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Sound Bites & Digital Seasoning

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Abstract

Although often considered as the forgotten flavour sense, what we hear – be it music, soundscape, or product sound – influences what we taste. For instance, loud noise has been shown to suppress our ability to taste sweetness, while enhancing the taste of umami. Furthermore, many studies have demonstrated sensation transference effects, whereby what we think about what we hear (and the ideas/concepts primed by such music or soundscapes), can be transferred to whatever we happen to be tasting. The emotions that can be induced by music can also influence the experience of taste. In this presentation, though, I want to take a closer look at the specific way in which what we hear influences what we taste: In particular, the focus will be on the latest research showing that the crossmodal correspondences between music and tastes, textures, aromas, and flavours can be systematically used to direct a listener's attention to certain elements within the tasting experience. I will demonstrate how chefs, sound designers, culinary artists, brands, and psychologists are becoming increasingly interested in modifying the taste of food and drink through sound – think of it as digital, or sonic, seasoning. I will also stress why contemporary gastronomy and sensory apps offer a rich opportunity both to advance our theoretical understanding in this area, and also to impact consumer behaviour more generally.

Keywords: multisensory, gastronomy, digital seasoning

1. Introduction

Although often considered as the forgotten flavour sense (Spence et al., 2011), what we hear – be it music (Spence & Wang, submitted b), soundscape (Knapton, 2015), or product sound (Spence, 2015a; Zampini & Spence, 2004, 2005) – influences what we taste. So, for instance, changing the sound we make when we crunch on a crisp or apple significantly changes perceived crispness and freshness (see Demattè et al., 2014; Zampini & Spence, 2004). Meanwhile, loud noise has been shown to suppress our ability to taste sweetness, while enhancing the taste of umami (Spence, 2014; Spence, Michel, & Smith, 2014a; Yan & Dando, 2015). Music and soundscapes can also induce a change in the mood or emotion of the listener (Juslin & Sloboda, 2010; Konečni, 2008; see also Crisinel & Spence, 2012b), and this too has also been shown to affect certain aspects of taste perception (see Spence, 2015b, for a review). Soundscapes such as the sound of the sea, as served at Heston Blumenthal's The Fat Duck restaurant in Bray have also been shown to enhance the pleasantness of a matching seafood dish while having no effect on perceived saltiness (see Spence et al., 2011).

Furthermore, many studies have demonstrated sensation transference effects (Cheskin, 1957). This is where what we think about what we hear (and the ideas/concepts primed by such music or soundscapes), can be transferred to whatever it is we happen to be tasting (e.g., North, 2012; Spence & Wang,

submitted b). For instance, Adrian North has demonstrated how playing music that is heavy and powerful (think Carmina Burana by Carl Orff) can bring out the heavy and powerful notes in wine. In other words, there are a number of ways in which what we hear can influence what we think about what we taste (see North & Hargreaves, 2008; Spence et al., 2011, for reviews).

2. The crossmodal correspondences

In this presentation, though, I want to take a closer look at the role that crossmodal correspondences between music and tastes, textures, aromas, and flavours (e.g., Belkin et al., 2007; Crisinel & Spence, 2010, 2012a, b; Deroy et al., 2013; Knoeferle et al, 2015; Knöferle & Spence, 2012; Mesz et al., 2011; Spence, 2011, 2012) may play in systematically directing a listener's attention to certain elements within the tasting experience (Gray, 2007b; Spence & Wang, submitted b). Crossmodal correspondences refers to the initially-surprising connections that many of us appear to make between seemingly unrelated attributes, features, or dimensions of our sensory experience. So, for example, most people associate sweet tastes with round shapes and high-pitched sounds – think tinkling wind chime or piano sounds. By contrast, most people will associate bitter tastes with angular shapes, low-pitched sounds, and brass instruments. It is hard to point to where such associations may have come from, hence why they initially seem surprising.

In my talk, I will argue against the notion that synaesthesia provides a useful way of thinking about such connections between music and taste (Knapton, 2015; Rudmin & Cappelli, 1983; Sachse-Weinert, 2012, 2014; see also Spence & Wang, submitted a), seductive though it may be to do so. Importantly, the correspondences appear to be shared across large groups of people whereas the concurrents that are such a key feature of synaesthesia tend to be idiosyncratic (though, of course, the synaesthete is also subject to the crossmodal correspondences just like the rest of us). The correspondences may be learnt from the statistics of the environment or may reflect some more affective form of matching (Palmer et al., 2013; Parise et al., 2014).

