RUNNING HEAD: SYNAESTHETIC CUISINE

Synaesthesia:

The Multisensory Dining Experience

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RESUBMITTED TO: *International Journal of Gastronomy and Food Science*

WORD COUNT: 11,150 WORDS

DATE: OCTOBER, 2019

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ABSTRACT

The phenomenon of synaesthesia has undoubtedly proved a great inspiration to a number of artists, designers, and marketers for more than a century now. In fact, novelists, poets, composers, and painters, such as Nabokov, Baudelaire, Scriabin, and Kandinsky, all used synaesthetic correspondences to inform their world-famous artworks. By contrast, chefs, the best of whom are increasingly being considered as artists in their own right, rarely seem to reference the condition in their culinary creations. This situation is, though, slowly starting to change, as a small but growing number of innovative chefs take the surprising cross-sensory connections exemplified by synaesthesia, and the related phenomenon of crossmodal correspondences, as a source of culinary inspiration and aid to menu design. Illustrating this new approach, we summarize *Synaesthesia,* a multisensory dining concept that was presented to diners by Kitchen Theory in London in 2015. The recipes for this multicourse tasting menu are provided and a number of the key experimental findings, based on the dishes that were served, discussed. The popularity of this culinary concept highlights the potential of the synaesthesia/crossmodal correspondences approach to stimulate both the chefs as well as the diners they serve. *Synaesthesia* constituted a delicious form of edible 'edutainment'. According to press reports, many diners came away from this tasting menu with their curiosity having been stirred. The hope is that they also learnt something about how their senses function together in order to deliver the rich multisensory experiences of everyday life, no matter whether or not they themselves happened to be synaesthetic.

KEYWORDS: SYNAESTHESIA; ARTISTS; CROSSMODAL CORRESPONDENCES; CUISINE; CHEFS.

Introduction

Synaesthesia has long been linked to the arts (Duffy, 2001); Furthermore, it has long been of interest to marketers (e.g., Allchin, 2013; Meehan, Samuel, & Abrahamson, 1998; Nelson & Hitchon, 1995, 1999; Spence, 2013; Spinney, 2013; see also Bolognesi & Lievers, 2018), and designers too (see Haverkamp, 2014, for a review; though see Spence, 2015a). Academic researchers have also been interested in the putative link between synaesthesia and creativity (e.g., see Chun & Hupé, 2016; Dailey, Martindale, & Borkum, 1997; Domino, 1989; Mulvenna, 2007; Rothen & Meier, 2010; Ward, Thompson-Lake, Ely, & Kaminski, 2008b). According to Grossenbacher and Lovelace (2001), synaesthesia can be defined as a '*conscious experience of systematically induced sensory attributes that are not experienced by most people under comparable conditions.'* Synaesthesia, then, is currently considered to be a rare (though quite how rare the researchers can't seem to agree on) neurological condition in which people automatically experience a specific idiosyncratic sensory or conceptual concurrent on perceiving, or imagining, a particular inducing stimulus (e.g., Cytowic & Eagleman, 2009; Deroy & Spence, 2013a; Simner & Hubbard, 2013).

A century or so ago, artists such as Nabokov, Baudelaire, Scriabin, Sibelius, Degas, and Kandinsky all claimed to be synaesthetes (e.g., Brennan, 2014; Just, 2017; Kemp & Blakemore, 2006). In hindsight, though, it is sometimes hard to figure out which of these novelists, poets, composers, and painters would fit the modern definition of synaesthesia, requiring, as it increasingly does, the criterion-of-consistency (CoC) to be met (Baron-Cohen, Harrison, Goldstein, & Wyke, 1993; Simner, 2012). See also Jewanski, Simner, Day, and Ward (2011; Jewanski, Simner, Day, Rothen, & Ward, 2019) on the early history of synaesthesia research amongst the scientific community. According to the CoC, genuine synaesthetes exhibit precisely the same mappings between the inducer and the concurrent regardless of the delay between testing sessions (even when the delay extends over decades). It has been suggested that a number of artists may simply have been pretending to be synaesthetic at the turn of the 19th century, due to the popularity/trendiness of the condition in that epoch (see Harrison, 2001, for a review). Nevertheless, among contemporary artists, David Hockney, Jimi Hendrix, Pharrell Williams, and Lady GaGa all claimed to be synaesthetic (Brennan, 2014; Massy-Beresford, 2014).

According to one suggestion, the surprising sensory connections experienced by synaesthetes might give them an advantage. It has, for example, been reported that the unusual experiences

of audiovisual synaesthetes tend to be appreciated by those who are not themselves synaesthetic (Ward, Moore, Thompson-Lake, Salih, & Beck, 2008a). Furthermore, it is easy to imagine how the establishing of remote connections between seemingly-unrelated concepts, a signature feature of the synaesthetic condition, would be advantageous in terms of the creative endeavour (Mednick, 1962).

As a growing number of chefs are now starting to be considered artists in their own right (e.g., see Deroy, Michel, Piqueras-Fiszman, & Spence, 2014; Dornenburg & Page, 1996; Spence, in press), the question increasingly becomes one of why it is that there is not an overrepresentation of synaesthetic chefs, or synaesthesia-inspired menus, in the upper echelons of modernist cuisine (Spence & Youssef, 2018). While a few internationally-renowned chefs, such as the sadly-deceased Homaro Cantu (of *Moto* fame) and Heston Blumenthal (of *The Fat Duck* fame) have suggested in print/interviews that they might have had synaesthesia as a child (see Blumenthal, 2008; McQuaid, 2015; Rossant, 2007), it is surprising how few chefs working in the kitchen as an adult report having the condition (Spence, Youssef, & Deroy, 2015b; see also Spence, 2015a). According to Cantu (quoted in Rossant, 2007): *"I think a lot of creativity – synesthesia that I probably had when I was a kid– is bread* [sic] *out of kids."* According to an alternative suggestion, though, only a tiny percentage (c. 1 %) of all synesthetes have sensory crossovers that affect their relationship with food and drink (see Carlsen, 2013; Day, 2005).

> *"But only a very few people — maybe only 1 percent of synesthetes — have sensory crossovers that affect their relationship with food and drink. Jaime Smith is one of those people. He's a sommelier by trade, and he has a rare gift: He smells in colors and shapes. For Smith, who lives in Las Vegas, a white wine like Nosiola has a "beautiful aquamarine, flowy, kind of wavy color to it." Other smells also elicit three-dimensional textures and colors on what he describes as a "projector" in his mind's eye."* (Carlsen, 2013).

One chef, whose approach to menu design might, at least at first glance, suggest synaesthesia (see **Figure 1**), namely Paul Bertolli (2003), turns out, on closer inspection, most probably not to have the condition (see Spence & Deroy, 2012, for a critical evaluation of this particular

case). The only other case that we have come across is that of a pastry chef described by Carlsen (2013).

INSERT FIGURE 1 ABOUT HERE

> *"Atlanta-based pastry chef Taria Camerino also has synesthesia. But for her, synesthesia is more than just an advantage — it's a necessity. Camerino experiences the world through taste. She tastes music, colors, shapes and even people's emotions. She says she has a hard time remembering what things look or sound like, but she can immediately identify objects based on their synesthetic flavors. In addition to working as a pastry chef, Camerino is often asked by clients to make dishes that mimic her synesthetic experiences. She creates "flavor profiles" of things like satisfaction and discontent. She takes inspiration from music to put together nine-course tastings featuring dishes like moss-flavored cotton candy and oyster ceviche. "I move through the world this way all the time," she explains. "If I want someone to understand it, I have to create a dish out of it. I have to make it palatable.""* (Carlsen, 2013).

If there are other synaesthetic chefs, they are certainly not particularly vocal about having the condition. (Note here that in order to assess the actual incidence of synaesthesia amongst chefs, one would, these days not simply want to rely on first person reports, but instead administer some version of the Test of Consistency; see Carmichael, Down, Shillcock, Eagleman, & Simner, 2015). In order to explain why it is that synaesthetic tendencies would appear to be overrepresented amongst those artists working with audiovisual media, but not amongst those working in the world of food and drink, Spence et al. (2015) suggested that there might be something special about the integration of smell and taste. It may, for instance, be that we just respond differently to those creations (artistic or otherwise) that enter our bodies and hence are potentially capable of poisoning us than those that do not (Koza, Cilmi, Dolese, & Zellner, 2005; see also Zampini & Spence, 2005). This suggestion, in some sense running parallel to the question of whether we can ever make a truly disinterested judgment about food, in the way

that genuine aesthetic appreciation would seem to require (see Carey, 2005; Kant, 1892/1951; Monroe, 2007; Spence, in press).

According to Spence et al. (2015b, p. 1), an alternative explanation: *"is that synaesthetic creativity, when expressed in edible form, may simply not be very tasty: As such, the very fact that the fruits of the artist's work are consumed may fundamentally distinguish the culinary arts from other inedible forms of art."* The North American synaesthete, Sean Day, in an article on synaesthetic cuisine, illustrates the problem with one of the synaesthetic (or synaesthesia-inspired) recipes that he outlines: Specifically, the problem that dishes composed on the basis of combinations of ingredients dictated by idiosyncratic synaesthetic inspiration/connections might simply not taste that good (to the rest of the population). For instance, Day (2011, p. 2) describes a dish called Light Cyan Blue that lists chicken breast, vanilla ice cream, vanilla extract, orange juice concentrate, brown sugar, and corn starch as ingredients. One does not need to be a chef in order to realize that this particular synaesthesia-inspired concoction probably isn't going to taste very good. In this sense, then, the unappealing nature of synaesthetic food creations contrasts with Ward et al.'s (2008a) observation, mentioned earlier, concerning the generally positive response that non-synaesthetes seem to have in response to synaesthetes' unusual audiovisual experience.

