

We Who Eats: Understanding Food Perception upon First Sight

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Abstract—Images of food has been making a ubiquitous presence thanks to social media. People would use the social media to share and communicate about food. Some users are even drawn to travel around the world just to experience local delicacies. Often, they rely on web information and images to identify how local delicacies look like and in certain cases, predict its taste. Many food outlets or tourism sector use food image to market local food requiring users to tap into their visual cognition and perception of what it represents. However, little exploration has been done to understand if image can indeed simulate food taste particularly in the initial interaction with the food image. Therefore, we were motivated to understand user perception on local delicacies upon the first sight of its image. We applied the case study approach where we focused on three ‘Sarawak Layer Cakes’ to compare user perception of the cakes’ taste. Using Instagram as image mediator, users were requested to create hashtags that depicts how the food might taste like from the image alone. The hashtags were then analysed using content analysis where we found that appearance, perceived flavour and perceived texture affects user perception differently with the appearance dimension significantly affects user perception.

Index Terms—digital taste, food digital experience, taste perception, taste experience, visual perception

I. INTRODUCTION

Culinary tourism or food tourism relates very much to food and eating experiences that occur when people travel. Malaysia offers a variety of food which can serve as an opportunity for Malaysia to become a culinary tourism destination in Asia [1] as local food is central to the tourist experience [2]. Henceforth, Malaysia should capitalize on food tourism where the benefits can be two-fold; global identification of Malaysian food as well as generate economic opportunities [3].

Ideas and images on local cuisine are increasingly embedded in the marketing collateral of tourist destinations [4] due to the core belief that food is an important element in tourist experience when choosing a holiday destination. It is only natural then most marketers have given attention to the presentation of images and textual description of local cuisine in their advertising materials (i.e. travel guides, brochures and websites) to market tourist destinations.

Apart from the formal marketing initiatives, local delicacies are also promoted through social media where it is communicated as a form of celebration and experience sharing [5]. Such celebration is widespread that hashtags such as are #foodie, #foodporn and #foodgasm, among others, are evident across the Instagram platform with more than associated 216 million posts in 2017 alone [6].

Food taste might differ through expectation [7] as it is influenced by visual impressions of the food and its actual taste [8]. The former is attributed to many types of visual cues such as the colours of the food, shape of the plate it is served on, and the orientation of the food on the plate.

Perception on the basic tastes of sweet, salty, umami, sour, and bitter as well as the oral sensation of fat, plays a vital role in determining food acceptance, preference, and choice [9]. According to [10], the taste of food is reformed by combined sensations in the mouth but nevertheless, senses such as vision, emotion, and the environmental circumstance can pre-affect the taste of food.

Perception serves as an active and conscious act of seeking out and searching for cues within the stimulus information available to us [7], [11]. As such, food images can be used as a mediator to elicit taste perception. Nevertheless, it raises the question of how to stimulate taste sensations with respect to the various stimulation approaches and purposes of a stimulation [12].

A. Food Visual Perception

Food encounter is almost always initiated by visual sensory [13], [14] where a visual image with quality attributes could influence users to taste the food. Food is capable in providing some of the most universal and rich sensory experience possible [8].

Bitter, sweet, sour and salty are based on taxonomy of perceptions [15]. Nevertheless, the perception of tastes can vary from person to-person [2] due to sensory evaluations being affected by different sensory experience [16].

Perception is an active and conscious act of seeking out and searching for cues within the stimulus information available to us [7]. Food is often evaluated in terms of flavour through a complex combination of smell, texture and taste [17], [13]. However, the sensory attributes for making perception is not limited to smell and texture.

Using image to represent food requires careful visualization of attributes. For example, [13], [18] and [19] found that food image should have elements of attractiveness, opacity, gloss, flavour profile, familiarity, distinctiveness, taste, texture, appearances and hedonics.

As images are often remarked as "telling a thousand words" [14], this study sets to investigate how user perceive food taste upon first sight (i.e. looking at the food image for the first time). Using Malaysian local dessert as a case study on Instagram platform, we seek to understand attributes that encapsulates user perception on food taste without the actual tasting of the food. It marks the visual cues user seeks for which could ultimately be used in identifying sensory attributes in food image presentation to digitize taste.

