TOWARDS VALUE-DRIVEN EXPERIENCE DESIGN BY MINDING THE GAP BETWEEN VISUAL-OLFACTORY PERCEPTION

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ABSTRACT

Intuition and insight are two processes that link the tacit and the explicit knowledge, which are relevant to idea sharing in the design process for evolving critical values into an innovative design. Experiences to link the tacit and the explicit knowledge easily enhance and foster more valuable and creative thinking. The present research aimed to verify unanswered questions focused on multisensory stimulation and integration as follows. Q1: Visual or olfactory stimuli influence the same way regardless of whether it is *unimodal* or *multimodal*? Q2: Is *liking* the only intuitive value compared to other semantical values such as *freshness, weightiness* and *experience*? The current research presented significant findings which answer the above-mentioned questions. A1: Visual knowledge is more solid and influenceable than olfactory knowledge in *unimodal* conditions, whereas olfactory knowledge is more solid and influenceable than visual knowledge in *multimodal* conditions. A2: *Liking* is a more clear and effectible value to verify the impression of the perceived stimuli. And the worthiest finding from the results is that *liking* is relevant to experience. The evaluation results of *liking* show similar trends as experience, and vice versa. Further research should clarify in further research whether *liking* correlates with sensitivity or not in the structured sensory and leads the subjective evaluations to modify specific evaluation values. The findings of this research are worthy as they provide a hint to enhance value-driven design factors to foster more valuable and creative experiences which will be beyond our expectations.

Keywords: Multisensory, cognition, interference

1   INTRODUCTION

1.1 Rethink human being

There can be no doubt that all human knowledge begins with experience. Humans experience external features through their senses such as vision, olfaction, audition, etc., and understand the external world. I. Kant explains that although all our knowledge begins *with* experience, it does not follow that it arises *from* experience. Even human knowledge is a compound that humans receive through impressions, we don't distinguish from that raw material until the long practice has made us attentive to it and rendered us capable of separating one from the other, and the accumulative knowledge is in relation to intuition. The question is that, how does an individual's experience affect or be affected in relation to knowledge and intuition?

The present research focused on clarifying the role of individual experiences in modifying *the innate subjective filter*. *The innate subjective filter* postulates influenced and changed by the experiences considering the variety of subjectivity. *The model of explaining the relationship of an innate subjective filter and the individual modification process by the experiences* by Kim et al. (2012) [1], clarifies the reason why affective values are significant in design and how designers can investigate those subjective evaluation results as deceve values. The updated version of this model is presented in Figure 1. It presents the *kansei* process i.e., synthesized affective data of how human sensory receptors (eyes, ears, nose, and so on) receive stimulants as an external feature from the environment, and how the perceived data is integrated into the brain through the filter-dependent affective output. The synthesized information in the brain comes out as reactions such as emotion or intuition, which act as the scale of aesthetic and logic of the individual. Logic comes out as beyond judgment that is relevant to the choices

and empirical results whereas, aesthetic comes out as judgment that is relevant to desires or examples. These two outcomes influence perceptual and conceptual fluencies such as familiarity, preference, aesthetic feeling, and so on. In addition, they also interact to impact subjective evaluations of new designs through the individual experience that is based on one's new understanding. Perceptual fluency originates from external feature conditions of the filter whereas conceptual fluency originates from the evolved phase of the filter (Figure 1).
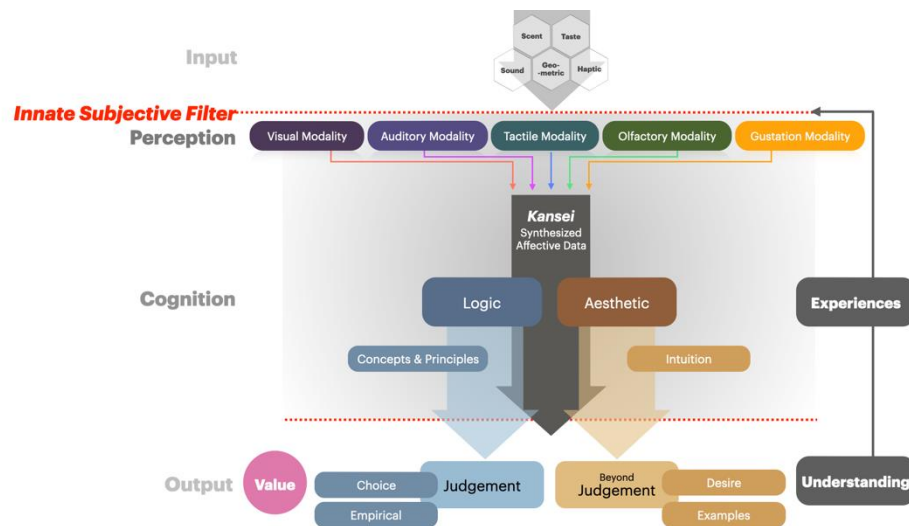

