

1st International Workshop on Multi-sensorial Approaches to Human-Food Interaction (Workshop Summary)

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ABSTRACT

This is an introductory paper for the workshop entitled ‘Multi-Sensorial Approaches to Human-Food Interaction’ held at ICMI 2016, which took place the 16th of November, 2016 in Tokyo, Japan. Here we discuss our objectives and the relevance of the workshop, and summarize the key contributions of the position papers. We were able to gather a group of researchers from different countries in Europe and Asia who presented their research and discussed the current developments, trends, limitations, and future applications of the field. Whilst this is the first workshop of its kind, we anticipate that the field of multisensory Human-Food Interaction (HFI) will grow in the upcoming years in terms of research and development, and its products will impact our everyday eating experiences.

CCS Concepts

• **Human-centered computing–Auditory feedback** • *Human-centered computing–User interface design* • **Human-centered computing–User models**

Keywords

Food; flavor, drink; sound; multisensory; ingestion

1. INTRODUCTION

Eating and drinking are, perhaps, some of the most multisensory events of our everyday life [15]. Take, for instance, flavor, which is one of the most important elements of such experiences. It is known that flavor is the product of the integration of, at least,

gustatory and (retronasal) olfactory cues [14]. Nevertheless, researchers have suggested that all our senses can influence the way in which we perceive flavor, not to mention our eating and drinking experiences [14,15]. For instance, the color and shape of the food [21,24], the background sonic cues in our eating environments [10], and/or the sounds that derive from the food’s mastication [16,25] can all influence our perception and enjoyment of our eating and drinking experiences.

There is a growing interest in the context of HFI to capitalize on the aforesaid multisensory interactions in order to enhance our food-related experiences with technology [4,17,18]. Furthermore, researchers are working on digitizing taste, smell, and flavor experiences. Indeed, digital interfaces for multisensory experience design are becoming an interesting trend for research and development. For example, Narumi et al. [8] introduced a visual and olfactory display that modified the perception of the flavor. Karunanayaka et al. [5] proposed an interface to study how dining behaviors can be enhanced through dynamically changing the weight of foods and eating utensils using magnetic fields. Further, it has been suggested that electrical stimulation of the tongue may generate sour, bitter [12], and salty [7] sensations, and under very specific circumstances, thermal stimulation has resulted in sweet sensations in a few people or enhanced sweetness perception of foods and drinks [3]. Importantly, traditionally underused sensory inputs such as those that pertain to audition in eating contexts are increasingly being involved into food and drink experience design [16,20]. Multisensory interactions and cross-modalities related to HFI are now becoming part of Human-Computer Interaction [9,11].

In this workshop, we were particularly interested in new systems that were designed to enhance people’s eating experiences in the context of HFI and which were based on the principles that govern the systematic connections that exist between the senses (e.g., spatiotemporal congruence, semantic congruence, and crossmodal correspondences, [22]). This included the experiencing food interactions digitally in remote locations, sensing flavor information from one place, transferring them over

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the internet digitally, and effectively regenerate at the destination. Further, we were interested in digital interfaces that would bring advantages such as precious controlling, cheaper maintenance, avoid refilling, and avoid calories. Therefore, in this workshop we called for studies on flavor sensing and actuation interfaces, new communication mediums, and persisting and retrieving technologies for HFI.

Enhancing social interactions to augment the experience of eating was another issue that we intended addressed in this workshop. In addition, we wanted to discuss what is possible through multimodal technology and what is not possible without it in HFI. Factors such as measurement techniques (e.g. mastication, eating speed, food tracking, psychophysiological responses to food consumption), potential for interactivity, and potential for customized experiences were taken into consideration. Finally, applications of multisensory approaches to HFI were also encouraged to submit since they can promote healthy eating habits, design of food-related products (e.g. packaging) and more compelling eating experiences.

2. WORKSHOP CONTRIBUTIONS

A number of researchers from multiple disciplines contributed their work from topics such as taste technologies, multisensory flavor perception, sound enhancing food and drink experiences, and multisensory product design.

