving the muffins a specific and unique footprint [2], it will create three "fake" touches, even without the user touching the muffin (as described in [3]). The baking wafers used to create the footprint are edible, but can also be removed if an unaltered taste is desired. As the moisture in the muffin dough evaporates over time, the touchscreen will fail to recognize it after some days, making the Muffidget an edible, ephemeral, tangible interface.

This is interesting for a number of reasons: The recognition and identification of a muffin allows it to unlock information about it when placed on a screen. This can be a personal message for kids at the birthday party, or assigning an owner to a muffin, but can also be of more serious nature, such as showing information on allergens in that specific recipe. The creation of artificial touches can also be used to detect internal parameters of the muffin. The functional principle is the one of a conductive bridge. By forming a line of touches, we can think of a moisture sensor with the distance between the first and the last touch decreasing with decreasing conductivity.

## 2 VISION

While many elements of food are electrically conductive, the intersection with the ones suitable for tangible interaction is much smaller as this mostly boils down to finger-food.

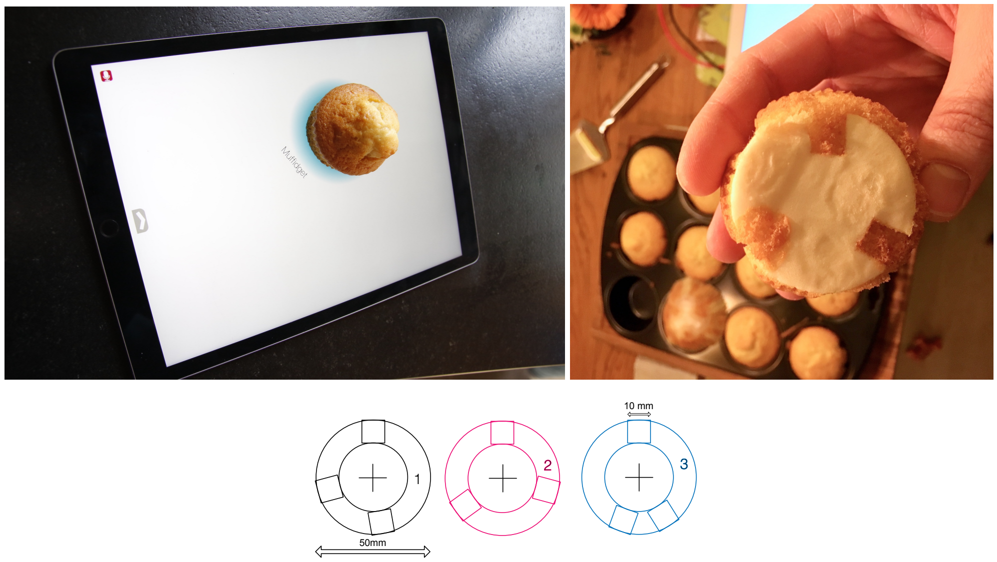


Fig. 1. The Muffidget is a muffin with a specific footprint that can be recognized on a regular capacitive touchscreen. We defined three different patterns, allowing our software to recognize and identify three muffidgets simultaneously.

A precise parametrization of what can be a tangible is necessary for future exploration. For example, depending on the touchscreen calibration, a crust which is rather dry in nature is problematic, but if the inside is moist, recognition might still work, similar to a touchscreen recognizing a finger through a sheet of paper.

While in the case of baking, the footprint of the tangible can be created using a specific inlay or the baking tin being shaped accordingly, creating such a footprint for interactive sushi is more complicated. For such applications, we imagine pre-cut dry crackers that are ignored by the touchscreen to create various footprints making the food accessible to the touchscreen. While this alters how the food is arranged and served, it would remain entirely edible, and possibly opening an entirely new way of serving food. Similar to food sculptures, chefs could embrace the new possibilities of combining food and interactivity. The detection and identification of food on a screen enables animated recommendations on how to eat the creation, enabling a more personal communication between the creator and the consumer, even in larger restaurants.

While this work is still in an early stage, it opens an interesting interaction space. A critical view should be maintained as the tangibles should remain food that people enjoy eating, and not become an interaction device that happens to be edible as an additional feature.

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