Figure 1. The model of explaining the relationship of an innate subjective filter and the individual modification process by the experiences

The innate subjective filter postulates modification of subjective evaluation with one's experiences and the changes separate each individual to be one unique filter. Figure 2 presents an example of why subjective evaluations depend on the filter to the same stimulus even if the same individual evaluates it differently. In case of an individual who focuses on the colour of the stimulus (in this case an apple), the colour red will be a critical value in their evaluation. Whereas an individual who focuses on the taste of the stimulus may focus on sweetness as the most critical value in their evaluation. Even though it is the same stimulus that was perceived, the cognized data were interpreted differently by individuals.
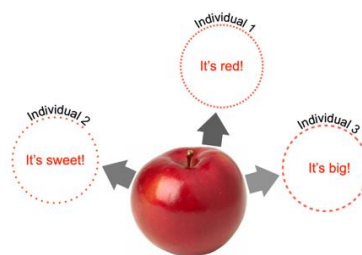

Figure 2. The relationship of an innate subjective filter and the subjective evaluation to the same stimulus

1.2 Rethink design

To rethink the notion of the transformative design for the future not so far, it should be understood that the user' expectation of the design needs more focus than what design is per se. User research is about understanding the users, their needs and experience, and about designing a user's interactions with a product from moment to moment. A user's experience is the cumulative effect of many factors, some that the designer can control, and some that the designer can't control. How to design what the users want and need? Design has mainly been discussed in industrial design and engineering design. However, society is already saturated with various high-end technological products and design is continually reconfiguring itself from object-centred to human-centred. Current design does not only produce form-function-based objects but also places importance on what the users expect from the objects or services, i.e., experience design. Therefore, clarifying the meaning of perceived data of the users will help gain more understanding as to why design needs to place emphasis on multimodal perception.

2 METHODS

As to the importance of experience unanswered questions are twofold: How to determine cause-and-effect relations of the perceived information and the evaluation results in accordance with our daily life? How to implement the perceived information in user experience design? To answer these questions, the present research aims to verify two questions focused on multisensory stimulation and integration as follows. Q1: Do visual and olfactory stimuli influence the participants' evaluation value the same way regardless of whether it is *unimodal* or *multimodal*? Q2: Is *liking* an only intuitive value unlike other semantical values such as *sweetness, freshness, weightiness*? Twenty-four Japanese participants attended in the visual experiment and thirty-six in the olfactory experiment. The olfactory experiment was conducted in three groups (twelve participants in each group) and each participant evaluated fifteen stimuli.

2.1 Procedure

The current research aimed to clarify the gap between the visual and olfactory stimuli. In the experiment, forty-five essential oils and their representing photos were used as olfactory and visual stimuli. The essential oils were categorized into three groups namely, sweets (brownie, bubble gum, candy corn, caramel corn, chocolate, chocolate mint, coconut cream, coffee cake, cotton candy, cupcake, marshmallow, orange creamsicle, orangesicle, peaches & cream, pina colada), fruits (apple, banana, black oak currant, coconut lime verbena, cranberry, cucumber melon, lemon, mandarin, mango, orange, peach, pineapple, red cherry, strawberry, tropical passionfruit) and flowers (azalea, freesia, gardenia, honeysuckle, jasmine, lavender, lilac, lily, magnolia, peony, plumeria, rose, sweet pea, violet, ylang ylang) . The subjects were instructed to make the ratings using the subjective states, which are: Each trait below the stimulus that you will use to rate your feelings about the stimuli. The evaluation traits are in five: *sweetness, freshness, weightiness, liking,* and *experience.* The evaluation implemented a 6-point character rating scale as follows: *strongly disagree, disagree, slightly disagree, slightly agree, agree, strongly agree*.

2.2 Analysis & results

One-way ANOVA was used to analyse.

