Garnish into Thin Air

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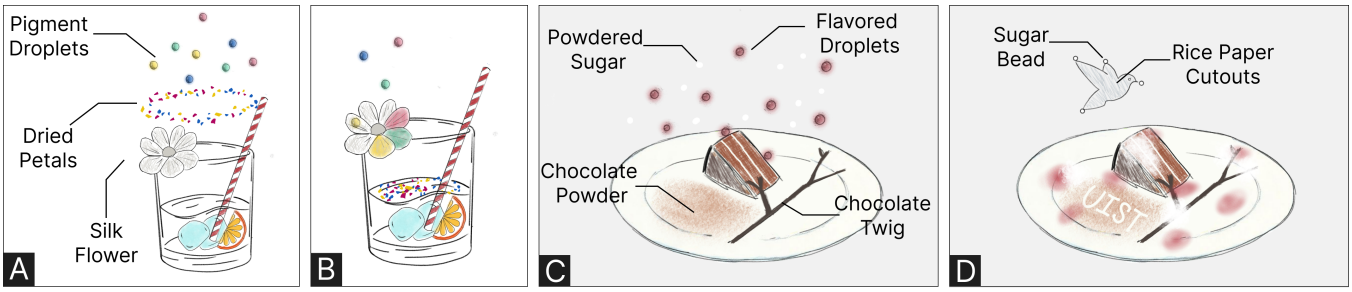

Figure 1: Two demonstrations of Garnish into Thin Air: (1) *The Floral Party*, (A) a glass of cocktail with flower garnish, which features floating pigment droplets, dried petals, and a silk flower. (B) As a guest picks up the glass, the pigments dye the silk flower, and dried petals sprinkle into the glass to add flavor to the drink. ; and (2) *The Winter Twig*, (C) a chocolate cake decorated with mid-air sugar dusting and cranberry jam droplets above. (D) As a guest approaches the plate, sugar and jam drizzle onto the plate, "UIST" magically strokes on the chocolate powder, and a rice-paper bird lands on the chocolate twig.

ABSTRACT

We propose Garnish into Thin Air, dynamic and three-dimensional food presentation with acoustic levitation. In contrast to traditional plating on the dishes, we make the whole garnishing process an interactive experience to stimulate users' appetite by leveraging acoustic levitation's capacity to decorate edibles dynamically in mid-air. To achieve Garnish into Thin Air, our system is built to orchestrate a range of edible materials, such as flavored droplets, edible beads, and rice paper cutouts. We demonstrate Garnish into Thin Air with two examples, including a glass of cocktail named *"The Floral Party"* and a plate of dessert called *"The Winter Twig"*.

CCS CONCEPTS

• **Information systems** → **Multimedia information systems**; • **Human-centered computing** → *Displays and imagers.*

KEYWORDS

Garnishing, Human Food Interaction, Acoustic Levitation, Ultrasonic Transducer

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1 BACKGROUND

The human sense of taste is significantly influenced by their visual perception [5]. Specifically, when food is presented in a more appealing manner, people enjoy it more [13, 14].

Such effect has been extensively utilized in modern days food presentation. A common food presentation technique is embodying pleasing imagery into the dish, such as sculptural vegetable with the shape of cute animals or artistic sketches of sauces. Beyond these static presentations, in recent TV advertisements and food photography, people have brought in dynamic elements such as an exploded view of hamburgers floating on the plate or milk splashes with cornflakes in the air. However, these effects require physical support (e.g., robotic arms or toothpaste) and extra post-editing, hindering their presence on guests' dining plates.

In this project, we bring *garnish into thin air*. We propose using acoustic levitation to make garnishing dynamic and interactive. Past acoustic levitation techniques have already explored various ways to produce visual effects, including 3D raster display, projected holography, and volumetric images [2, 4, 7, 8]. By introducing these techniques to the art of plating and garnishing, we extend the food presentation from 2.5D (i.e., stacking on the plate) to 3D (mid-air), allowing chefs and food presenters to design a dish with a richer and more complex composition. In the meantime, we also explore and fabricate edibles based on previous levitated primitives to make this 3D garnishing not only visually pleasing but also flavor-enhancing.

2 GARNISH INTO THIN AIR

We garnish a cocktail and a dessert into thin air. Figure 1A shows our cocktail named *The Floral Party*. The glass is topped with a silk flower, and there are floating pigment droplets, and dried petals circulate in mid-air. When a guest is about to pick up the glass (Figure 1B), the droplets drizzle down onto the silk flower, dying

the flower into a colorful blossom. Meanwhile, dried petals fall into the cocktail and flavor the whole glass of the drink.

Figure 1C shows our dessert called *The Winter Twig*. A slice of chocolate cake is accompanied by a chocolate twig and chocolate powder on the plate. Meanwhile, the dish is decorated with floating sugar dusting and cranberry jam droplets in the air. As a guest approaches the plate (Figure 1D), sugar and jam drizzle onto the plate, and strokes of "UIST" magically appear on the chocolate powder. Finally, a rice-paper-made bird with sugar beads slowly lands on the twig.

To summarize, our two examples showcase static 3D mid-air decoration, blending and mixing food, remotely 2D sketching and dynamic 3D animation. All these elements enrich visual experiences and span a greater design in food presentation.

3 ACTUATABLE EDIBLES

The key to enabling Garnish into Thin Air is orchestrating plating elements with acoustic levitation. We collected feedback from local bakeries and restaurants about common garnishing materials. Based on prior literature, we summarized a list of edibles that can be actuated by ultrasound transducer arrays in our Appendix A.