An alternative explanation as to why synaesthesia does not appear to be overrepresented amongst professional chefs relates to the suggestion that we are, in fact, all synaesthetic in terms of the confusion of smells and tastes (Stevenson & Boakes, 2004; Stevenson & Tomiczek, 2008). However, here it is important to note that there is no clear distinction between inducer and concurrent in the case of sweet-smelling foods, such as vanilla, caramel, or strawberry (though see Auvray & Spence, 2008; Deroy & Spence, 2013b). Potentially relevant here, it is interesting to note how of all the many different types of synaesthesia reported by those who contacted Sean Day's (2005) website (a total of 572 cases), smell-taste synaesthesia (what Day describes as taste-synaesthetic smell or "smelling flavours") never appears. That said, it is worth pointing out here that in the flavour industry, flavourists often talk of smelling flavours (Shankar, Simons, Levitan, Shiv, McClure, & Spence, 2010), on the basis that the majority of what we think we taste we actually smell (see Spence, 2015b, for a review). While we all do undoubtedly experience a number of more-or-less surprising crossmodal connections, or correspondences, between tastes, aromas, and flavours on the one hand, and shapes, sounds, and colours on the other (e.g., Cytowic & Woods, 1982; Deroy, Crisinel, & Spence, 2013;

Spence, 2019; Spence, Wan, Woods, Velasco, Deng, Youssef, & Deroy, 2015a), the shared nature of these mappings across individuals argues against their being synaesthetic. Synaesthesia, remember, is defined by the idiosyncratic mappings between inducer and concurrent. (Rather they would appear to fit the definition of crossmodal correspondences.)

Nevertheless, despite the notable absence of chef/artists claiming to be synaeasthetic (see Spence et al., 2015), it is clear that the phenomenon of synaesthesia, or crossmodal correspondences, has proved a rich source of inspiration for several chefs when creating/organizing their menus (see Bertolli, 2003). That said, while Bertolli talks about organizing a meal and pairing drinks in terms of the pointiness of the shapes that those foods/drinks elicit (see **Figure 1**), he doesn't mention synaesthesia directly. Hence, it is hard to know whether this shape-taste meal organization is a genuine example of synaesthesia or whether instead, as seems more likely, it reflects a rather more intuitive utilization of the shape-taste crossmodal correspondences that are seemingly common to us all (see Spence & Deroy, 2012, 2013, for reviews; though see Bremner, Caparos, Davidoff, de Fockert, Linnell, & Spence, 2013, for somewhat different shape-taste correspondences in the Himba tribe of rural Namibia).

More recently, synaesthesia also constituted the theme for part of another dinner organized by an Indian chef together with experimental psychologist, and former member of the Crossmodal Research Laboratory at Oxford University, Carlos Velasco (see Velasco, Veflen, & Naranjo Agular, 2019b). The event called 'Awaken your senses' involved a multicourse multisensory experiential tasting menu in which two of the dishes linked to synaesthesia/crossmodal correspondences (see **Figure 2**). The event was held at Le15's monthly event called "Table Number 12" where the chefs are able to experiment with a new tasting menu. 'Sonic sip' was a dish that guests sampled twice while blindfolded, once with sour music once with spicy music. The idea was to illustrate the sonic seasoning effect of sour and spicy music on a dish that consisted of both sour and spicy elements. According to Velasco et al. (2019b, p. 14). *"This dish consists of water extracted from fresh tomatoes, blended with seasonal strawberries fermented for 48 hours with Gluconacetobacter kombuchae, and seasoned with home-made grilled pickled jalapeños, lime, raw honey and a hint of garlic vinegar."*

INSERT FIGURE 2 ABOUT HERE

‘Synaesthesia’ was the second relevant dish on the menu consisting of *“oak smoked salmon ceviche, served with a spicy tiger’s milk made with home-made confit tomatoes, ginger, coconut milk, lime and celery salt, topped with puffed flat rice and coriander.”* (Velasco et al., 2019b, p. 14). In this case a saxophonist tasted the dish, and he created a composition designed to “play the sound of the dish”. The musical piece was designed to represent the textures, aromas, and taste/flavour of the dish. Although there was no formal data collection, the diners who tasted the dish as part of the *Awaken your Senses* event reported that *“both dish and music blended well”* and that they *“enjoyed the flavour experience with the music.”* (Velasco et al., 2019b, p. 15). Over the last few years, several other chefs/culinary artists have also developed dining concepts that riff off the synaesthetic theme (see Brennan, 2014; Jordan, 2015; Miller, 2015; http://www.the-eatelier.com/portfolio/synesthetic_dinner/, for other isolated examples).

> *“The link between synaesthesia, art and creativity was explored in a unique dining event staged by an experimental art company based in Birmingham, England. Siân Tonkin and Kaye Winwood - aka* Companis - *are the artists behind the* Scintillating Synaesthetic Supper, *an immersive multi-sensory experience which formed part of the city’s* Flatpack Film Festival. … *“We enjoy the possibilities of confusing the senses or omitting them completely so synaesthesia is very interesting to us in terms of our work.” The five-course supper aimed to demonstrate what it might be like to hear and taste colour in the context of experimental cinema. ….Chefs and a composer were drafted in to match perceived flavours with colours and sounds. … Far from being an exact science, the emphasis was very much on imagining the artistic possibilities of cross-sensory perception in a challenging, thought-provoking but fun way. “The dinner should in no way be misconstrued as a scientifically accurate portrayal of synaesthesia,” says Tonkin. “Rather it was intended as a test-bed for envisaging the sound and taste of colour whilst referring to a genre of experimental film-making.”* (Brennan, 2014).

The world-famous Spanish chef Jordi Roca, of *El Cellar de can Roca,* has also been considering a synaesthetic angle to the creation of one of his dishes. In particular, the chef has

been working with self-styled human cyborg Neil Harbison. According to one description: *"The idea behind the dish being conceived in collaboration was primarily to be able to listen to a plate. Neil's antenna was the perfect technological interface to imitate the construction of an artifact that, in addition to serving as a plate, was able to translate colors into sounds. However, the idea was not to translate the colors of a dessert composed to be heard but, rather, to ground the dessert around sound.*" (Ulloa, 2019, p. 195). According to a summary of the interaction that was reported by Ulloa (2019), Jordi Roca and Neil Harbisson finally presented "The Music of Flavors" to the gastronomic forum Madrid Fusión. However, as Ullua (2019, p. 196) goes on to note: *"Interestingly, however, the instrumental idea proposed by Jordi and Neil has stagnated. As Jordi confessed in an interview in 2017, it has been difficult to move the project forward because it is not easy to cross from expertise in flavor to expertise in sound; they have had trouble making the two speak to each other (Guerrero 2017). Much work is still needed to make a dessert that both sounds and tastes good."* Getting inspired by synaesthesia when creating a new dining experience can, then, be challenging as well as stimulating.

Synaesthesia and crossmodal correspondences

At this point, it is important to note that many of the phenomena studied/presented under the rubric of synaesthesia might actually better be described as 'crossmodal correspondences' instead. According to Spence (2011), crossmodal correspondences can be defined as a tendency for a sensory feature, or attribute, in one modality, either physically present, or else merely imagined, to be matched (or associated) with a sensory feature in another sensory modality. That said, many have confounded the two phenomena (e.g., see Harrison & Baron-Cohen, 1996). Others, meanwhile, have wanted to argue that the two phenomena can be considered as opposite ends of a synaesthetic continuum (e.g., see Martino & Marks, 2001). This undoubtedly remains a contentious issue amongst academics, with some commentators arguing at length about the importance of keeping synaesthesia and crossmodal correspondences, separate (e.g., Deroy & Spence, 2013a, b). That said, to members of the general public, weighing-up whether or not to come along to the latest multisensory experiential dining concept, they are presumably more likely to have heard about synaesthesia than they are to know what exactly crossmodal correspondences refer to. And, what is more, the press always become excited whenever the topic of synaesthesia is mentioned, and hence Synaesthesia was chosen as the name for the culinary concept.

‘Synaesthesia’ by Kitchen Theory

The multicourse Synaesthesia tasting menu organised by chef Jozef Youssef of Kitchen Theory when he was based in Maida Hill Place, London, in 2015 (https://www.kitchen-theory.com/synaesthesia-by-kitchen-theory/). The dining concept, which ran from February to June, and was based on many of the cooking techniques described in Youssef (2013). Importantly, the Synaesthesia dining concept (see **Figure 3**) was very positively reviewed by the academic press/food bloggers (e.g., Fleming, 2015; Rhodes, 2015; https://landonlife.co.uk/2015/03/01/molecular-gastronomy-at-its-best-kitchen-theory/). All of the courses were arranged around the theme of/inspired by synaesthesia. The recipes for the majority of the dishes can be found in Appendix 1, and the underpinning reasoning behind the dishes in Appendix 2.

INSERT FIGURE 3 ABOUT HERE

Once all of the guests had arrived, the meal started off with two short videos, one by Richard Cytowic (specifically his animated TED Talk entitled “What colour is Tuesday? Exploring Synaesthesia”; http://youtu.be/rkRbebvoYqI), the other by Prof. Charles Spence had been specially commissioned for the dining experience. Note that Cytowic, a neurologist by training, is commonly credited with reviving contemporary interest in the topic of synaesthesia with the publication of his bestselling books ‘*Synaesthesia: A union of the senses’* (Cytowic, 1989), and four years later ‘*The man who tasted shapes’* (Cytowic, 1993; see also Cytowic & Eagleman, 2009, for more recent findings).[1] The idea was to provide those guests who had no prior knowledge of with a foundation understanding of what synaesthesia is all about. Meanwhile, Spence’s video interview was designed to highlight the multisensory nature of flavour perception, and also introduce the notion of crossmodal correspondences.

