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Keywords: Food Photography, Cast Shadows, Perception, Del...

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The influence of cast shadows on "Deliciousness" perception in cakes

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Abstract: Food images contain several visual elements, such as lightning, color, shapes, shadows, etc. While the influence of the mentioned above have been well studied, the influence of shadows on "Deliciousness" impression of food remains unexplored. Thus, this study investigated how does the strength of the cast shadow and the angle of the light source influence deliciousness perception. There were 38 participants which evaluated 4 experimental conditions regarding the strength of the cast shadow, and 3 experimental conditions regarding the angle of the light source. A total of 12 images were evaluated with the conditions described. In each condition, the participants rated how delicious they perceived the visual stimuli. The results showed that the cast shadows acts as a diminisher of the light, and that high lightning angles images rated better than the other light angle conditions when the presence of shadows is null or close to null.

Keywords: *Food Photography, Cast Shadows, Perception, Deliciousness, Visual Elements*

1. INTRODUCTION

Shadows are an important visual element on any type of images; especially when it comes to advertisement. Practitioners manipulate the way shadows are going to be displayed by locating the light source/s in different positions. Furthermore, by softening or hardening the light, to magnify or diminish the presence of the attached and cast shadow in the image.

Every image regardless of object that is being portrayed; is made by the sum of different visual elements such as light, color, shadows, camera angle, background and decoration [4]. All these creates different effects which have been proven to influence our perception and preference towards the object in the image. Moreover, several researches have proven that visual elements such as lightning and color have a direct influence on how food is perceived [1, 3, 6].

In this paper, we will discuss which effects cast shadows has over "Deliciousness" perception on cakes, by experimenting with the cast shadow strength and proportion on cake images. Shadows can be classified as attached or cast shadows. Both are physically the same in nature but quite different perceptually. While attached shadows are an integral part of the object, cast shadows are an imposition by one object upon another [7]. This unique characteristic thus the fact that the most shadow manipulation on food images occur on the cast shadow,

were the main reasons as to experiment with this group. Cast shadows allow us understand hidden contexts, depth of field and even spatial positioning [2]. Nevertheless, on a previous study, experiment results showed that shadows were one of the least important visual elements, making us believe that their presence might be unconsciously perceived, raising questions about how could it impact our perception of "Deliciousness" on food images.

2. METHOD
2.1 Participants

The participants were 38 graduate and undergraduate Japanese female students from the University of Tsukuba, aged 19-29 years, M= 22.16, SD = 2.89. Although, initially the study considered including Japanese male population as well, though the low attendance of participants created a lack of data consistency for the statistical analysis, therefore it was decided to work only with the female population data.

2.2 Visual Stimuli

A set of 12 digitalized photographs were created taking in account 2 shadow factors. First the shadow intensity which was separated in the following four levels: no shadow (NS), soft shadow (SS), medium shadow (MS), hard shadow (HS), and the second factor was the light angle or shadow proportion (amount of shadow on the image) which was separated in the following three levels: High angle (HA), Medium angle (MA) and Low angle

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(LA). To avoid differences in the other visual elements, variation of a shooting procedure was utilized [4], in which all the visual elements are averaged to have a standardized image of the food except for the shadows. In this variation several attempts were made to create all 12 images with the same characteristics. However the changes on the light angle created differences on the highlights which when averaged resulted in a non-realistic image after some evaluation trials with people. Therefore, it was decided that the visual elements standardization process will be determined by the light angle as filter (Fig. 1).

Figure 1: Visual Stimuli
Rows: Shadow intensity; Columns: Lightning Angle

2.3 Evaluation items and scales.

There is a vast number of descriptors in which cakes can be described. Thus, a separate screening experiment was conducted to identify and stablish which descriptors people believe are the most important in the visual evaluation of cakes [5].

The results of the screening showed six descriptors ("crispness, deliciousness, excitement, freshness, happiness, and sweetness") to be significant. However, it was also observed that "deliciousness" presented a bigger

mean difference between the conditions evaluated which could be attributed by the changes of the cast shadow in the conditions evaluated, consequently for effects of this study, it was decided to focus on "deliciousness" as descriptor for analysis.

