Topping Up Digitally – Multiplayer Approach to Preparing a Pizza in Mixed Reality

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Abstract
The preparation of food usually follows a recipe towards a tasty dish. While such a recipe is usually just a guideline for the person cooking a meal for themselves or family, it was sometimes raised to the status of a chemical formula in Taylorist modernism, leading to repeatable dishes branded as trademarks of food franchises. (Preble, 1993) But taste changes; today's consumer is more interested in options and customisable orders. This is underlined by a survey published in the Wall Street Journal, whereas only one in five millennials ever tasted a Big Mac®.(Jargon, 2016) The former flagship burger seems to get less important under ever changing seasonal features and a wider menu then in Taylorist times. The desire for customisability in the food industry can be seen from Coca Cola's printing names on Coke cans to ordering your custom cereals at mymuesly.com or simply personalising your burger at the food delivery service of your choice. This paper tries to follow this trend to an extreme, proposing a computer game-like approach to collaboratively topping up a pizza[1] in virtual reality (VR) and preparing it using an augmented reality (AR) guiding mechanism.

Keywords
virtual reality, augmented reality, pizza, food ordering, discrete

1. The Recipe
Following a recipe is usually the means, by which all of the ingredients are measured, processed and either cooked or baked towards a finished dish. It is often used as a simile to explain the workflow of a planning process to laymen. In an architectural context the recipe stands in for the project drawings, relaying the construction process to the workers on site. The workers gather all the ingredients at the appropriate time and assemble them – following the instructions on the drawings – towards a finished building. This puts the recipe in the preparation part of Food Cycles – the construction phase in a building's life cycle.

This concept of relating a recipe to the erection of a building, of course, oversimplifies the processes on a modern construction site. On the other hand, it also misrepresents the reality of most cooking. A recipe is usually but a rough description of the dish. Often relying on quantities like "a pinch" or the average size of an egg. The distinguished chef takes pride in relating the rough descriptions of quantities and time given in a recipe into a tasty dish. The similarities with the construction process work better when we consider oral or textual transmission of architectural ideas in the middle ages, which would need a master builder to translate them into a finished building. This makes cooking an artisanal form of making, while construction today follows an industrial mode of manufacturing. (Carpo, 2011)

The belief in Taylorist forms of manufacturing in the first half of the twentieth century, led to a design language of the industrial. The highest praise any product could claim, was to be exactly like every other from the same run. This credo of modernism soon became applicable for food and beverages also, started by the Seagram's companies claim "Say Seagram's and Be Sure" for their whisky to have a permanent level of quality – a nice change after the experiences of moonshine whisky in the years of the prohibition. The connection to architecture is made clear when considering, that Seagram's was the client for one of modernisms most iconic projects – the Seagram's building by Mies van der Rohe. (Carpo, 2011) The process of branding the taste and appearance of a product to such a high standard of recognisability also enabled the rise of the modern fast food chain, as made obvious in the 1974

advertisement for the Big Mac®, listing all the ingredients of said burger: "Two all-beef patties, Special Sauce, lettuce, cheese, pickles, onions – on a sesame seed bun."(Clifford, 2008)

Recent developments in industry and marketing have been leading away from Taylorism. Consumers nowadays are more interested in distinguishable products, personalised to their needs if possible. In food consumption this has led to customisable dishes being integrated in the drop-down lists of today's food delivery apps (Lieferando, Grubhub, UberEats). (Samsudin *et al.*, 2011)

This paper further follows these lines in giving a gaming approach to the collaborative design and production of pizza in mixed reality.

2. Digital Design Approach to Topping up a Pizza

Pizza is already one of the most customisable dishes imaginable. Its modular layout with the dough, tomato sauce and cheese as a given, invites to topping it up with all kinds of different ingredients. Especially in online ordering this is taken to an extreme sometimes reinterpreting the dish to include regional ingredients, far departing from Neapolitan origins.

While customers can order any variation of toppings on their pizza, they usually don't have any influence on their distribution. Who wouldn't want to have their pizza quattro stagioni customized with their own seasons? One quarter mushrooms, onions and asparagus, one quarter zucchini, carrots and basil, one quarter spinach, ham, mushrooms and pepperoni and just to indulge in some perversion one quarter anchovies, pineapple and corn.