[1] Funnily enough this medic’s interest in synaesthesia was actually triggered by a comment from his neighbour about food; Namely, that the roast chicken that they were cooking had burnt because it had too many points on it (see Cytowic, 1993). Having served what seemed like a perfectly decent roast chicken, the synaesthetic neighbor Michael apologized that *“it’s nearly spherical, […] I can’t serve this if it doesn’t have points.”* (Day, 2011, pp. 392-393).

Research based on the dishes served as part of the Synaesthesia menu

The '4 Tastes' dish was designed to assess the crossmodal correspondences that we all seem to experience between colour and taste. Intriguingly, the diners provided data by arranging the four purposefully randomly-arranged clear spoons (see **Figure 4**), each one containing a colourful spherified liquid. One red, one browny-black, one green, and the last white (see Spence, Wan, Woods, Velasco, Deng, Youssef, & Deroy, 2015a). Intriguingly, versions of the dish have subsequently been served in several different countries, with the recipes adapted to local techniques/ingredients. Intriguingly, more-or-less the same pattern of results (in terms of matching colours to one of the basic tastes) has now been replicated in both Mexico, together with chef Jozef Youssef, and in Porto Alegre, Brazil, with chef Xavier Gamez of Restaurant 260˚ (see Velasco, Michel, Youssef, Gamez, Cheok, & Spence, 2016).

INSERT FIGURE 4 ABOUT HERE

'Bouba and Kiki', the second dish on the Synaesthesia menu builds on an emerging literature on the associations that most people appear to experience between shape properties – such as angularity and roundness and basic tastes (see Spence & Deroy, 2012, 2013, for reviews). Here, it is interesting to note here that Cytowic and Woods (1982) were already assessing the shape properties that people, synaesthetes, chef, and normal participants (see also Velasco, Woods, Petit, Cheok, & Spence, 2016). The dish was presented sequentially as two half plates (see **Figure 5**). The diners were encouraged to match the names 'Bouba' and 'Kiki' to the tastes, textures, and shapes on the two sides of the plate.

INSERT FIGURE 5 ABOUT HERE

The 'Sight and Sound of Flavour' dish was also used in experimental research on plating, specifically preferences for particular plating orientations (Spence, Michel, Youssef, & Woods, 2019a). The dish consisted of white miso velouté, Scottish langoustine poached in beurre noisette, sweetcorn fluid gel, tofu cream, and chilli oil (see **Figure 6**). An image of this dish was uploaded online and participants were invited to pick the orientation of the dish that they would prefer the dish to be served at. The results revealed a clear preference for canonical orientations, especially with the claws pointing at 3 o'clock, or 12 o'clock (see Spence et al., 2019a, for a summary of the results). This particular dish was focused on sound and flavour correlations. A carefully selected piece of music (https://www.youtube.com/watch?v=bznD_ySyw8M) and the accompanying fMRI

visualisation was used as inspiration by the Kitchen Theory chefs to design both a flavour profile and visual presentation. The final dish was developed on the basis of both the existing literature related to the relationship between audio and flavour perception as well as 'culinary intuition'.

INSERT FIGURE 6 ABOUT HERE

The 'Marinetti – Cubist Vegetable Patch' dish was served with a textured black cube while, once again, not turned into an experiment, nevertheless highlighted the link with the Italian Futurist, F. T Marinetti and his Futurist Cuisine (Marinetti, 1932/2014). Marinetti's proposed (and, on occasion, executed) dishes explored some of the surprising links between the senses with syn-tactilissmo, and syn-olfactissmo (see Spence, 2017a). To accompany the savoury dish (see **Figure 7**), copies of the Futurist cookbook had been arranged on the middle of the table. Subsequent to the serving of this dish, we have been experimenting with the impact of texture (see Biggs, Juravle, & Spence, 2016; Carvalho, Moksunova, & Spence, submitted; Wang & Spence, 2018). Chef Jozef Youssef has also developed this in a very multisensory whisky tasting (see Chambers, 2015). The latest research, in other words, definitely suggests that Marinetti and his fellow Futurists really were on to something.[2]

INSERT FIGURE 7 ABOUT HERE

The 'Give Weight to it' dish (see **Figure 8**) also played on synaesthetic connections/crossmodal correspondences between weight and lightness on the one hand and elevation on the other (see Sunaga, Park, & Spence, 2016, on the lightness-elevation crossmodal correspondence; and Velasco, Adams, Petit, & Spence, 2019a, on basic-taste elevation crossmodal correspondences). The dish also used cotton candy / candy floss, one of the early modernist techniques (see Spence, Corujo, & Youssef, 2019).

INSERT FIGURE 8 ABOUT HERE

The 'Believe Nothing of What you Hear' dish was a dessert dish based on the emerging literature of sonic seasoning (Spence, 2017b), specifically the matching of taste to sound (see **Figure 9**). Note that this is an area of growing research interest in recent years (see Spence, Reinoso-Carvahlo, Velasco, & Wang, 2019b, for a review). Not only do certain sounds match

[2] Relevant here on the theme of syn-tactilissmo, the synaesthetic artist Kandinsky (1977, p. 45) points out that some colours are described, in a tactile sense, as rough or prickly, while others are smooth and velvety.

specific tastes, aromas, textures, and flavours but the taste/flavour of food and drink can be systematically modified simply by playing the appropriate sonic accompaniment.

INSERT FIGURE 9 ABOUT HERE

Conclusions

Ultimately, therefore, while the synaesthetic theme has undoubtedly been a popular topic/source of inspiration for artists, designers, and marketers for a century or more, it has yet really to catch on amongst chefs. That said, there are insights/inspiration to be had, at least if one broadens one's definition to include the often-confused theme of crossmodal correspondences. As the growing number of synaesthetic dining concepts outlined here (see Brennan, 2014; Fleming, 2015; Jordan, 2015; Miller, 2015; Rhodes, 2015; Velasco et al., 2019; http://www.the-eatelier.com/portfolio/synesthetic_dinner/) make clear, one does not necessarily need to be a synaesthete in order to find inspiration in the surprising connections that we all make between tastes, aromas, textures, and flavours on the one hand and colours, sounds, and shapes on the other. (Indeed, as far as we can tell, neither of your authors are, or ever have been, synaesthetes.) At the same time, however, it is important to recognize the fundamental difference between those creations, be they artistic or otherwise, that enter the body and those that do not. It is for the latter reason, that synaesthesia may better serve as inspiration for non-synaesthetic chef or culinary artist than for the synaesthetic creative of the kitchen to try and illustrate their own unusual sensory connections in edible form.

REFERENCES

Auvray, M., & Spence, C. (2008). The multisensory perception of flavor. *Consciousness and Cognition*, **17**, 1016-1031.

Allchin, J. (2013). Heston Blumenthal on sensory marketing: Heston Blumenthal on what brands can learn from chefs and the wisdom of synaesthetic marketing. *Marketing Week*, **May 1st**. https://www.marketingweek.com/heston-blumenthal-on-sensory-marketing/.

Baron-Cohen, S., Harrison, J., Goldstein, L. H., & Wyke, M. (1993). Coloured speech perception: Is synaesthesia what happens when modularity breaks down? *Perception*, **22**, 419-426.

Bertolli, P. (2003). *Cooking by hand*. New York, NY: Clarkson Potter.

Biggs, L., Juravle, G., & Spence, C. (2016). Haptic exploration of plateware alters the perceived texture and taste of food. *Food Quality & Preference*, **50**, 129-134.

Blumenthal, H. (2008). *The big Fat Duck cookbook*. London, UK: Bloomsbury.

Bolognesi, M., & Lievers, F. S. (2018). *How language and image construct synaesthetic metaphors in print advertising*. Unpublished manuscript.

Bremner, A., Caparos, S., Davidoff, J., de Fockert, J., Linnell, K., & Spence, C. (2013). Bouba and Kiki in Namibia? A remote culture make similar shape-sound matches, but different shape-taste matches to Westerners. *Cognition*, **126**, 165-172. http://dx.doi.org/10.1016/j.cognition.2012.09.007

Brennan, J. (2014). What's the taste of colours? Food and synaesthesia. *Fine Dining Lovers*, **June 3rd**. https://www.finedininglovers.com/stories/synaesthesia-food-event/.

Carey, J. (2005). *What good are the arts?* London, UK: Faber & Faber.

Carlsen, A. (2013). Some people really can taste the rainbow. *The Salt*, **March 18th**. http://www.npr.org/sections/thesalt/2013/03/12/174132392/synesthetes-really-can-taste-the-rainbow.

Carmichael, D. A., Down, M. P., Shillcock, R. C., Eagleman, D. M., & Simner, J. (2015). Validating a standardised test battery for synesthesia: Does the Synesthesia Battery reliably detect synesthesia? *Consciousness and Cognition*, **33**, 375-385.

Carvalho, F. M., Moksunova, V., & Spence, C. (submitted). Cup texture influences taste and tactile judgments in specialty coffee evaluation. *Food Quality & Preference*.

Chambers, M. (2015). Think you know how to taste whisky? Think again... *The Huffington Post*, **September 23rd**. http://www.huffingtonpost.co.uk/matt-chambers/think-you-know-how-to-taste-whisky_b_8183010.html.

Chun, C. A., & Hupé, J.-M. (2016). Are synesthetes exceptional beyond their synesthetic associations? A systematic comparison of creativity, personality, cognition and mental imagery in synesthetes and controls. *British Journal of Psychology*, **107**, 397-418.

Cytowic, R. E. (1989). *Synaesthesia: A union of the senses*. New York, NY: Springer.

Cytowic, R. E. (1993). *The man who tasted shapes*. USA: G. P. Putnam's Sons.

Cytowic, R. E., & Eagleman, D. M. (2009). *Wednesday is indigo blue: Discovering the brain of synesthesia*. Cambridge, MA: MIT Press.

Cytowic, R. E., & Wood, F. B. (1982). Synaesthesia II: Psychophysical relations in the synaesthesia of geometrically shaped taste and colored hearing. *Brain and Cognition*, **1**, 36-49.