A 0 to 6 Likert scale was chosen to measure the intensity towards the descriptor being 0 the lowest and 6 the maximum rate.

2.4 Experiment & Procedure

The experiment consisted on the visual evaluation of cake images (visual stimuli). To accomplish that, the following procedure was created: After the participants entered the testing room, an explanation of the experiment and a misleading argument about the experiment was told to deviate the attention from the main purpose of the experiment. After this, a small training session took place to ensure that previous explanations were understood. For this training session, a random cake image (not relevant to the experiment) was placed in front of the participant and they were asked to observe it for twenty seconds. After that, the image was retrieved, and a Survey was administered. Then, the participants were given another twenty seconds to answer the survey. Next, a solid color image was shown to them (70% grey image) for twenty more seconds in an effort to scramble their memory by adding a new visual stimulus that could replace the cake image stored in the participants memory. In addition, several dummy cake images were presented and evaluated as part of this scrambling process. These steps were repeated until all twelve images were evaluated. Finally, the participants were told about the misleading objective of the experiment and were presented with the real objective of the study and were asked if after this they were still willing to cooperate with their data for analysis.

Additionally, dummy cake images were also created following the different light angle conditions with the purpose of having homogeneous images and avoiding a specific image to stand out. The room in which the experiment took place, also had specific lightning conditions to avoid changes on the color perception of the images.

3 RESULTS

Due to the number conditions (Angle & Intensity) and levels for each condition (3 levels for Angle, and 4 levels for Intensity), a two-way ANOVA was performed on the "deliciousness" evaluations.

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The main effect of "Angle" was significant for "Intensity" (F (2, 222) = 4.53, p< 0.013, partial ŋ = 0.109, observed power = 0.767): cakes presented with NS and SS conditions were rated higher when presented with high lightning angles rather than low or medium lightning angles. In the other hand, cakes presented with medium shadows had a higher score when presented with medium angles rather than high or low angles (Table 1). On the contrary HS condition showed no significance between the lightning angles conditions (Fig. 2).