By sensory modality differences in each evaluation values

All evaluation values *sweetness, freshness, weightiness* (in the left / the middle / the right of Figure 3), *liking,* and *experience* (in the left / the right of Figure 4) present the significance by modality differences of visual and olfactory. All visual stimuli were evaluated higher than olfactory stimuli and the biggest difference by modality was observed for the evaluation value *liking*. It means that visual is more affectable than olfactory in the evaluation process. Moreover, the clearest value to verify modality differences between visual and olfactory was observed for the evaluation value *liking*.
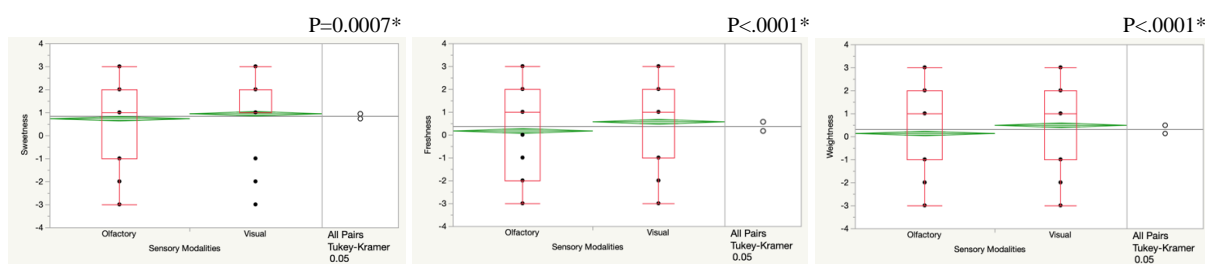

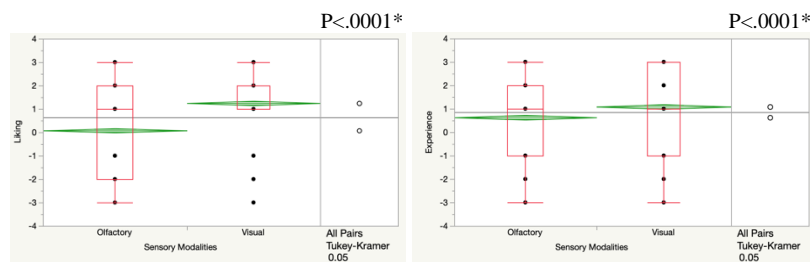Figure 3. The results in s*weetness, freshness, weightiness by sensory modalities*

Figure 4. The results in liking and experience by sensory modalities

By the characteristic in visual stimuli in each evaluation values
All evaluation values *sweetness, freshness, weightiness* (in the left / the middle / the right of Figure 5), *liking,* and *experience* (in the left / the right of Figure 6) by characteristic categories in visual evaluations. In *sweetness,* the three categories such as *sweets, fruits, flowers* showed significant difference in each category. Whereas *freshness* and *weightiness* did not show any significant difference between *fruits* and *flowers. Fruits* are the most preferred of three characters in *liking* and *experience* evaluations in visual.
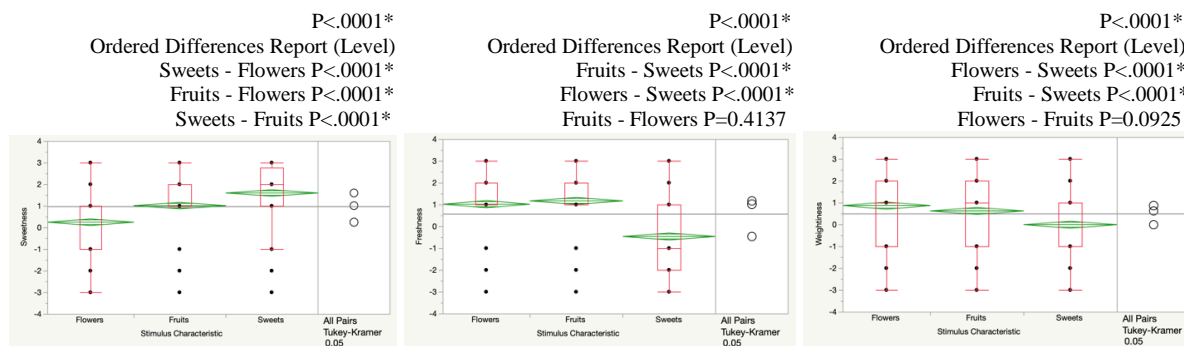