A more practical aspect is the consideration of dietary requirements of a user. An online profile could contain information like vegetarianism, veganism, religious food taboos or ingredients that are not to the user's taste. While these can get overlooked easily in a restaurant between ordering and the chef preparing the dish, AR controlled preparation of food, could make certain that undesired ingredients are shunned.

To try and imagine a way of designing a fully customised pizza, we take the existing platform of Project DisCo and build a layer of pizza topping on top of it, enabling users to collaboratively design a pizza in VR. This scenario is applicable to the online ordering market, where more customisability is a competitive advantage. Customers get the ability to design their pizza and order it to the specifications of their 3d-model. The model is streamed over the internet to the restaurant offering the service and given to the chef, who uses it as a reference to top up the pizza. This leaves the customers with exactly the dish they wished for. In addition a robotic process of topping up is imaginable, streamlining the whole process of pizza baking into a digital fabrication workflow, like tested at ETH Zurich for cake design. (Liu *et al.*, 2017)

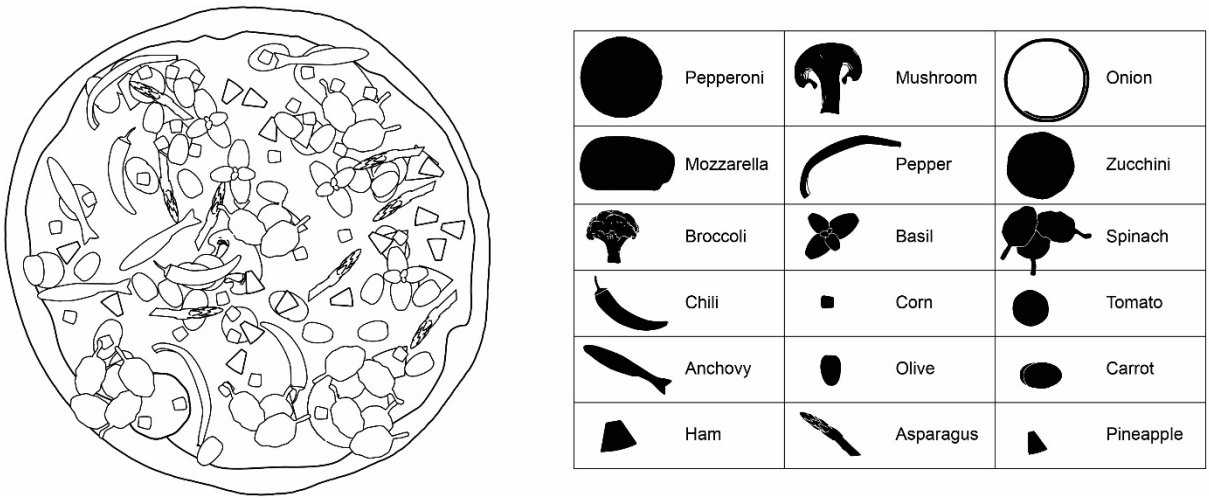

Figure 1. Catalogue of toppings and dough. Authors: Drude & Sardenberg, 2020.

3. Let's Play

Project DisCo[2] is a tool for intuitively assembling modular structures in VR in a bottom-up fashion. Modular building blocks for the assembly can be designed in Rhino/Grasshopper and ported to Project DisCo, where users are prompted with a cloud of said blocks hovering about. They can then be agitated using a manner of choreographed interaction. The blocks snap together when brought in proximity with an aggregating structure.(Drude et al., 2020)

For the purpose of topping up a pizza, we disappropriate Project DisCo into having a catalogue of 18 pizza toppings as building blocks and an empty pizza as the starting point for the aggregation. (Fig. 1) The users then proceed to topping up their pizza in an environment scaled to approximately 20:1, were the pizza becomes the floor while users are immersed within the hovering toppings. (Fig. 2)

Figure 2. Player view in Project DisCo. Authors: Drude & Sardenberg, 2020.