Table 1: Deliciousness Means and Standard Deviation for each condition

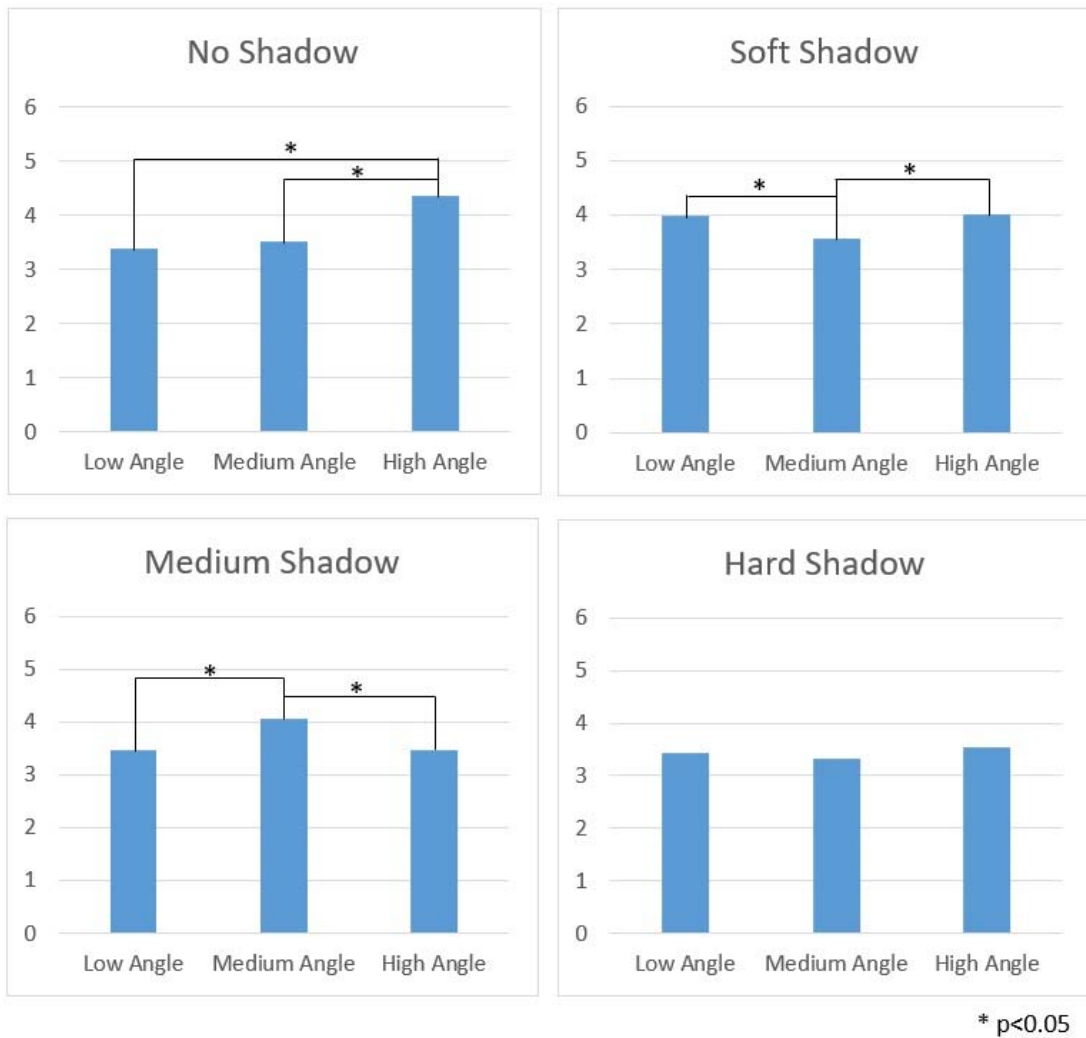|	Low Angle	Medium Angle	High Angle
No Shadow	M=3.39 SD=1.405	M=3.52 SD=1.409	M=4.36 SD=1.172
Soft Shadow	M=4.00 SD=1.273	M=3.57 SD=1.177	M=4.02 SD=1.262
Medium Shadow	M=3.47 SD=1.428	M=4.07 SD=1.148	M=3.47 SD=1.409
Hard Shadow	M=3.42 SD=1.407	M=3.31 SD=1.337	M=3.52 SD=1.502

Figure 2: 2-Way ANOVA results for Deliciousness on each lightning angle and shadow strength

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4. DISCUSSION

The current study demonstrated that cast shadows influence the perception of "Deliciousness". In other words, in terms of visual elements; when the presence of cast shadows was null, the perception of "Deliciousness" was mostly determined by the shape and location of the highlight of the cake (lightning). Although the attached shadow could also have influenced on the evaluation (Fig. 1 & 2). Furthermore, when there was a presence of cast shadow, the angle of the light also played a major role on how "Delicious" the cakes were perceived (see Soft and Medium Shadow Fig. 2). This phenomenon could happen because both attached and cast act as a diminisher of the effect of the light, and the highlights on any type of food image are the result of the reflection property of light when it hits water droplets within the food, therefore, looking more appealing for human consumption.

"Deliciousness" comprehension depends highly on the knowledge the participants had of the stimuli. The visual cues that the cakes presented in the study could have revealed information that the user could have used to associate with their taste memory. However, if the images did not have such cues (black & white image), then softer shadows could have created a higher impression of "Deliciousness" as it was proven on a previous study [5].

5. CONCLUSION AND RECOMMENDATIONS

To summarize, this study provides with evidence on the influence that cast shadows have over "Deliciousness" perception on cakes images. Further research on this topic is necessary to unravel the possible interaction between the cast shadows and the other visual elements since in this study the visual stimuli tested consisted in a single type of cake with a certain shape, color and texture. Extending this study into testing several unconventional shape and colors and textures of cakes could reveal if the findings of this study can applicable to any type of cake.

On the other hand, the word "Deliciousness" is quite general in its definition, which conveys not only emotional parameters but also physiological ones; words related to taste and smell are often used to describe "Deliciousness". Although this study aimed for its general definition a narrower target of the concept behind the word "Deliciousness" could give more promising results.

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