II. METHODOLOGY

A. Research Design

We approached this study with the concept that any food image should comprise manageable constructs that represents food characteristics. We postulate that these characteristics are drivers of food perception which users try to apply acuity in predicting what the food would taste like. In addition, the same constructs are used to manifest the taste experience albeit perhaps within different use of terms. Therefore, this study has adopted the visual dimension model from [18], [19] and [13] which is summarised in Table I below.

TABLE I. FOOD IMAGE CONSTRUCTS

Dimensions	Description
Appearance	Colour, design, aesthetics of the food
Flavour	Various flavour attributes which include but not limited to soury, bitter, sweet, salty, umami
Texture	Physical shape, physical structure of the food
Hedonic	The feelings of pleasure or displeasure towards the food

It is important to note that studies from [18], [19] and [13] have indeed motioned more constructs on food




description. However, we have limited the constructs into the above four due to the food sample chosen in this study. This is further explained in Section B.

We argue that the 'appearance', 'flavour' and 'texture' dimensions of the food would interact with users' physiological, behavioural, and cognitive factors to exert influence on user taste perception. This interaction would then affect users' 'hedonic' response of which they may feel pleasure or displeasure towards the food.

B. Food Selection

The focus of our food investigation is *Kek Lapis Sarawak* or Sarawak Layer Cake. It is one of the local desserts from Malaysian Sarawak state. It is widely promoted in Sarawak Tourism website as well as regarded as one of the must have take-home food for visitors [20]. Sarawak Layer Cake comes in many varieties of which we have chosen three variety to work with. The variety chosen were identified as top selling items among Sarawak Layer Cake sellers. These three cakes also allowed the facilitation to elicit dimensions are per Table I due to the different colours, flavours and textural appearance of each cake. A summary of the selected cakes can be seen in Table II.

TABLE II. SARAWAK LAYER CAKE VARIETY

Sarawak Layer Cake	Description
 <p>Cake 1: Masam Manis</p>	Green, yellow and brown layers with sweet soury taste
 <p>Cake 2: Idola</p>	Brown and yellow layers with chocolatey taste
 <p>Cake 3: Swissroll Masam Manis</p>	Red, yellow and green zig-zag layers with sweet soury taste

Sarawak Layer Cakes will generally maintain its taste when kept in room temperature but within 3 days best. After the period, the quality would degrade. Although the cake could be refrigerated for longer shelf-life, the cake would harden affecting its genuine texture representation. In consideration of this, image of the cake was taken immediately after it is sliced to capture its best texture state and used as image sample for our study.

C. Participants

A purposive sampling was employed in this study where a filtering criterion was achieved through a short survey. We recruited 10 participants from the age group of 25 to 40 years old, enjoy food while travelling and is employed. It must be noted that this study is just one of the many series of studies conducted with the same participants, prompting us to work with 10 participants as to ensure the practicality in data analysis management.

The age group is chosen as this is the group mostly found to travel using their own expenditure which also meets the third criteria. The second criteria on the other hand is critical as we feel such candidate could provide relevant taste reflection due to their travelling experience.

D. Procedure

As this study focused on the use of food visual cues on the web, we have created a dummy Instagram account. Instagram was chosen to mediate the food image as well as served as a tool for participant to create corresponding hashtags. Moreover, it is one of the largest social media platforms for foodporn industry [21] as its core feature is a focus on image with complementary hashtags.

To avoid influence of data content, the account was set into private and did not follow any other Instagram user. Participants played the role of account owner of the dummy Instagram account. As owner, they would create hashtags based on first sight of the food artefact, as a typical Instagram account owner would. The hashtags were merely representation of the visual insight in textual form, which in turn allowed us to capture their visual perception of the cakes in their own words. This required us to record all hashtags entries and delete them after each participant session ends as to enable the enactment of “Instagram account owner” for each user study. The dummy account was then deleted after the course of study ends.

To capture the image of the cake, we used white plates placed on a white cloth. On the plate we served uncut cake loaves as well as several pieces of sliced cakes. We used natural lightings and made sure the camera only pointed to the cake on the plate to avoid visual distraction of non-cake elements. This is in line with suggestion by [14] where he found that background colour could influence the perception of food taste and flavour. Moreover, he opines that dessert is more suited to a white background and should be put on the table which have been covered by white table cloth. The setup can be seen in Fig. 1.