Different types of edibles enable different garnish designs, and thus, suitable for different types of gourmet. We mainly explore four: (1) flavored and colored droplet, (2) spicing powder, (3) edible beads and fragments, and (4) edible paper cutouts, which serves as Garnish into Thin Air's repertoire.

3.1 Flavored and Colored Droplet

Manipulating liquid drop has been well explored within acoustic levitation [1, 11, 12]. These techniques allow various garnish design, including mid-air decoration (Figure 1a,c), adding flavor or color to the plate (Figure 1b,d), and triggering droplet-actuated interaction [10], e.g., deforming the silk flower.

Since condiments, pigments, and sauce are nearly indispensable for modern food, such garnish design fits many kinds of different gourmets, e.g., sushi with soy sauce, dessert with syrup, and tequila sunrise with grenadine.

3.2 Spicing Powder

In contrast to droplets and liquid sauce, powder dusting mainly appears in pastry and dessert decorations. The chocolate powder dusting, i.e., the "UIST" text in Figure 1 appears without any physical stroke. This is inspired by Marzo et al. [6], where they remotely draw traces on sands by projecting several focal points on them. Similarly, such techniques allow us to attain dynamic pastry dusting with a wide range of spice powders, such as edible glitter, sugar powder, pepper, salt, etc. Besides on the plate, as shown in Figure 1c, mid-air dusting is also possible by trapping powder with the acoustic potential field, which is heavily based on Ochiai et al. [8, 9]'s mid-air raster display.

3.3 Edible Beads and Fragments

In Figure 1A, "The Floral Party," shattered petals circulate in the air. Their arbitrary shapes and colors add to the richness of the whole cocktail's visual presentation. Similar plating materials include crumbles, chiffonaded herbs, and chopped vegetables. While these edibles are still within the weight range of $5 \times 10^3\ kg/m^3$ (as per [8] with their 100 pcs transducer arrays and levitated ring washers), our garnished plate can be topped with these mid-air floating fragments.

However, to attain more precise mid-air movement with acoustic levitation, spherical edibles are desirable [8]. While prior researchers used white expanded polystyrene beads, there are plating materials with similar weight such as sugar, starch, or chocolate made from a spherical mold. We plan to test these sweet beads' levitability and sensing capability (after being coated with edible luster powder) to allow mid-air motion and even volumetric images [3, 4].

3.4 Edible Paper Cutouts

In Figure 1D, a paper cutout in the shape of a bird flies through the dessert plate. This is enabled by attaching and controlling levitated beads onto it. Inspired by PixieDust [8], Leviprop [7] and ArticuLev [2], which utilized printed papers or fabric cutouts, we attain levitated shapes with edible cutouts, such as edible silk, sticky rice paper, icing sheet, or gold leaf.

By rigging articulated shapes with edible paper cutouts, we can bring animated character and narrative to the garnished plate (e.g., the bird lands on a chocolate twig), adding theatrical experiences to food presentation.

4 LEVITATION TRAY

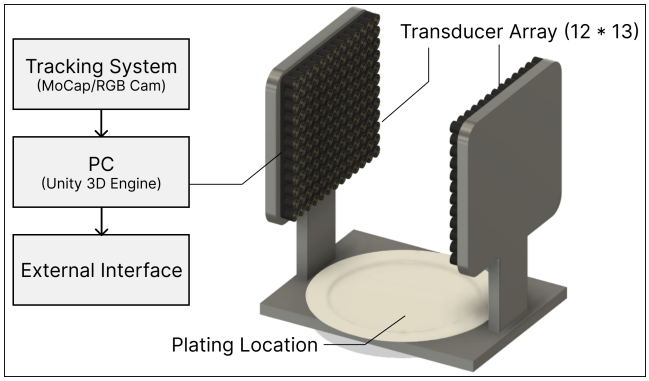

Figure 2: Our levitation tray consists of two transducer arrays face-to-face mounted on the sides of a flat tray for placing containers.

We plan to build a levitation tray using the two provided transducer arrays to support Garnish into Thin Air, as shown in Figure 2. Our primary software system is expected to be implemented in Unity3D Game Engine on our VR-graded laptop to enable easier 3D programming and to test various garnishing applications.

5 POTENTIAL ADJUSTMENT FOR DEMO

After experiments, we will eventually pick most interesting and feasible garnished features for a live demo. Although the proposed demo experience includes a cocktail, we will provide a non-alcohol version. We will also consider additional lighting to optimize visual experiences.

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A ACTUATABLE EDIBLES SURVEY

Edible Type			
Flavored & Colored Droplet	Spicing Powder	Edible Beads & Fragments	Edible Paper Cutouts
Barbecue Sauce	Chocolate	Azuki Bean	Bonito Flakes
Chocolate	Cinnamon	Basil	Edible Fabric
Cocktail Sauce	Edible Glitter	Bonito Flakes	Golden Leaf
Condensed Milk	Garlic Powder	Carrot	Icing Sheet
Edible Glitter	Garlic Powder	Cheese	Sticky Rice Paper
Grenadine	Ginger	Chocolate	Wafer Paper
Guacamole	Luster Dust	Corn	
Honeydew	MSG	Crumble	
Hot Sauce	Oregano	Cucumber	
Juice	Pepper	Dried Petal	
Ketchup	Pigment	Edible Pearl	
Oil	Rosemary	Golden Leaf	
Peanut Butter	Salt	Grass Jelly	
Pigment	Shio Koji	Lays'S Cracker	
Soy Sauce	Sugar	Mung Bean	
Steak Sauce	Thyme	Oat	
Syrup		Oregano	
Vinegar		Pea	
Worcestershire		Pepper	
Yellow Mustard		Pork Flos	
		Ramtil	
		Rice	
		Salsa	
		Seaweed	
		Sugar Icing	
		Thyme	