A large body of empirical research shows that sweetness tends to be matched with sounds that are higher in pitch, with the sound of the piano, with music that is legato in articulation, and with consonant harmonies (Bronner et al., 2012; Mesz et al., 2011). By contrast, sourness tends to be matched with very high pitch sounds, fast tempo, and dissonant music instead (Bronner et al., 2012; Mesz et al., 2011).[1] Bitterness is matched with sounds that are lower in pitch and more likely to be brassy (e.g., Crisinel et al., 2012; Wang et al., submitted).

Further information concerning the crossmodal correspondences that have been documented in this area comes from the results of a series of experiments conducted by Crisinel and Spence (2010, 2012a). The participants in these studies had to pick a musical note (one of 13 sustained musical notes (from C2 (64.4 Hz) to C6 (1,046.5 Hz) in intervals of two tones), and pick a class of musical instrument (piano, strings, wind, and brass) to go with a variety of basic tastes, and with each of 20 of the key aromas (presented orthonasally) commonly found in wine (including almond, apple, apricot, blackberry, caramel, cedar, dark chocolate, cut hay, green pepper, honey, lemon, liquorice, mushroom, musk, pepper, pineapple, raspberry, smoked, vanilla, and violet).

The participants were seated in front of a virtual keyboard that allowed them to play each one of the 52 possible sounds (i.e., 4 instruments x 13 pitches) in order to find the best match. The results demonstrated that for a number of the tastes and aromas, the participants were consistent in terms of the notes and instruments that they felt went especially well together. So, for example, fruity notes such as apricot, blackberry, and raspberry were all matched with higher (rather than lower) musical notes, and with the sounds of the piano and often also woodwind instruments, rather than with brass or string instruments. In contrast, lower pitched musical notes were

[1] Back in 1855, Hector Berlioz suggested that the sound of the oboe had an 'acid-sweet voice'

associated with musky, woody, dark chocolate, and smoky aromas, bitter tastes, and brassy instruments.

Of course, just because stimuli are judged as matching does not, in-and-of-itself entail that playing the matching music, soundscape, or sound/chord would necessarily influence the tasting experience. However, that being said, the evidence that has been published to date does indeed suggest that such crossmodal effects are normally found when matching (or corresponding) stimuli are presented together. And what is more, the subjectively rated goodness of the match between what we hear and what we taste tends to correlate with how much we report enjoying what we are tasting (Spence et al., 2014b; Wang & Spence, in press b).

A growing body of empirical research now shows that our experience of many different food and drink products can be modified changing the music or soundscape that people listen to. To date, studies have been conducted with everything from cinder toffee through chocolate and fruit juice (Crisinel et al., 2012; Reinoso Carvalho et al., in press; Wang & Spence, in press a, submitted a), and from beer through wine, whisky, and vodka (Holt-Hansen, 1968, 1976; Rudmin & Cappelli, 1983; Spence et al., 2013, 2014c; Velasco et al., 2013; Wang & Spence, in press b, submitted b).

By far the most research has, though been done on the crossmodal matching of music with wine (see Spence & Wang, submitted a, for a review). A growing body of empirical research now shows that sweetness, acidity, fruitiness, astringency, and length of the flavour sensation can all be modified by playing the appropriate musical selections (see Spence & Wang, submitted b, for a review). Hence, while some have been sceptical concerning music's ability to influence taste (just see Jones, 2012), there is now enough evidence to demonstrate just what a profound effect it really has.

Get the combination right and it is possible to deliver an experience like the following from James John, Director of the Bath Wine School, when Mozart's *Laudate dominum* is combined with Chardonnay: *"[…] Just as the sonant complexity is doubled, the gustatory effects of ripe fruit on toasted vanilla explode on the palate and the appreciation of both is taken to an entirely new level"* (quoted in Sachse-Wienert, 2012).

What is particularly interesting about the crossmodal influence of music and soundscape on taste and flavour perception is that the effects often appear to occur more-or-less instantaneously (Crawshaw, 2012; Spence & Wang, submitted c). No sooner has the music changed from major to minor say than the taste of the wine also changes.

My suspicion about what may be going on here is that the crossmodal correspondences between audition and taste/flavour serve to direct the listener's attention to one aspect of what can be a complex tasting experience. Just take the following quote from one sceptic describing his experience on finding that a change in music (by Clark Smith, a Californian wine maker and wine consultant) changes the perception of wine *"What seemed to be happening was not that we noticed new flavors when the music changed. Instead, the same flavor elements were there all along, but the music seemed to change the way we perceived them. Some music made us pay more attention to astringency, so we disliked the wine. With other music, we chose to ignore the oak and tannin, so we liked it more."* (Gray, 2007). From everything I have seen and experienced I would certainly wish to reiterate that point about sound merely accentuating, or suppressing, certain features that are already there in the tasting experience, rather than creating new tastes/flavours out of nowhere.