Dailey, A., Martindale, C., & Borkum, J. (1997). Creativity, synesthesia and physiognomic perception. *Creativity Research Journal*, **10**, 1-8.

Day, S. (2005). Some demographic and socio-cultural aspects of synesthesia. In L. C. Robertson & N. Sagiv (Eds.), *Synesthesia: Perspectives from cognitive neuroscience* (pp. 11-33). New York, NY: Oxford University Press.

Day, S. A. (2011). The human sensoria and synaesthetic approach to cooking. *Collapse*, **VII**, 378-409.

Deroy, O., Crisinel, A.-S., & Spence, C. (2013). Crossmodal correspondences between odors and contingent features: Odors, musical notes, and geometrical shapes. *Psychonomic Bulletin & Review*, **20**, 878-896.

Deroy, O., Michel, C., Piqueras-Fiszman, B., & Spence, C. (2014). The plating manifesto (I): From decoration to creation. *Flavour*, **3**:6.

Deroy, O., & Spence, C. (2013a). Are we all born synaesthetic? Examining the neonatal synaesthesia hypothesis. *Neuroscience & Biobehavioral Reviews*, **37**, 1240-1253.

Deroy, O., & Spence, C. (2013b). Weakening the case for 'weak synaesthesia': Why crossmodal correspondences are not synaesthetic. *Psychonomic Bulletin & Review*, **20**, 643-664.

Domino, G. (1989). Synesthesia and creativity in fine arts students. An empirical look. *Creativity Research Journal*, **2(1-2)**, 17-29, 37-41.

Dornenburg, A., & Page, K. (1996). *Culinary artistry*. New York, NY: John Wiley & Sons.

Duffy, P. L. (2001). *Blue cats and chartreuse kittens*. New York, NY: Henry Holt and Co.

Fleming, A. (2015). Quick bites: Culinary synaesthesia, a feast for the senses. *The Guardian*, **February 20th**. http://www.ft.com/cms/s/0/2be19458-b7bd-11e4-981d-00144feab7de.html.

Grossenbacher, P. G., & Lovelace, C. T. (2001). Mechanisms of synesthesia: Cognitive and physiological constraints. *Trends in Cognitive Sciences*, **5**, 36-41.

Guerrero, B. (2017). Jordi Roca: "Ahora muchos jóvenes pagan lo mismo por un partido de la Champions que por una buena mesa" [Jordi Roca: Now many young people pay as much to watch a Champions League match as for a good meal]. *Cambio 16*, **October 29th**. www.cambio16.com/lifestyle/jordi-Roca.

Harrison, J. (2001). *Synaesthesia: The strangest thing*. Oxford, UK: Oxford University Press.

Harrison, J., & Baron-Cohen, S. (1996). Acquired and inherited forms of cross-modal correspondence. *Neurocase*, **2**, 245-249.

Haverkamp, M. (2014). *Synesthetic design: Handbook for a multisensory approach.* Basel, Switzerland: Birkhäuser.

Jewanski, J., Simner, J., Day, S., Rothen, N., & Ward, J. (2019). The "golden age" of synesthesia inquiry in the late nineteenth century (1876–1895). *Journal of the History of the Neurosciences*. DOI: 10.1080/0964704X.2019.1636348

Jewanski, J., Simner, J., Day, S. A., & Ward, J. (2011). The development of a scientific understanding of synaesthesia from early case studies (1849-1873). *Journal of the History of the Neurosciences*, **20**, 284-305.

Jordan, A. (2015). A meal for the senses: Dining out at a restaurant for synaesthetes. *The Long+Short*, **June 11th**. https://thelongandshort.org/society/synaesthesia-a-meal-for-the-senses.

Just, D. K. (2017). Was Kandinsky a synaesthete? Examining his writings and other evidence. *Multisensory Research*, **30**, 447-460. https://doi.org/10.1163/22134808-00002547.

Kandinsky, W. (1977). *Concerning the spiritual in art, especially in painting* (trans. M. T. H. Sadler). New York, NY: Dover Publications.

Kant, I. (1892/1951). *Critique of judgment*. New York, NY: Haffner.

Kemp, M., & Blakemore, C. (2006). Hearing colours, seeing sounds. Wassily Kandinsky's paintings go on show in London. *Nature*, **442**, 514.

Koza, B. J., Cilmi, A., Dolese, M., & Zellner, D. A. (2005). Color enhances orthonasal olfactory intensity and reduces retronasal olfactory intensity. *Chemical Senses*, **30**, 643-649.

Marinetti, F. T. (1932/2014). *The futurist cookbook* (Trans. S. Brill, 1989). London, UK: Penguin Books.

Martino, G., & Marks, L. E. (2001). Synesthesia: Strong and weak. *Current Directions in Psychological Science*, **10**, 61-65.

Massy-Beresford, H. (2014). How we all could benefit from synaesthesia. *The Guardian*, **April 26th**. http://www.theguardian.com/science/2014/apr/27/benefit-synaesthesia-brain-injury-mental-decline.

McQuaid, J. (2015). Why there are hardly any super chefs with synesthesia, the strange sensory mixups many artists share. *Forbes*, **October 15th**. https://www.forbes.com/sites/johnmcquaid/2015/10/15/why-there-are-hardly-any-super-chefs-with-synesthesia-the-strange-sensory-mixups-many-artists-share/#7ad32a51b43b.

Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, **69**, 220-232.

Meehan, M., Samuel, L., & Abrahamson, V. (1998). *The future ain't what it used to be: The 40 cultural trends transforming your job, your life, your world*. New York, NY: Riverhead Books.

Miller, B. (2015). Artist invites public to taste colour in ten-day event with dancers and wine at The Oval. *Culture 24*, http://www.culture24.org.uk/art/art516019-artist-invites-public-to-taste-colour-in-ten-day-event%20with-dancers-and-wine-at-the-oval.

Monroe, D. (2007). Can food be art? The problem of consumption. In F. Allhoff & D. Monroe (Eds.), *Food and philosophy* (pp. 133-144). Oxford, UK: Blackwell Publishing.

Mulvenna, C. M. (2007). Synaesthesia, the arts and creativity: A neurological connection. In J. Bogousslavsky & M. G. Hennerici (Eds.), *Neurological disorders in famous artists – Part 2* (Basel, Karger). *Frontiers in Neurology and Neuroscience*, **22**, 206-222.

Nelson, M. R., & Hitchon, J. C. (1995). Theory of synesthesia applied to persuasion in print advertising headlines. *Journalism & Mass Communication Quarterly*, **72**, 346-360.

Nelson, M. R., & Hitchon, J. C. (1999). Loud tastes, colored fragrances, and scented sounds: How and when to mix the senses in persuasive communications. *Journalism & Mass Communication Quarterly*, **76**, 354-372.

Rhodes, E. (2015). A synaesthetic dining experience. *The Psychologist*, **28**, 90-99. http://thepsychologist.bps.org.uk/volume-28/february-2015/synaesthetic-dining-experience?utm_source=Kitchen+Theory+Pop-up+mailing+list&utm_campaign=8ac96db6ef-Synaesthesia_final_dates4_28_2015&utm_medium=email&utm_term=0_2f81822279-8ac96db6ef-189613837&goal=0_2f81822279-8ac96db6ef-189613837.

Rossant, J. (2007). Homaro Cantu: Interview. http://superchefblog.com/2012/02/07/homaro-cantu-interview/.

Rothen, N., & Meier, B. (2010). Higher prevalence of synaesthesia in art students. *Perception*, **39**, 718-720.

Shankar, M., Simons, C., Levitan, C., Shiv, B., McClure, S., & Spence, C. (2010b). An expectations-based approach to explaining the crossmodal influence of color on odor identification: The influence of temporal and spatial factors. *Journal of Sensory Studies*, **25**, 791-803.

Simner, J. (2012). Defining synaesthesia. *British Journal of Psychology*, **103**, 1-15.

Simner, J., & Hubbard, E. M. (Eds.). (2013). *The Oxford handbook of synesthesia*. Oxford, UK: Oxford University Press.

Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics*, **73**, 971-995.

Spence, C. (2012). Synaesthetic marketing: Cross sensory selling that exploits unusual neural cues is finally coming of age. *The Wired World in 2013*, **November**, 104-107.

Spence, C. (2015a). Book review: Synaesthetic design. *Multisensory Research*, **28**, 245-248.

Spence, C. (2015b). Just how much of what we taste derives from the sense of smell? *Flavour*, **4**:30.

Spence, C. (2015c). Eating with our ears: Assessing the importance of the sounds of consumption to our perception and enjoyment of multisensory flavour experiences. *Flavour*, **4**:3.

Spence, C. (2015d). Music from the kitchen. *Flavour*, **4**:25.

Spence, C. (2017a). *Gastrophysics: The new science of eating*. London, UK: Viking Penguin.

Spence, C. (2017b). Sonic seasoning. In L. Minsky & C. Fahey (Eds.), *Audio branding: Using sound to build your brand* (pp. 52-58). London, UK: Kogan Page.

Spence, C. (2019). On the relationship(s) between colour and taste. *Experimental Psychology*, **66**, 99-111.

Spence, C. (in press). On the empirical aesthetics of plating In M. Nadal & O. Vartanian (Eds.), *The Oxford Handbook of Empirical Aesthetics*. Oxford, UK: Oxford University Press.

Spence, C., Corujo, A., & Youssef, J. (2019). Cotton candy: A gastrophysical investigation. *International Journal of Gastronomy & Food Science*. https://doi.org/10.1016/j.ijgfs.2019.100146.

Spence, C., & Deroy, O. (2012). On the shapes of tastes and flavours. *Petits Propos Culinaires*, **97**, 75-108.