Several filters are accessible to the users, whereby they can decide to only top up certain parts of the pizza or only use certain ingredients. The toppings are set in motion by movements of the VR-controllers, which affect the direction and velocity of the hovering parts proportionally to their movements. The users can thus top up the pizza in a process moderated by game physics, leaving the user as the choreographer of the toppings without placing every piece by hand. The result can then be exported back to Grasshopper, which acts as an intermediate platform to bring the model into CAD to be used as a reference for the actual topping up of the physical pizza. (Fig. 3)

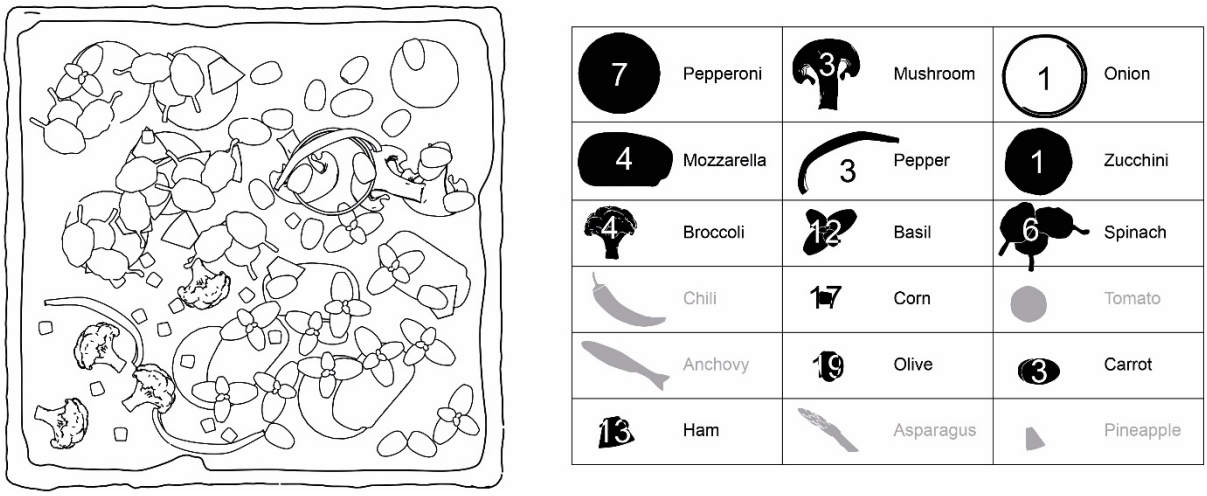

Figure 3. Pizza designed in Project Disco with shopping list. Authors: Drude & Sardenberg, 2020.

To transform the digital model into a dish, we propose an AR approach. For this purpose, we use the Grasshopper plugin fologram[3] (Jahn *et al.*, 2018) to overlay the dough with the digital model of our pizza,

successively prompting us with the right places to put the toppings. (Fig. 4) This utilizes a well-tested form of assembly, where the user's senses are augmented by the device, enabling the placement of parts at pre-planned positions and rotations within the tolerances of the device and human limits of precision. The order wherein the toppings are placed follows an algorithm, that groups the ingredients according to type and successively lets the users place them considering overlapping. Finally, the pizza goes into the oven to be baked at the users' discretion and eaten in due course. (Fig. 5)