P<.0001*
Ordered Differences Report (Level)
Sweets - Flowers P<.0001*
Fruits - Flowers P<.0001*
Sweets - Fruits P<.0001*

P<.0001*
Ordered Differences Report (Level)
Fruits - Sweets P<.0001*
Flowers - Sweets P<.0001*
Fruits - Flowers P=0.4137

P<.0001*
Ordered Differences Report (Level)
Flowers - Sweets P<.0001*
Fruits - Sweets P<.0001*
Flowers - Fruits P=0.0925

Figure 5. The results in s*weetness*, freshness, weightiness *by the characteristic in visual*

P<.0001*
Ordered Differences Report (Level)
Fruits - Flowers P<.0001*
Sweets - Flowers P=0.0022*
Fruits - Sweets P=0.0076*

P<.0001*
Ordered Differences Report (Level)
Fruits - Flowers P<.0001*
Sweets - Flowers P<.0001*
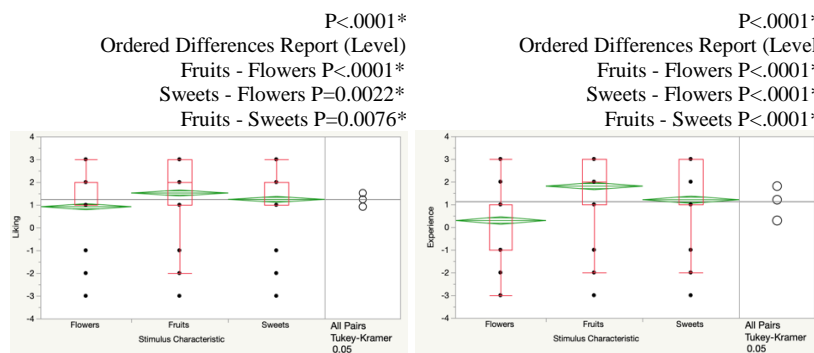Fruits - Sweets P<.0001*

Figure 6. The results in liking and experience by the characteristic in visual

By the characteristic in olfactory stimuli in each evaluation values
Only *liking* did not show any significant difference and excluded from the trends. *Experience* showed significant difference between each characters excluding *fruits* and *flowers*. It postulates that the olfactory similarity of *fruits* and *flowers* influence not only visual evaluation but also olfactory evaluation. In *sweetness,* each of the three categories showed significant difference. Whereas, *freshness* and *weightiness* show the opposite trend to *sweetness*, which was also observed in visual evaluations. And also, no significant difference was observed between *fruits* and *flowers*. It postulates that the olfactory similarity of *fruits* and *flowers* influences not only visual evaluations but also olfactory evaluation.
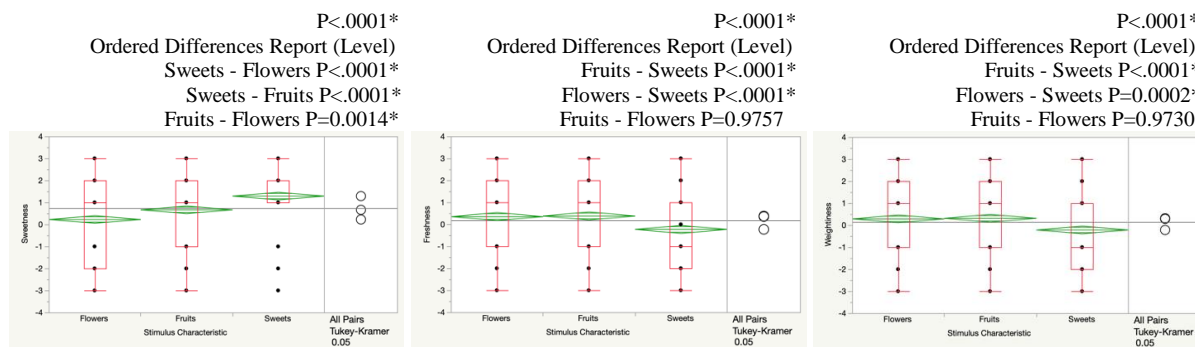

P<.0001*
Ordered Differences Report (Level)
Sweets - Flowers P<.0001*
Sweets - Fruits P<.0001*
Fruits - Flowers P=0.0014*