Spence, C., & Deroy, O. (2013). Tasting shapes: A review of four hypotheses. *Theoria et Historia Scientiarum*, **10**, 207-238.

Spence, C., Michel, C., Youssef, J., & Woods, A. (2019a). Assessing the aesthetic oblique effect in painting and plating. *International Journal of Gastronomy & Food Science*.

Spence, C., Reinoso-Carvalho, F., Velasco, C., & Wang, Q. J. (Eds.). (2019b). *Auditory contributions to food perception and consumer behaviour*. Leiden, NL: Brill.

Spence, C., Wan, X., Woods, A., Velasco, C., Deng, J., Youssef, J., & Deroy, O. (2015a). On tasty colours and colourful tastes? Assessing, explaining, and utilizing crossmodal correspondences between colours and basic tastes. *Flavour*, **4**:23.

Spence, C., & Youssef, J. (2018). Assessing the long-term impact of the molecular gastronomy movement on haute cuisine. *International Journal of Gastronomy & Food Science*, **14**, 35-44.

Spence, C., Youssef, J., & Deroy, O. (2015b). Where are all the synaesthetic chefs? *Flavour*, **4**:29.

Spinney, L. (2013). Synesthesia sells: Marketers are using colors, scents, sounds, and other sensations to manipulate buyers. *New Scientist*, **September 22nd**. https://slate.com/technology/2013/09/cultural-synesthesia-in-marketing-tiffany-cadbury-and-corona-use-multiple-senses.html.

Stevenson, R. J., & Boakes, R. A. (2004). Sweet and sour smells: Learned synaesthesia between the senses of taste and smell. In G. A. Calvert, C. Spence, & B. E. Stein (Eds.), *The handbook of multisensory processing* (pp. 69-83). Cambridge, MA: MIT Press.

Stevenson, R. J., & Tomiczek, C. (2007). Olfactory-induced synesthesias: A review and model. *Psychological Bulletin*, **133**, 294-309.

Sunaga, T., Park, J., & Spence, C. (2016). Effects of lightness-location consumers' purchase decision-making. *Psychology & Marketing*, **33**, 934-950.

Turoman, N., Velasco, C., Chen, Y.-C., Huang, P.-C., & Spence, C. (2018). Tasting transformations: Symmetry and its role in the crossmodal correspondence between shape and taste. *Attention, Perception, & Psychophysics*, **80**, 738-751.

Ulloa, A. M. (2019). The chef and the flavorist: Reflections on the value of sensory expertise. *Food, Culture & Society*, **22(2)**, 186-202, DOI: 10.1080/15528014.2019.1573042

Velasco, C., Adams, C., Petit, O., & Spence, C. (2019a). On the localization of tastes and tasty products in 2D space. *Food Quality & Preference*, **71**, 438-446.

Velasco, C., Michel, C., Youssef, J., Gamez, X., Cheok, A. D., & Spence, C. (2016). Colour-taste correspondences: Designing food experiences to meet expectations or to surprise. *International Journal of Food Design*, **1**, 83-102.

Velasco, C., Veflen, N., & Naranjo Agular, P. (2019b). Awaken your senses: What can marketers learn from chefs? *BI Marketing Magazine*, **2019**, 14-15.

Velasco, C., Woods, A. T., Petit, O., Cheok, A. D., & Spence, C. (2016). Crossmodal correspondences between taste and shape, and their implications for product packaging: A review. *Food Quality & Preference*, **52**, 17-26.

Wang, Q. J., & Spence, C. (2018). A smooth wine? Haptic influences on wine evaluation. *International Journal of Gastronomy & Food Science*, **14**, 9-13.

570 Ward, J., Moore, S., Thompson-Lake, D., Salih, S., & Beck, B. (2008a). The aesthetic appeal
571 of auditory-visual synaesthetic perceptions in people without synaesthesia. *Perception*, **13**,
572 1285-1297.

573 Ward, J., Thompson-Lake, D., Ely, R., & Kaminski, F. (2008b). Synaesthesia, creativity and
574 art: What is the link? *British Journal of Psychology*, **99**, 127-141.

575 Youssef, J. (2013). *Molecular cooking at home: Taking culinary physics out of the lab and into*
576 *your kitchen*. London, UK: Quintet Publishing.

577 Youssef, J., Keller, S., & Spence, C. (2019). Making sustainable foods (such as jellyfish)
578 delicious. *International Journal of Gastronomy & Food Science*.
579 https://doi.org/10.1016/j.ijgfs.2019.100141.

580 Zampini, M., & Spence, C. (2005). Modifying the multisensory perception of a carbonated
581 beverage using auditory cues. *Food Quality and Preference*, **16**, 632-641.

582

583 FIGURE LEGENDS

584

585 Figure 1. A shape-inspired menu from chef Paul Bertolli (2003, p. 242).

586

587 Figure 2. The Table No13 'Awaken your Senses menu served at Le15 Café in India in 2018
588 (http://le15.com).

589

590 Figure 3. The Synaesthesia multisensory tasting menu served by Kitchen Theory in 2015
591 (https://www.kitchen-theory.com/synaesthesia-by-kitchen-theory/).

592

593 Figure 4. The '4 Tastes' dish served as part of the Synaesthesia menu at Kitchen Theory.

594

595 Figure 5. The 'Bouba & Kiki' dish served as part of the Synaesthesia menu at Kitchen Theory
596 dish served as part of the Synaesthesia menu at Kitchen Theory.

597

598 Figure 6. The 'Sight & Sound of Flavour' dish served as part of the Synaesthesia menu at
599 Kitchen Theory.

600

601 Figure 7. The 'Marinetti – Cubist Vegetable Patch' dish served as part of the Synaesthesia
602 menu at Kitchen Theory.

603

Figure 8. The ‘Give Weight to it’ dish served as part of the Synaesthesia menu at Kitchen Theory.

Figure 9. The ‘Believe Nothing of What you Hear’ dish served as part of the Synaesthesia menu at Kitchen Theory.

609 Figure 1.

The Shape of a Menu

Four Types of House-Cured Sausages (Salame Toscano, Genovese, Mortadella, Coppa di Testa)
Bitter Lettuces
N.V. Lambrusco, Barbolini

~

Maccheroni al Sugo di Carne
1999 La Sagreta Rosso, Sicilia

~

Halibut with Fresh Porcini Mushrooms
1997 "Batar," Querciabella

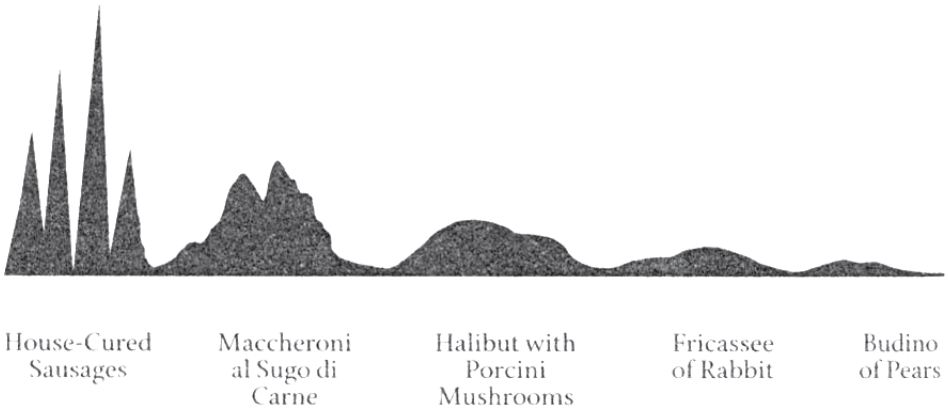
~

Fricasee of Rabbit
1998 Chardonnay, "Kleinstein," Santa Maddalena

~

Budino of Pears with Almonds
1997 Orvieto, "Calcaia," Barberani

Sometimes I think of a menu as having a graphic shape. This menu might look like this:



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612 Figure 2.

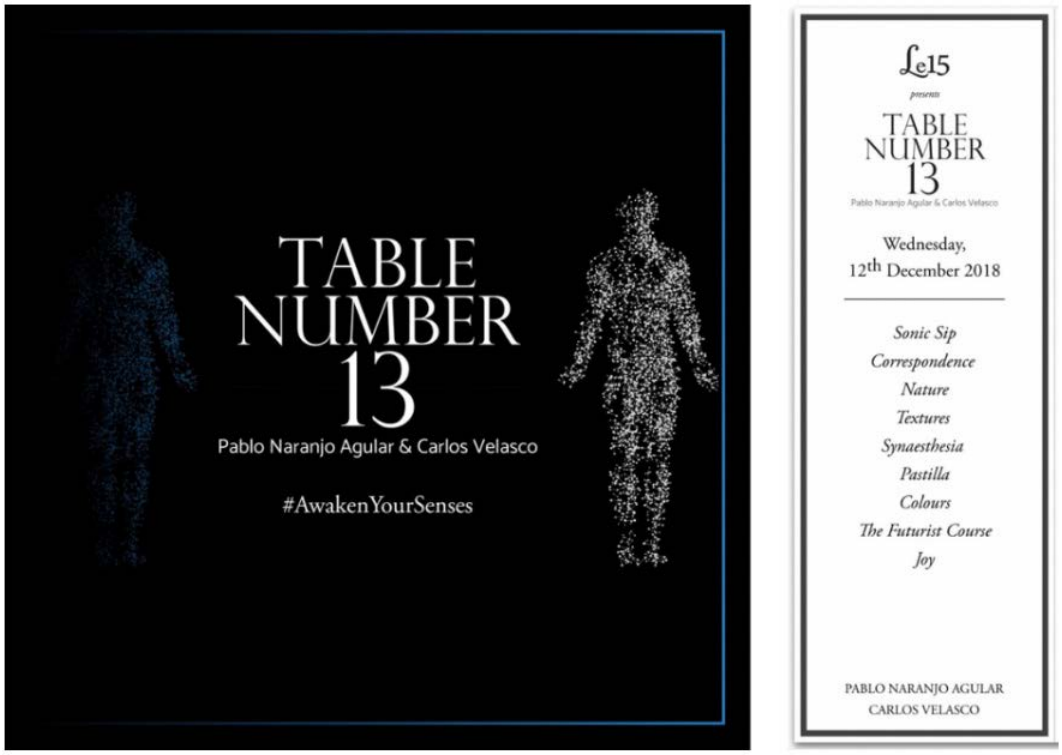

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Figure 3.