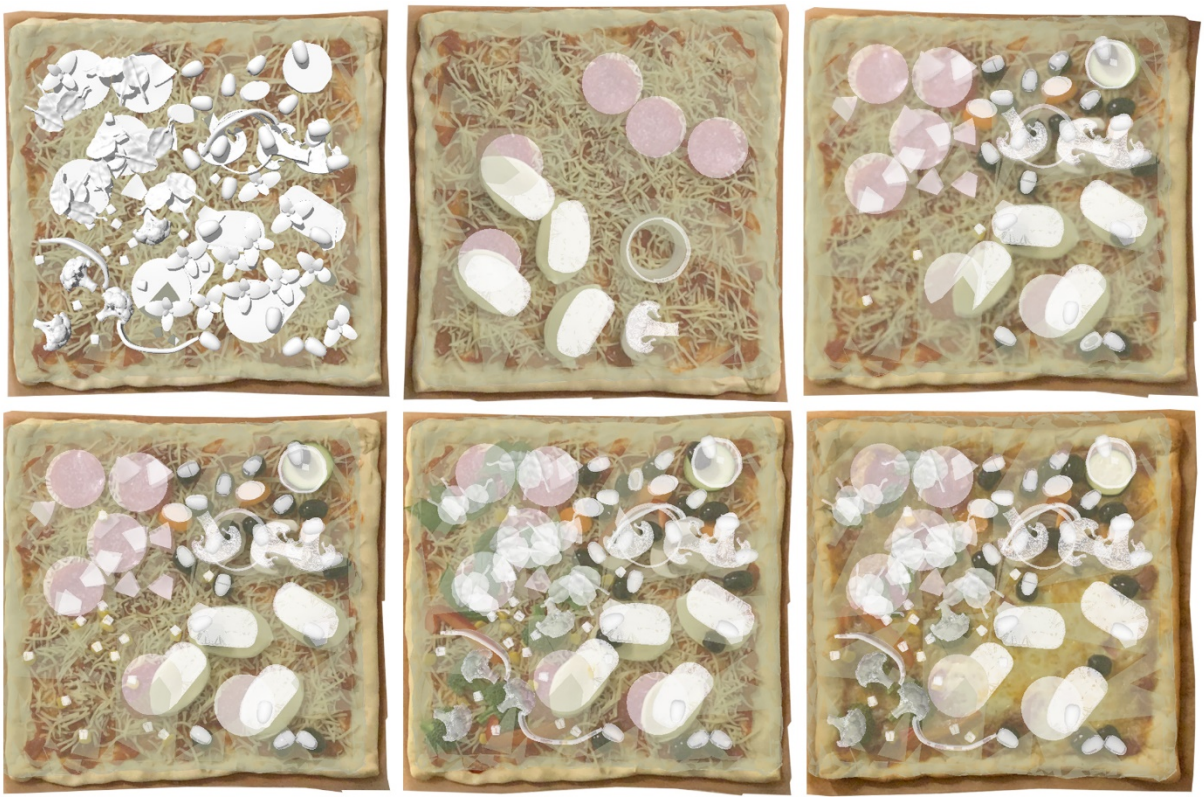

Figure 4. Topping up with AR overlay. Authors: Drude & Sardenberg, 2020.

4. Final Thoughts

The paper takes a contemporary approach to design and fabrication in architecture, using a discrete design system and assembly in AR. Such an approach to digital design and fabrication is currently practised in several universities and employed in a few architectural firms. An example would be the project IBrick created at UCL Bartlett's BPro Research Cluster 9 in 2018, where students created a furniture system out of discrete parts to be assembled with AR assistance. (Cherry, 2018) The work shown in this paper disappropriates this approach of discrete design and AR-fabrication to the realm of food preparation, placing it at the intersection between computation and the design of food.

While it showcases a workable solution for made-to-measure dishes, it wants to be understood as a hyperbole. Using a game-like approach to ordering a pizza is an overly complicated method to receiving a meal and is but a speculative continuation of today's means of ordering. The restaurants with the widest variety of offers and the most sophisticated mechanisms for customisation are usually big chains, which get a lot of return on the investment in a refined system, by using it in a large number of restaurants. For the customer looking for a tasty pizza these large chains usually don't offer the best product, which is why it is the authors' appeal to the reader to skip overly complicated methods of customisation and trust their chef.

Bon appetit.

Figure 5. Pizza design (no basil) – topped-up pizza – baked pizza. Authors: Drude & Sardenberg, 2020.

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Footnotes

1 The computer games from the pizza connection series offer the player the ability to design their own pizza to be sold in their virtual restaurants. The design is mostly 2D and does not offer the ability to export the layout of ingredients. See: https://store.steampowered.com/app/588160

2 Project DisCo is an application to integrate bottom-up aggregation of modular building blocks and intuitive spatial design into Virtual Reality (VR). It allows the designer to choreograph large amounts of building blocks interactively through physics simulations as a means of form generation. It is developed by Jan Philipp Drude. See: https://www.project-disco.com

3 Fologram is an AR interface build on top of Rhino and Grasshopper. It allows users to stream 3D-models to their AR devices, like the Microsoft HoloLens or Smartphones and interact with them through grasshopper scripts. See: https://fologram.com/