P<.0001*
Ordered Differences Report (Level)
Fruits - Sweets P<.0001*
Flowers - Sweets P<.0001*
Fruits - Flowers P=0.9757

P<.0001*
Ordered Differences Report (Level)
Fruits - Sweets P<.0001*
Flowers - Sweets P=0.0002*
Fruits - Flowers P=0.9730

Figure 7. The results in s*weetness*, freshness, weightiness *by the characteristic in olfactory*
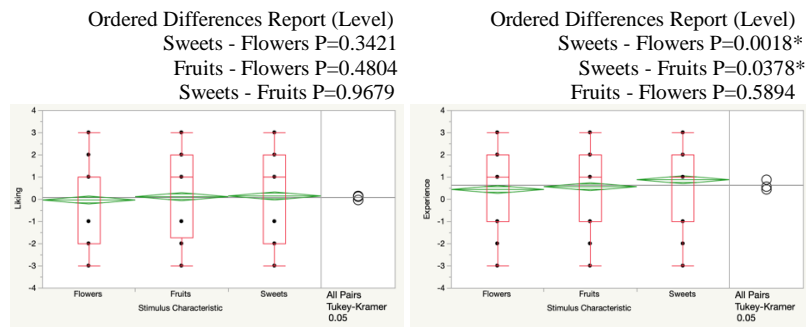
P=0.3280

P=0.0020*

Figure 8. The results in liking and experience by the characteristic in olfactory

2.3 Considerations

The results of the current research present that: (1) All evaluation values present significant modality differences. In *liking* evaluation, visual and olfactory differences present the biggest gap and enhance the influence of the visual stimuli. It postulates that visual stimuli are more affectable than olfactory stimuli. However, the previous research by the author presents different possibilities for this discussion [2]. In the previous research, which was supported by JSPS KAKENHI16H07097, olfactory stimuli which were evaluated positively influenced all evaluation values such as *sweetness, freshness, liking*. Whereas visual stimuli which were evaluated positively affected partly its traits on the evaluation when the modalities presented at the same time. It is a reasonable postulation that in unimodal perception, visual stimuli are more affectable than olfactory when presented independently. However, in multimodal perception, olfactory stimuli are more affectable than visual when presented dependently. (2) Regarding *sweetness*, the three categories' *sweets, fruits, flowers* show the significant difference between the categories. Whereas *freshness* and *weightiness* do not show any significant difference between the category's *fruits* and *flowers*. In the previous research mentioned above, *sweet trigger* stimuli, which are relevant to the three categories in the current research, was the most affectable value in both visual and olfactory independently. Although, there was no significant difference in *sweetness* evaluation. It is reasonable to postulate that *sweet trigger* is the most various and complex bias excluding *sweetness* per se. (3) All evaluation values *sweetness, freshness, weightiness,* and *experience* present significant difference by characteristic categories in olfactory evaluations but only *liking* does not show any significant difference and is excluded from the trends. It postulates that *liking* is influenced by the individual preference not by stimulus characteristics. In *sweetness,* each of the three categories show the significant difference, whereas *freshness* and *weightiness* show the opposite trend to *sweetness* which was also observed in visual evaluations. It does not show the significant difference between fruits and flowers as well. It postulates that the olfactory similarity of *fruits* and *flowers* influences not only visual evaluations but olfactory evaluation as well. And *sweet trigger* influences perceived stimuli to *freshness* and *weightiness* differently.

3   DISCUSSION AND CONCLUSION

The current research aimed to verify unanswered questions focused on multisensory stimulation and integration as follows. Q1: Do visual and olfactory stimuli influence the participants' evaluation value the same way regardless of whether it is *unimodal* or *multimodal*? Q2: Is *liking* an only intuitive value unlike other semantic values such as *sweetness, freshness, weightiness*? The current research presented significant findings which answer these questions. A1: Visual knowledge is more solid and influenceable than olfactory knowledge in unimodal conditions whereas olfactory knowledge is more solid and influenceable than visual knowledge in multimodal conditions. A2: *Liking* is a more clear and effectible value to verify the impression of the perceived stimuli. The worthiest finding from the results is that *liking* is relevant to experience. Figures 4,6 presents statistically significant evaluation trends for the evaluation of *liking* and *experience*. This tendency was observed in Figure 8 even though it did not present any significance.