4 Tastes

Bouba & Kiki

The Sight & Sound of Flavour

Marinetti – Cubist Vegetable Patch

Give Weight to it

Believe Nothing of What you Hear

625 Figure 4.

626

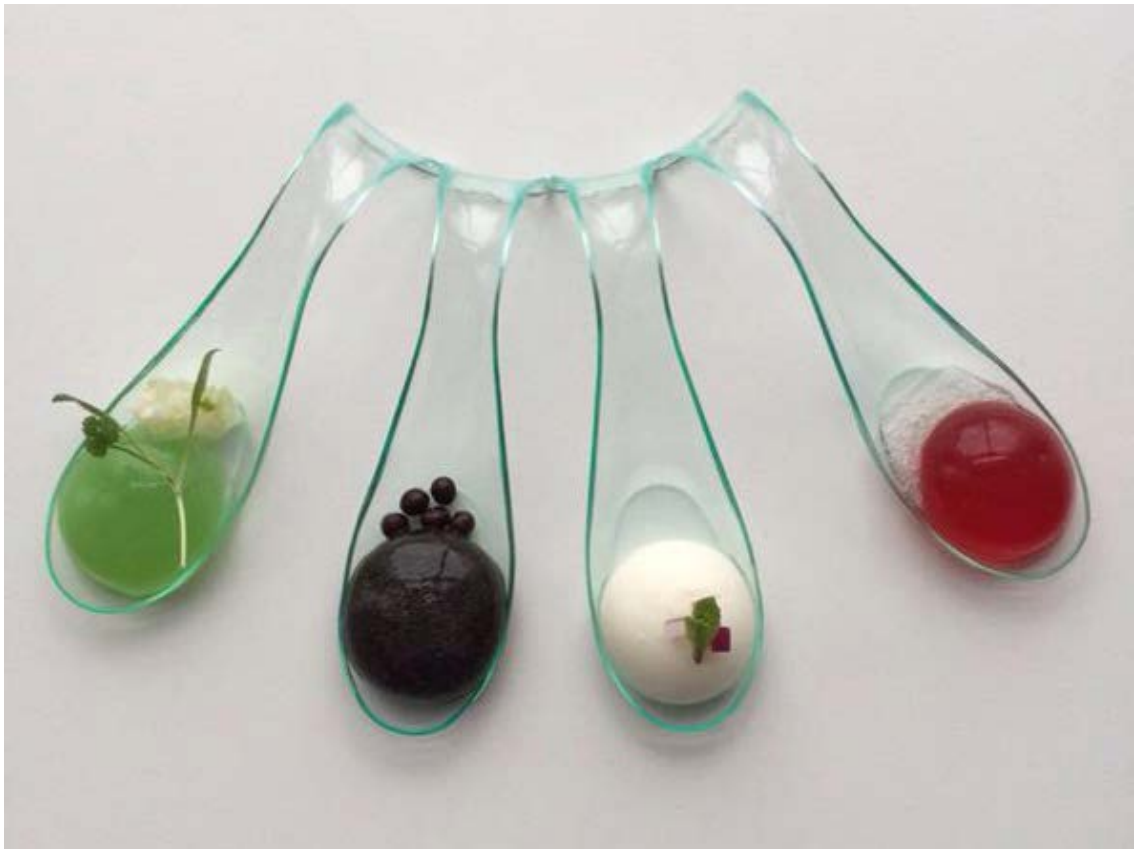

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Figure 5.

Figure 6.

Figure 7.

Figure 8.

Figure 9.

APPENDIX 1: RECIPES

The ‘4 Tastes’ dish

Alginate bath

1000g Water (de-ionised or water which has a low calcium content)

5g Sodium alginate (Texturas brand)

Blend with a hand blender (ISI brand) and leave to rest for 30 minutes to 2 hours in order to release all the gas which will have been incorporated. The result should be clear (a slight yellow tint in some cases), with a slightly viscous feel.

Lime spheres

320g/480g	Water
80g/120g	Simple syrup
400g/600g	Lime juice
16g/24g	Calcium gluconate (Texturas brand)
2.4g/3.6g	Xanthan gum (Texturas brand)
1g	Green food colour (Sosa brand

De-ionised water as needed

Combine water, syrup, food colour and lime juice. Add gluconate followed by xanthan and blend with hand blender (ISI brand) until fully incorporated and slightly thickened. At this point, it will be aerated and needs to rest for 12-24 hours in order to release all of the trapped gas. Once all the air has been released, the solution can now be ‘dropped’ into the alginate bath in approximately 5ml measuring spoons to create the spheres. Leave the spheres in the bath for between 1-2 minutes, flipping frequently (approximately every 40 seconds), and moving the spheres in the bath to attain an even result. Do not let the spheres touch each other for too long as they will bond. Once removed from the alginate bath, place in clean deionised water to rinse off the excess alginate and halt the gelling process. Place the sphere in a holding liquid (we make this using the same ingredients as those in the sphere excluding the calcium and xanthan). This allows you to hold the spheres without losing the colour/flavour through diffusion. Once ready to serve, garnish with cinnamon powder, candied fennel, and coriander cress.

Cranberry & rose spheres

390g/1170g	Cranberry juice

20g/60g Rose compound (MSK brand)

1.2g/3.6g Xanthan gum (Texturas brand)

8g/24g Calcium gluconate (Texturas brand)

De-ionised water as needed

Combine the juice, rose compound, and food colour. Add gluconate followed by xanthan and blend with hand blender (ISI brand) until fully incorporated and slightly thickened. At this point, it will be aerated and needs to rest for around 12 to 24 hours to release all the trapped gas. Once all the air has been released, the solution can now be 'dropped' into the alginate bath in approximately 5ml measuring spoons to create the spheres. Leave the spheres in the bath for between 1-2 minutes, flipping frequently (approximately every 40 seconds), and moving the spheres in the bath to attain an even result. Do not let the spheres touch each other for too long as they will bond. Once removed from the alginate bath, place in clean deionised water to rinse off the excess alginate and halt the gelling process. Then, place the sphere in a holding liquid (we make this using the same ingredients as those in the sphere excluding the calcium and xanthan). This allows for the spheres to be held without losing the colour/flavour through diffusion. Once ready to serve, garnish with lychee gel.

Yoghurt spheres

400g Full-fat natural yoghurt

100g Water

Salt to taste

De-ionised water as needed

Combine the yoghurt, water and salt using a whisk till you get an even consistency. The mix can now be 'dropped' into the alginate bath in approximately 5ml measuring spoons to create the spheres. Leave the spheres in the bath for between 1-2 minutes, flipping frequently (approximately every 40 seconds) and moving the spheres in the bath to attain an even result. Do not let the spheres touch each other for too long as they will bond. Once removed from the alginate bath, place in clean water to rinse off the excess alginate and halt the gelling process. Then, place the sphere in a holding liquid (we make this using 100g of yoghurt and 400g water – NO calcium and xanthan). This allows you to hold the spheres without losing the colour/flavour through diffusion. Serve with a couple of pieces of brunoised onion, a baby mint leaf and a hint of cracked black pepper.

Guinness spheres

40g Simple syrup (1:1 water and sucrose)

360g Guinness

2g Xanthan gum (Texturas brand)

8g Calcium gluconate (Texturas brand)

1g Black food colour (Sosa brand)

De-ionised water as needed

Combine all the ingredients using a hand blender, scoop out into small demi-sphere moulds and freeze till solid. Remove from the freezer and 'drop' into the alginate bath – it is important that the bath is at room temperature, if it is too cold the process will be slowed down. Leave the spheres in the bath for around 3 to 5 minutes, flipping frequently (approximately every 40 seconds) and moving the spheres in the bath to attain an even result. Do not let the spheres touch each other for too long as they will bond. Once removed from the alginate bath, place in clean water to rinse off the excess alginate and halt the gelling process. Then place the sphere in a holding liquid. Once again, this is made using the same ingredients as those in the sphere excluding the calcium and xanthan. This allows the spheres to be held without losing the colour/flavour through diffusion.

Lychee gel served (served with cranberry & rose sphere)

460g Lychee juice

4g Agar agar (Texturas brand)

Heat the lychee juice till simmering (around 85°C is perfect). Disperse agar into the juice while still on the stove, using a small whisk. Allow to simmer for around 2 minutes then remove from the heat and pour in to an empty container lined with cling film. Place in the fridge for 15-30 minutes (this depends on how deep the container is). Once set, remove from the container, remove the cling film and place in a jug blender, blitz the solid gel into a puree consistency – if the blender is having difficulty in processing a small quantity you can always add a little lychee juice to the blender to help it along. Once smooth, store in a squeeze bottle. Ready for immediate use or refrigerate for up to 5 days.

Candied Fennel (served with lime sphere)

½pcs Head of fennel

300g Simple syrup (1:1 water and sucrose)

Heat the syrup to 75°C, then let it cool to around 55°C. Brunoise the fennel. Add the hot syrup to the fennel and leave to cool. Refrigerate. Ready for immediate use or refrigerate for up to four days. To serve, drain the fennel and place alongside the lime sphere.