Sakurai et al. [13] presented a system and study to show that cathodal direct current stimulation to the tongue can influence taste perception. In particular, these researchers suggested that such stimulation suppresses the perception of saltiness and umami.

Bruijnes et al. [1] presented a review paper of multisensory taste technologies in HFI. In particular, they focused on a number of interactive and mixed reality systems that have been introduced to influence food/drink experiences and to create playful interaction in such a context. In agreement with other papers presented at the workshop, the authors highlighted that multisensory design can be thought of as a means to design and influence specific human perceptions and behaviors associated with eating and drinking.

In a similar vein, Velasco et al. [23] discussed a designed framework for multisensory experiences. In particular, these authors focused on the use of auditory cues associated with ingestion (e.g., mastication, drinking) as means to enhance the perception of multiple sensory attributes such as textures and tastes, and also the enjoyment of food in HFI. Adding weight to the role of audition in food/drink perception, Reinoso-Carvalho et al. [2] presented a number of studies designed to assess the influence of ambient soundscapes and music on taste and flavor perception. The authors concluded that ambient sonic cues can modulate attributes such as creaminess, sweetness, and sourness. Both Velasco et al. [23] and Carvalho et al. [2] highlighted a number of opportunities for development, based on audition in the context of HFI, such as sound-taste algorithms, sound-taste mixed reality, sounds in food and drink product design, and also possible applications for people with sensory dysfunctions.

Mroczo-Wasowicz [6] highlighted the multisensorial basis of flavor perception and discussed the importance of the conceptualization of this concept both from epistemological and empirical points of view. These reflections provide some relevant bases for the design of system that want to take into account our perceptual system.

In another contribution, Zhao et al. [26] conducted two studies in order to evaluate how people search for foods and drinks. In their studies, they demonstrated that certain visual features of a product's labelling can change how quickly people find them. In particular, these authors demonstrated that people are faster in finding wine bottles that use downward-pointing vs. upward-pointing triangles. The orientation of a geometrical shape is shown to influence visual attention towards a drink, as revealed in the increasing strength of the effect as a function of set size.

In addition to the different submissions, we also had Takuji Narumi [19] from the University of Tokyo as an invited speaker to the workshop. In his talk and paper, he focused on a topic that has gained increasing interest in the last few years, namely, multisensory virtual reality and human food interaction. Through different examples, including "MetaCookie", a flavor augmentation system, he discussed how the perceived taste of, and behavior toward, a given food can be modulated crossmodally, that is, by utilizing different cues in other sensory modalities. Finally, we also had a presentation by Johannes H.F. Bult (NIZO food research, Ede, The Netherlands), Joost Wegman (Donders institute for Brain, Cognition and Behaviour, Radboud Universiteit, Nijmegen, The Netherlands), Tobias Heffelaar (Noldus BV, Wageningen, The Netherlands), and Esther Aarts (Donders institute for Brain, Cognition and Behaviour, Radboud Universiteit, Nijmegen, The Netherlands), about their novel Thelometry, a measurement system that uses both behavioral (e.g., a motivation task) and neural (e.g., event-related EEG potentials) data in order to assess people's anticipated food reward.

The different contributions made to the present workshop provide an interesting overview of both the current endeavors, and the future opportunities that are available for exploration in, multisensorial HFI. It is worth mentioning that this is the first workshop of its kind. We expect that in the years to come, and as the aforesaid opportunities develop, we will witness an increasing number of systems and technologies that capitalize on multisensory process for experience design of eating and drinking experiences.

3. CONCLUSIONS

Food perception can be influenced by multiple factors, such as vision, olfaction, taste, sound, atmosphere, and related memories. This workshop explored how these and other multisensory inputs could be used to introduce concepts, technologies, and prototypes for the next generation of multisensory experiences in the context of HFI. We believe that, in the future, food will become some kind of media, which can be created, shared, and experienced remotely and digitally. Moreover, we believe that technology will increasingly take over HFI in order to target specific food-related behaviors. Our workshop is an effort to make a platform for multisensory HFI researchers to meet, propose, and discuss their ideas, and to invent the next big steps in the field.

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