Why is visual knowledge more solid and influenceable than olfactory knowledge in unimodal conditions whereas olfactory knowledge is more solid and influenceable than visual knowledge in multimodal conditions? Research by Rolls et al (1996) regarding the orbitofrontal cortex presented that, the rapid associative learning by the neurons in the orbitofrontal cortex which is associated with behaviours such as tasting is affected more by olfactory stimuli than visual stimuli [3]. Cho and Sai

(2018) studied the interaction effect of the spatial design elements and scent on the psychological mood state. They reported that the presence of olfaction helped reduce the negative mood of the participants and improved positive mood states in deficit spatial conditions such as narrow spaces with low ceiling heights [4]. These findings validate the postulation that olfactory knowledge is more affectable than visual in multimodal condition. These findings validate the postulation that olfactory knowledge is more affectable than visual in multimodal condition.

Why is *liking* influenced by the individual preference and not by stimulus characteristics? Berridge et al. (2003) have suggested *unconscious emotion* such as *unconscious liking* can elicit affective reactions subliminally while an individual is completely unaware of their affective reactions to a given scenario or stimulant [5]. Kihlstrom, John F., et al. (2000) suggested that emotions such as like/dislike can be unconscious expression of an individual's perception, memory or thoughts and can be expressed via the individual's behavioural and emotional response to things [6]. Therefore, it is safe to postulate that *liking* is an implicit *emotion* based on the individual's personal experience-driven value to influence clear and effectible on evaluations.

Why does sweet trigger the most various and complex bias excluding *sweetness* per se? Previous research works have demonstrated associations between taste/flavour attributes such as *sweetness* and external sensory stimuli. Blazhenkova & Kumar (2018) demonstrated that curved shapes were associated with sweet taste than angular shapes [7]. Another research by Wang et al. (2017) on the role of emotions in cross modal modulation of taste presented that sense of hearing could trigger on the sensory dimension of the tasting experience. The findings of the study suggested that positive emotions evoked by music enhanced the sweetness of different foods and drinks [8]. This leads to the assumption that *sweetness* is triggered not only by stimulants but also positive emotions. Therefore, it is reasonable to postulate that sweet triggers the most various and complex bias excluding sweetness per se.

The findings of this research are worthy as they provide an insight into the influence of structuring intuitive knowledge on subjective evaluations enhancing value-driven design factors to foster more valuable and creative experiences. The questions to be answered through the further research are as follow. Q1: Do structured knowledge affect perceived values? Q2: Does *liking* which contributes to the affective experience correlate with *sensitivity*? Q3: Do cognitive biases intervene in perception? Further study should clarify whether *liking* correlates with *sensitivity* in the structured sensory and if it leads the subjective evaluations to modify specific evaluation values.

REFERENCES
[1] Kim S., Cho Y., Niki K. and Yamanaka T. The Influence of Holistic View Impression in Product Evaluation by an Approach in Kansei. In *Proceedings of the International Conference on Kansei Engineering and Emotion Research*, pp. 945-952, 2012.

[2] SuKyoung K. Designing User Experiences Focused on Multimodal Perception. *Linköping Electronic Conference Proceedings*, No. 146 (KEER 2018) pp.454-463, 2018.

[3] Rolls E. T., Critchley H. D., Mason R. and Wakeman E. A. Orbitofrontal Cortex Neurons: Role in Olfactory and Visual Association Learning. *Journal of Neurophysiology*, Vol. 75, No. 5, pp. 1970-1981, 1996.

[4] Cho Y. and Gopal S. An Evaluation Model of the Sense of the Presence in Virtual Reality Environment, *In the 13th International Conference on Design Principles and Practices,* Saint Petersburg, Russia, 1st to 3rd March 2019.

[5] Berridge K.C. and Winkielman P. What is an Unconscious Emotion? *Cognition and Emotion*, Vol. 17, No. 2, pp. 181-211, 2003.

[6] Kihlstrom J. F., Mulvaney S., Tobias B. A. and Tobis I. P. The Emotional Unconscious. In E. Eich (Ed.), *Cognition and Emotion*. New York: Oxford University Press. 2000.

[7] Blazhenkova O. and Kumar M. M. Angular versus curved shapes: Correspondences and emotional processing. *Perception* 47.1 (2018): 67-89.

[8] Wang Q. and Spence C. A. Sweet smile: the Modulatory Role of Emotion in Howextrinsic Factors Influence Taste Evaluation. *Cognition and Emotion*, Vol. 32, pp. 1052-1061, 2018.