The ‘Bouba & Kiki’ dish

Vanilla dressing

2pcs Vanilla pods

500g Olive oil

100g Simple syrup (1:1 water and sucrose)

200g Lime juice

1g Xanthan gum (Texturas brand)

2.5g Table salt

Roast the vanilla on a grill or in a pan till it swells up and smokes lightly (without burning or charring). Place the roasted vanilla pods in a jug blender along with the oil, juice, and salt. Blend till the vanilla pods have disintegrated into the dressing. Add the xanthan gum and blend briefly till the dressing thickens, this will also stabilise the emulsion – meaning that the juice and oil will not separate even when refridgerated. Ready for immediate use or refrigerate for up to 10 days.

For the rest of the Kiki dish you will need (Serves 4):

100g Rhubarb brunoise

100g Tart green apple brunoise

5g Red chilli brunoise

3 small skinless seabass fillets, portioned to provide each guest with 3 bite-size pieces.

Roasted corn powder made by grinding roasted corn kernels in a spice grinder.

Sweet potato dauphine:

300g Sweet potato powder

700g Roasted potato mash

180g Butter

Choux pastry for dauphine

180g Milk

180g Water

164g Butter

216g Flour

7pcs Eggs

3g Caster sugar

3g Salt

Mix the sweet potato powder, warm roasted potato mash, and butter till homogenous. For the choux; combine the water and milk, bringing it to a simmer. In a separate pan, melt the butter and add the flour to form a roux. Cook the roux for 2 minutes then begin adding the water/milk mix as well as the sugar and salt. Once you have a smooth roux, take off the heat and work for a short while to reduce the temperature. Once cooled slightly, place back on the stove on a gentle heat and begin to add the eggs, one at a time, working the 'dough' till it is smooth and glossy. Once the choux pastry is ready, combine with the potato mix by folding it in. Once you have a homogenous mix, begin to form small balls roughly 12 to 15g in weight.

Sweet potato powder

2kg Sweet potato

Roast the sweet potato in the oven till fully cooked (check this by making sure a knife passes in to the core and back with no resistance. Once cooked, scoop out all the flesh and spread thin 2mm layers on parchment and place in a dehydrator (Excalibur brand) at 70°C for up to 4 days. Once the 'mash' is completely dry, crisp and brittle; smash it up and then grind in a spice grinder of food processor, till it is a fine powder.

Parmesan powder

75g Parmesan oil

400g Maltodextrin (Texturas Brand)

Place the maltodextrin in a bowl, slowly pour in the parmesan oil while constantly whisking (ideally this is a two-person job, as you need a steady stream of oil as you whisk). Once all the oil has been incorporated place the malto-parmesan mix into a warm non-stick pan and gently heat while slowly moving the powder around for roughly two minutes. The powder will begin to clump into little 'pebbles'. Remove and serve immediately.

Parmesan oil

500g Parmesan cheese

Cut the parmesan into small cubes and place in a non-stick pan on the lowest possible heat setting and leave for up to an hour or more, till all the oil has come out of the cheese, strain this oil from the pan using fine muslin cloth and reserve for use, discard the leftover parmesan solids.

Curd

2000g Whole milk

4tbsp Double cream

1tsp Salt

6tbsp White wine vinegar

Combine the whole milk, cream, and salt. Bring to between 80 and 82°C. Take off the heat, briefly and gently whisk in the vinegar. Leave to rest on the workspace for around 20 minutes then gently remove the curd from the whey using a slotted spoon. Place the curd in muslin cloth and hang for 4 hours. Use the leftover whey to feed the sourdough starter.

For the rest of the Bouba dish you will need (Serves 4):

10g Pomegranate molasses

10g Paprika powder

12pcs Fried sage leaves (fried till crisp in 180°C veg oil)

The Sight & Sound of Flavour

White miso veloute

5L Shojin dashi

700g White miso

1L Double cream

10g Salt

Combine ingredients, bring to the boil.

Corn gel

300g Corn juice (made by juicing drained tinned corn)

4.5g Xanthan gum (Texturas brand)

Disperse the xanthan into the corn juice using a hand blender. Once thickened, reserve in a squeeze bottle in the fridge.

Tofu puree

300g Silken tofu

50g Water

2g Salt

2g Sancho pepper

Blitz the tofu in a blender adding a tablespoon of water at a time to aid the process till you have a smooth, thick tofu puree reserve in a squeeze bottle in the fridge.

For the rest of the dish you will need (Serves 4):

4pcs Langoustines

150g Buerre noisette

0.5g Saffron

15ml Chilli oil

Marinetti - Cubist Vegetable Patch

Grilled Paneer

360g Paneer cheese (cubed)
150g Flour
200g Sesame paste
30g Soy sauce
60g Coffee

Mix the coffee, sesame paste and soy sauce together till homogenous. Marinate the paneer cubes in the sesame mix for 24 hours in the fridge. Drain the tofu and remove any excess, then coat in flour and grill.

Pearl Barley

100g Pearl barley
60g Back bacon (diced and fried)
30g Fried onion
5g Goma seasoning (Japanese sesame seasoning)

Boil the pearl barley till tender, drain and cool. Heat up a frying pan, add all the ingredients, cook for 2-3 minutes and serve.

Tarragon Powder

50g Fresh tarragon

Place the tarragon on trays and place in a dehydrator (Excalibur brand) at 50˚C till dry, then grind to a powder in spice grinder.

Maple salt cream

2L Double cream
5g Liquid hickory smoke
130g Maple syrup
4pcs Leaves gold gelatine
Salt to taste

Reduce the cream to 1.4L. While warm; add the liquid smoke, maple syrup and salt, incorporate well. Place the gelatine in water to bloom. Add the gelatine to the cream mix and bring to a boil, then pour into a container and set in the fridge overnight.

Mushrooms crisps

500g Button mushroom

Slice the mushrooms using a Japanese mandolin. Spread out on a tray and place in the dehydrator at 50˚C till crispy.

The 'Give Weight to it' dish

Cotton candy

15g Lavender infused sugar

Preheat the cotton candy machine. Pour the sugar into the central cavity of the cotton candy machine and have a wooden stick (similar to a barbecue skewer) at hand to collect the resulting sugar threads that spew out of the spinning heated element. Once a nice dense 'cloud' of cotton candy has been collected place in the top receptacle of the dish service piece.

Rum baba with orange zest cream

For the baba

3 Eggs
5g Dried yeast
0.5g Salt
1tsp Honey
125g Flour
75g Unsalted butter

For the syrup

125g Caster sugar
500ml Water
125ml Dark rum
1pcs Star anise

For the cream

500ml Whipping cream
10g Orange zest

In a large mixing bowl, mix together the eggs, yeast, salt, and honey. Once combined, gradually sift in the flour and stir to create a smooth batter. Slowly pour the melted butter into the batter and mix until smooth and thoroughly incorporated. Divide the batter between 12 non-stick moulds and leave to prove in a warm place until the dough has doubled in size. Preheat the oven to 180˚C. Bake for 8–10 minutes until the babas are golden brown. Remove from the moulds and leave to cool. Place the sugar, water, star anise, and rum in a saucepan and bring to the boil. Reduce the heat to a gentle simmer, add the babas and soak for one hour. Infuse the zest into the whipping cream overnight, strain, then whip the cream and serve alongside the baba in the middle receptacle.

Double chocolate and cherry brownie

360g Dark chocolate (65% cocoa solids – Valrhona brand))
265g Unsalted butter
3pcs Large eggs
120g Plain flour
250g Soft brown sugar
1 tsp Baking powder
150g Fresh cherries, halved & pitted
1-2tbsp Cocoa powder, for dusting

Preheat the oven to 170˚C. Grease a baking tin with butter then line the base and sides with baking paper. Melt the dark chocolate and butter in a saucepan over a low heat until well combined, stirring occasionally. Remove from the heat and set aside to cool slightly for at least 10 minutes. Whisk the eggs with the sugar in a large bowl until thick, pale and creamy. Whisk the cooled chocolate mixture into the egg mixture, then gently fold in the flour, baking powder and half the cherries until just combined. Spoon the brownie mixture into the prepared tin, then scatter over the remaining cherries. Bake in the oven for 25-30 minutes, or until the surface is cracked and a skewer inserted into the centre of the brownies comes out with just a little mixture sticking to it. Remove from the oven and set aside to cool completely on a wire rack. To serve, dust the brownies with cocoa powder, and place in the bottom receptacle.

The Believe Nothing of what you Hear' Dish

Passion fruit & mango ganache
270g Passion fruit pureè (Boiron)
192g Mango pureè (Boiron)
60g Fresh lime juice
1080g Tanariva chocolate (Valrhona Brand)
138g Tremoline
153g Butter
60g Cocoa butter melted

Pour in a pan mango, passion fruit, lime, and tremoline and bring to boil. Keep aside. Melt cocoa butter and pour it on top of chocolate. Add normal butter, and the puree of fruits hot. Blend everything using a hand blender (ISI brand) until smooth and rest in fridge.

Passion fruit jelly

50g Passion fruit purée (Boiron)
50g Castor sugar
5g Lemon juice
1g Salt
20g Castor sugar
7g Agar agar (Texturas brand)

Pour in a pan passion fruit, 50g of caster sugar, lemon, and salt. Bring to boil, add the rest of caster sugar and agar agar. Cook for 2 minutes and pour in a tray with cling film. Cool down properly before cutting.

Dark chocolate crumble
150g Castor sugar
140g Guanaja chocolate (Valrhona brand)
50g Water

In a big pot, bring water and sugar to 150°C. Add chocolate and whisk vigorously. Take out of the pan and cool it on a silpat.

Crystalized cocoa beans
450g Water
660g Castor sugar (split into two parts)
330g Cocoa nibs

Pour in a pan water, half of the sugar and cocoa nibs. Bring to boil and let it go till reduced by half, before adding the rest of the sugar. Cook it until reaches thick syrup. Strain the excess. Dry it at 130°C for 20 minutes.

