

Web Audio in the Dining Room

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ABSTRACT

The worlds of the arts, gastronomy, and technology have been colliding and recombining with increasing frequency in recent years, resulting in unusual new forms of expression that engage with all of the senses in a uniquely responsive way. Artists are increasingly seeking to exploit the expressive potential of the chemical senses of smell and taste, while at the same time chefs have been investigating how to refine the narrative, aesthetic, and communicative capabilities of a meal [7].

Web Audio technologies offer a uniquely practicable solution to some of the unexpected challenges that arise when developing multisensory dining experiences, especially when considering the inherently indeterminate nature of a meal. A sophisticated and responsive real-time system is required to respond to diners' unpredictable choices and actions. Siting the source of the sound as close as possible to the food helps reinforce the links between the perception of taste, smell, and sound.

Presenting the soundtrack to a meal via the mobile devices that diners are already bringing with them to the restaurant setting provides an innovative, scalable, and cost-effective solution to these challenges. Moreover, by coordinating the music emanating from each diner's device, the restaurant space is transformed into an emergent sound environment, driven by the activities of the diners.

1. PREVIOUS WORK

I have been collaborating with chefs to design multisensory dining experiences since 2010, and I have addressed the unique technological challenges that have arisen from various angles. The first events used speaker wire to deliver signals to speakers at each place setting, while audio generation and processing was handled by a bank of computers at the side of the room. More recent projects explore approaches to distributing the sound production locally using mobile devices. As these events grow in scale, distributed audio production seems key, and Web Audio is the clear way forward. Specific examples follow:

Cena concertante alla maniera di Vivaldi (2017) was a collaboration with the Boston Symphony Orchestra, presented at Symphony Hall in Boston on January 5 and 7, 2017. Based on Antonio Vivaldi's *Piccolo Concerto* in C RV 443, this four-course, pre-concert dinner incorporated crossmodal associations of high frequency sounds with sweet and sour tastes to derive a menu from the music. More on this project below [5].

The Saint Paul Food Opera (2016) was a collaboration with new music ensemble *Zeitgeist*, based in St. Paul, MN, USA, and five St. Paul area chefs, comprising eight courses and 40 channels of coordinated audio [10].

Beside the White Chickens: A Summer Food Opera (2013) was my third collaboration with chef Jason Bond, taking place in his restaurant *Bondir*, in Cambridge, MA, USA, comprising five courses (with a choice of two dishes per course) and 30 channels of coordinated audio [4].

An overview of the food opera project was presented at TEDx Berklee Valencia in 2014. The talk includes a demonstration of what the coordinated sound of twenty-six diners sounds like [6]. Additional information about the food opera project, including previous papers published on the subject, is available at <http://www.audiogustatory.com>.

In addition to this ongoing work, previous compositions incorporating the Web Audio API include *The Tomb of the Grammarian Lysias* (2014), a setting of a poem by Constantine Cavafy for voice and audience mobile devices [11], and *Ornithological Blogpoem* (2015), a setting of a poem by Elisa Gabbert for choir and audience mobile devices [9], presented at the first two Web Audio Conferences.

2. GASTROMORPHOLOGY

If we consider the form of a meal from a time-based perspective, several time scales are identifiable. Perhaps most obvious is the succession of courses in a multi-course meal, analogous to movements of a symphony or suite. The high level form of each course is characterized by its internal entropy: hot elements cool, frozen elements melt, flavors meld, foams break down, and emulsions separate. The dish is experienced as a succession of bites initiated by the diner, effectively sampling the evolving dish at arbitrary intervals. Each bite sets off another time-based sequence (dependent upon the oral activities of the diner, such as deciding when to chew and swallow); a common example is when discussing the finish of a wine.

I have used the term *gastromorphology* in an effort to describe the way in which taste sensation evolves over time, adopting Denis Smalley's concept of *spectromorphology* [16] to apply to the chemical senses. We might also usefully compare these variable but interrelated time scales to Curtis Roads' chart of musical time scales [15].

3. MUSIC AND FOOD IN SYNC

Having identified the different time scales present in a meal, synchronizing music to them is not a trivial task, especially when considering the asynchronous manner in which people typically dine in a restaurant.

The simplest solution is to constrain diners' activity by requiring them to eat the same thing at the same time, and then start a piece of music as each new dish is served. This is the

approach taken in multisensory dining experiences such as those offered by Paul Pairet's Ultraviolet in Shanghai (which opened in 2012) [13] or Jozef Youssef's Kitchen Theory dining events in London (a project dating back to 2010) [14].

Another approach is to administer the sonic component of a dish via headphones, which allows for an intense, personalized experience, but one that also isolates diners from their companions and the rest of the dining room. Chef Heston Blumenthal has taken this approach with his famous Sound of the Sea dish (2007) at his restaurant The Fat Duck in Bray, England [2], as has performance artist Marina Abramović in her dessert Volcano Flambé (2012), developed in collaboration with pastry chef Kevin Lasko at Park Avenue Winter in New York City [3].

A third approach, which is the one I have applied in my work since 2012, is to position a speaker at each seat in the dining area and use real-time software to render a customized soundtrack based on each diner's behavior, adapting techniques from the practices of sound installation and video game audio to coordinate up to seventy individual channels into a unified soundscape.

My first several events were developed using a bank of computers generating all of the audio, with many feet of speaker wire running the signals to the different tables in the dining room. While this configuration is powerful, it is labor intensive to install, and it requires several powerful computers and multiple audio interfaces to perform the audio processing and output the signals.

So in late 2016, I developed a new implementation in which audio processing was distributed via a phalanx of iPads, one per diner, for a project entitled *Cena concertante alla maniera di Vivaldi*. We presented sixty-four iPads, all coordinated in harmony and rhythm, with beat synchronization across devices and certain shared melodic material generated on the fly, along with six additional speakers around the perimeter of the room for a total of seventy coordinated channels of audio. This solution was flexible, performant, and easy to set up, and it allowed me to scale up to a greater number of diners than in my previous pieces, but the obvious drawback is the cost of the iPads.

This has led me to my current research, which investigates how to leverage the powerful computing devices most diners bring with them into the restaurant in their pockets. As in my previous compositions involving audience mobile devices, I seek to explore how the Web Audio API can be used to instantly transform a crowd of spectators into a flexible, scalable multi-channel speaker array without the need to install a sophisticated sound deployment infrastructure in advance.

The obvious challenges to overcome include ensuring that audience members' devices remain charged, eliminating sonic notifications from other applications running on the device, and convincing diners not to use their devices for texting, taking photos, or other activities during the event. For these reasons, it may not be viable to scale this solution to an evening-length event, but for shorter experiences, the Web Audio API is an extremely appealing solution.

4. FUTURE WORK

This recent work provides an opportunity to pull together two disparate threads: music for audience mobile devices using the Web Audio API and the projects I have been doing with chefs to present responsive soundtracks to meals in restaurants, showcasing a new frontier for web audio technologies.

For an example of this concept in practice, please see my collaborative performance with chef Jozef Youssef of Kitchen

Theory, "Quiver, Pop, and Dissolve: Three Essays in Gastromorphology" also presented at the 2017 Web Audio Conference.

In parallel to this exploration of Web Audio technologies, I have also been developing sensors that will allow me to increase the extent to which diners' activities and gestures can influence the music that accompanies a meal. This work has been developed in workshops during the summer of 2017 in Badalona (north of Barcelona) and will be showcased in the context of a new collaboration with San Sebastián restaurant Mugaritz and Barcelona theater group La Fura dels Baus in 2018 [1].

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