Now as to whether this crossmodal attention effect happens automatically, that is, in a stimulus-driven manner, or whether instead it is a voluntary (i.e., effortful) process of matching is not yet known. Should the former be the case then, of course, incidental music playing in the background might be expected to influence the taste of whatever we are drinking. If, however, the crossmodal matching is an effortful process then, perhaps, the music / soundscape will only influence our taste perception if we actively direct our attention to

the music and consider the possible links to certain aspects of the tasting experience.

To date, most of the multisensory tasting events that have demonstrated an effect of music or soundscape on tasting have involved the participants/attendees being actively encouraged to try and make the link between their senses. Finding out whether this is necessary for these kinds of crossmodal effects to occur is certainly going to be an important question for future research to address (see Spence, 2015a). One final caveat to note here is that while we now know that music and soundscapes can change taste perception in the short term, no one has yet looked at how long-lasting the effects of 'sweet music' on taste perception may last.

It is perhaps unsurprising given what we have seen so far why a growing number of chefs, sound designers, culinary artists, brands, psychologists and even a few philosophers are all becoming increasingly interested in modifying the taste of food and drink by means of sound (e.g., Crisinel et al., 2012, 2013; Spence, 2014; Spence & Piqueras-Fiszman, 2014; Spence, Shankar, & Blumenthal, 2011; Spence & Wang, submitted c). Even British Airways launched a sonic seasoning soundtrack on their long haul flights last year, the idea being that those who were dining in the air could choose to listen in to music to match the taste of the food that they had ordered. Other chefs, like Grant Achatz of Chicago's Alinea fame is now starting to consider having a musician come into the restaurant to play something to accompany one of the dishes on his fabulous menu (see Ulla, 2011).

While much of the research in this area to date has utilized pre-existing music, this is not always ideal. Music tends to evolve over time, while the matching tasting experience may stay pretty much the same. Hence, it should come as no surprise that a growing number of composers and designers are now starting to create music and soundscapes especially to match a particular taste, aroma, or flavour (see Bronner et al., 2012; Crisinel et al., 2012, 2013; Knoeferle et al., 2015; Mesz et al., 2012). Ben Houge, the sound artist has made the sensible suggestion here that what one might actually want is something like the music in video games that stays forever the same until such time as the player gets to the next level when the music then evolves to match the. We have recently taken to testing the various musical solutions that have been developed to see which people find it easiest to match with specific tastes (Wang et al., submitted). What is more, we have also been able to demonstrate the cross-cultural meaning of certain of these musical selections (Knoeferle et al., 2015). So, for example, we have been able to demonstrate that music composed in Germany to match each of the four basic tastes (e.g., bitter, sweet, salty, and sour) can be decoded by participants in India almost as well as by those in Europe/North America. Excitingly, internet-based testing, as well as large-scale citizen science experiments are allowing us to collect large amounts of data in a very short space of time (see Woods et al., 2015, on the strengths and weaknesses of the internet-based testing approach). Such an approach can work well for those tastes/flavours that people are already familiar with.

Now while the majority of the work on crossmodal correspondences has focused on instrumental music/soundscapes, there is an interesting area to explore, moving forward, in terms of crossmodal correspondences between vocal attributes on the one hand and tastes, aromas, and flavours on the other (Simner et al., 2010).

Contemporary gastronomy and sensory apps (Crisinel et al., 2013; Jones, 2014; Spence, 2014; Spence & Wang, submitted, c) both offer a rich opportunity to advance our theoretical understanding in this area, and also impact consumer behaviour, more generally. I will discuss a couple of sensory apps that have been designed to match flavours/aromas with music that highlight the two approaches here, both the scientific and the more personal. The scientific approach is illustrated by the *Le Nez de Courvoisier* app (URL http://courvoisier.com/uk/le-nez-de-courvoisier-app/ [accessed 29th July, 2013]; Crisinel et al., 2013), and the more personal approach by the Krug Music Pairing app (https://www.krug.com/; Jones, 2014).

3. Conclusions

In conclusion, I firmly believe that the influence of what we hear on what we taste has the opportunity to transform our dining/drinking experiences in the years to come. There is also evidence to suggest that by combining audition with the flavour senses in the right manner, some truly extraordinary experiences can result (Knapton, 2015; Spence & Wang, submitted c). What is more, I see far more innovation coming out of the chefs and food/drinks brands than out of big business or anywhere else, hence making the rate of progress here much more pronounced than elsewhere in the field of multisensory experience design (see Spence et al., 2013; Velasco et al., 2013).

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