Chocolate cream
500g Whole egg
500g Double cream
160g Yolk
80g Caster
600g Chocolate
5g Gelatine (gold leaf)

Mix the whole egg, yolk, and caster sugar. Bring the cream to a boil, and add the chocolate. Temper the egg mix and incorporate in parts to the chocolate cream. Add the gelatine and bring to 82˚C.

APPENDIX 2: UNDERPINNING LOGIC BEHIND DISHES

The ‘4 Tastes’ dish

What is it? This amuse bouche consists of 4 'bite' size elements, each of which represent one of the four most recognised and familiar tastes, namely sweet, sour, salty, and bitter. Each element is coloured differently to represent that taste's generally associated colour e.g., salty=blue, sweet=red, sour=yellow, and bitter=green. Note that the actual colours were chosen on the basis of published research on colour-basic taste crossmodal correspondences (see Spence et al., 2015a; Velasco et al., 2016). In case you were wondering why other tastes such as fatty, umami etc. were not included, the dish was limited to the four tastes that people (especially western diners) are most familiar with.

What is being demonstrated? Here the idea was to try and highlight individual associations between colour and taste/flavour, and also the more universal (and cultural) associations that exist.

How it works? The service commences once the video introducing the diners to the topic of the senses and synaesthesia (featuring Professor Spence) has been screened. Towards the end of this 3-4 minute video, Prof. Spence asks the guests to arrange the four elements that have been placed in front of them from left to right according to what they perceive as being salty, bitter, sour, and sweet. Once the guests have followed the instructions, it’s time to put their expectations to the test. They will not find out whether they are right or wrong till they have tasted each element, for some this will be a straight forward experience, for others some of the elements may be incongruent and surprising. Note that the spherification technique helps ensure that there are no olfactory cues to taste prior to the sphere bursting in the diner’s mouth.

Musical accompaniment. Slowly http://youtu.be/pDe2pngBkeI

The ‘Bouba & Kiki’ dish

What is it? This starter course will be comprised of two elements. One of the elements will be characteristically rounder, fattier, smoother, while the other element will be more angular, sharper, perhaps with a sour or hot kick.

What is being demonstrated? The non-arbitrary mapping between speech sounds and the shape of objects, here displayed visually. Once again, the shapes that were chosen were based on the available research (see Spence & Deroy, 2012, 2013; Turoman et al., 2018).

How it works? While the guests are being served the dish, they will be prompted by the hostess to think about which of the two elements on the dish they would call ‘bouba’ and which they feel to be more ‘kiki’. Once the table is being cleared the hostess will ask guests if they have an answer, at which point they will be given the explanation behind this little experiment: 95 to 98% of people select the curved shape to be ‘bouba’ and the jagged one to be ‘kiki’, this

suggests that the human brain somehow attaches abstract meanings to the shapes and sounds in a consistent way (see Bremner et al., 2013).

Musical accompaniment. Keepin it steel http://youtu.be/CTH8Bnmapr8

The 'Sight & Sound of Flavour' dish

What is it? A dish which focuses mainly on the correlation between sight and sound. The elements, shapes, flavours and colours of the dish will all be inspired this fMRI video http://youtu.be/bznD_ySyw8M which will be played on a loop as the dish is being served and eaten.

What is being demonstrated? Correlation between senses of sight, sound, and taste. The question for the guest is 'Did the video match the food? If *yes*; why? If not: *why not*?

How it works? The video will be played as the dish is being served and will play throughout. The hostess will direct guest's attention to the video as the dish is introduced – no further details. Once the dish is being cleared the hostess should ask if they enjoyed their course and leave them with a question for the guests to discuss between themselves 'Did the video match the food? If yes; "Why?" If not "Why not?" This dish builds on the growing interest in sonic seasoning (Spence, 2017b; Spence et al., 2019b).

Musical accompaniment. Intermezzo: Brainmusic http://youtu.be/bznD_ySyw8M

The 'Marinetti – Cubist Vegetable Patch' dish

What is it? A homage to Filippo Tommaso Marinetti's Futurist Cookbook (Marinetti, 1932/2014). This will consist of a main course in which the guests are actively encouraged to use their Marinetti Cubes. Each guest will each be provided with a handcrafted cube on which each face consists of a different texture (wood, both sides of Velcro, rubber, silk, and sandpaper). Each cube was hand-crafted. They are called 'Marinetti Cubes' as a homage to F. T. Marinetti. These cubes will be placed on the table as part of the setup, guests will not be given any information regarding their purpose until they inquire as to their purpose at which time the hostess will tell them about the cubes and encourage them to finger the various textures at their own leisure while eating the various courses.

What is being demonstrated? The relationship between tactile sensations and food textures. Can changing a tactile sensation alter the flavour and/or mouthfeel of food?

How it works? As the course is presented, the hostess will give a brief explanation about Marinetti and direct the guests towards using their Marinetti cubes and ask; 'Can changing a tactile sensation alter the flavour and/or mouthfeel of food?'

Musical accompaniment. Wooden toy http://youtu.be/qSZJ97UFlbk

The 'Give Weight to it' dish

What is it? This course will consist of a trio of desserts, each served in a separate receptacle which will stack on top of each other. The top tier will consist of 'light', 'bright' *colours and flavours* in the smallest and lightest of the receptacles. The middle tier will be a little heavier in terms of both weight and flavour, and the final tier will be the 'heaviest' and richest in flavour and receptacle weight. So, for example, the top tier may be a light citrus mousse, the middle tier a rum baba while the lower tier could consist of a rich fudge and chocolate cream (see Sunaga et al., 2016, on the lightness-elevation crossmodal correspondence; and Velasco et al., 2019a, on basic-taste elevation crossmodal correspondences).

What is being demonstrated? Cross-sensory associations and how this reflects in metaphors used to describe food e.g., flavours and foods being described as 'light', 'rich', 'heavy', 'sharp' even 'orgasmic'.

How will it work? Once the course is served guests will then be asked to hold each receptacle as they eat (in order to gain an understanding the connection between 'light' and 'heavy' as well as the tactile sensation which accompanies it) and also to think about what foods we consider 'light' and 'heavy' and why do we do this?

Musical accompaniment. Journey Man https://www.youtube.com/watch?v=se7w6pqBBxg

The 'Believe Nothing of what you Hear' dish

What is it? The idea with this course will be to provide guests with an intense correlation between texture and sound. Different elements like crisps and popping candy will be used to illustrate this point (see Spence, 2015c, for a review). Note that this idea has since been followed up with the Jellyfish dish served as part of the Gastrophysics Chef's Table at Kitchen Theory (see Youssef, Keller, & Spence, 2019).

What is being demonstrated? Correlation between sound and texture/mouthfeel.

How it works? As the dish is being served the hostess will guide the guest towards focusing on the sounds and textures of the dish, and note that the dish was specifically created to the music currently playing (see music section).

Musical accompaniment. Piece of paper http://youtu.be/1WKPwaqpo0E

Music + Videos

The music for the entire dining event consisted of a specially selected playlist by Brazilian artist DJ Amon Tobin. The dishes have been created to match specific tracks which inspire their concept and flavours. The musical 'accompaniments' for each dish were listed on the menu alongside the dish and wine pairing (cf. Spence, 2015d).

The sighting http://youtu.be/eV870CN05JI - Beginning	Easy Muffin http://youtu.be/SVEusVobh5s - Random

Bridge http://youtu.be/lvNWkCbCLH0 - Beginning Switch http://youtu.be/4QGNdNsBt9s - Beginning El Wraith http://youtu.be/0fkd2ttXgXU - Beginning Chocolate lovely http://youtu.be/p07GxPjLllY - Random Saboteur http://youtu.be/8Hj6jKJ1oqU - Random Nightlife http://youtu.be/iCMf_D6ZDok - Random Cat people http://youtu.be/5glHhh92iyQ - Random Natureland http://youtu.be/TLI_ykZF2CE - Random	One day in my garden http://youtu.be/E4vR35v_PII - Random Journeyman http://youtu.be/se7w6pqBBxg - Random Back from space http://youtu.be/IzOgoO2-FLs - Random The method http://youtu.be/APGJlJUJFnQ - Random Nova http://youtu.be/v33r88NXK-8 - Random Four ton mantis http://youtu.be/gjoI5aNBzkg - End Get your snack on http://youtu.be/MqNhu8CwHEs - End

Video 1 http://youtu.be/12GqKmRA3q8 Video 2 http://youtu.be/XwUn64d5Ddk

The Menu + Techniques + Ingredients outline

• Focus on fresh seasonal British ingredients • Focus on vegetables + vegetarian menu • Homemade • Fermentation • Dehydration • Smoking/smoke flavour/Smoking gun • Flavoured salts • Craft beer/stout • Dry ice • Candy floss (in a savoury dish)	• Sea weed • Sourdough • Buttermilk • Malt • Honey • Insects • Macaroons • Soaked baba • Quinoa • Kirsch • Non-traditional fish • Coffee • Matcha • Rose water • Umami

Dish	**Flavour profile**	**Main ingredients**	**Music pairing**	
Bread & butter				
The 4 Tastes	Sweet/Sour/ Salt/Bitter	Guinness, Cranberry, Lime, Yoghurt	Slowly	
Bouba & Kiki	Salt/Sweet/ Sour/Umami	Fish, rhubarb, vanilla, sweet	Keepin' It Steel	

		potato, pomegranate, paprika		
The Sight & Sound of Flavour	Umami/Salt/ Sweet	Langoustine, corn, saffron	Intermezzo: Brain Music	
Marinetti Cubust Vegetable Patch	Umami/Salt/ Bitter	Paneer, maple syrup, bacon, pomegranate	Wooden Toy	
Give Weight to it	Sweet/Salt	Lavender, cranberry, vodka, chocolate, caramel, cherry	Journeyman	
Believe Nothing of What you Hear	Sweet/Sour	Passion fruit, chocolate, caramel	Piece of Paper	

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