User study was done one participant at a time. Before each of the study took place, we first explained the purpose and the procedures of the data collection to the participants. Then, each participant was presented with pictures of each of the three Sarawak Layer Cakes through the Instagram dummy account. Subsequently, participants were asked to create hashtags based on leading questions of “how would you describe the cake in terms of appearance, flavour and texture” as well as “how does the look of the cake make you feel?”. The purpose of the questions is to make sure participants do not create meaningless hashtags therefore defeating the purpose of the study.

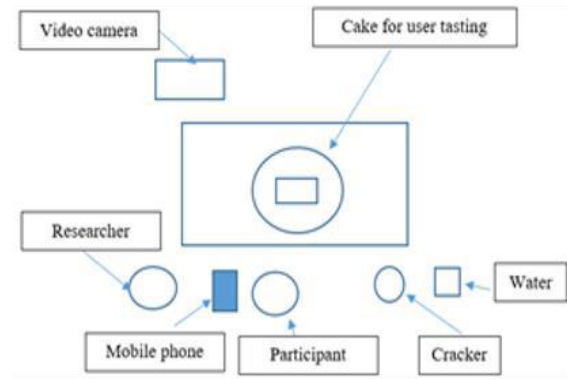


Figure 1. Study setup.

E. Data Analysis

Content analysis was used to examine the constructs of food visual dimensions in user created hashtags. These constructs were then quantified to tabulate the frequency of appearance. Presentation wise, the hashtags were translated into English words as the original hashtags mostly used Malay words. It must be noted however that the content analysis was done on the original hashtags as it captured users' original perception. This did not serve a problem to the researchers as Malay language is their native language.

III. RESULTS

A. Profile of the Participants

A total of ten users participated in this study. There were more females in the study (70%) and with 60% of them within the age range of 25 to 30 years old. This implied that our participants are mostly young adults. All participants have stable employment which has enabled them to travel locally. Interestingly, none of them have travelled to Sarawak before nor have they tasted the three Sarawak Layer Cakes used in this study. This we believe presented an opportunity for genuine user perception of food taste upon first sight.

B. Food Image Perception

TABLE III. FREQUENCY OF FOOD IMAGE CONSTRUCTS

Dimensions and Attributes	Description
1. Appearance	
• Colour	28
• Design	9
• Aesthetics	26
2. Flavour	
• Colour	25
• Design	16
3. Texture	
• Formation	23
• Ingredient Related	1
• Integration/disintegration	5

Based on the ten interviews, a total of 133 hashtags were compiled for all three cakes. Distribution of hashtags for each of the cakes were, Cake 1: 53 hashtags, Cake 2: 39 hashtags and Cake 3: 41 hashtags. These hashtags were then analysed and categorized into the food dimensions of

‘appearance’, ‘perceived flavour’ and ‘perceived texture’. The categorization was done inductively as the hashtags created by the users were very prescriptive allowing the themes to easily emerge from the data. Table III presents the dimensions and the attributes identified as well as their frequency of occurrence.

1) Appearance

Appearance is concerned with how food is presented in terms of colour (44.4%), design (14.3%) and aesthetics (41.3%). 63 hashtags describing the cakes appearance can be found from the data with Cake 1: 26 hashtags; Cake 2: 18 hashtags and Cake 3: 19 hashtags. From the tabulated data, colours affect user perception the most with aesthetics attributes following closely.

We found that colour-related hashtags incorporated the word ‘colour’ into the hashtags. Additionally, the hashtags also make use on hue description (i.e. chocho) and hue appeal (i.e. bright, looks moderately fine).

Hashtags with ‘design’ attribute looks specifically on the cake structure where in our case, participants scrutinized on the cake layers (i.e. zigzag, stacked design).

‘Aesthetics’ on the other hand look at the overall appeal of the cake appearance. Some examples included #cheerful, #attractive and #IWantToTasteIt.

In the context of ‘appearance’ dimension, our findings show that colour is an important sensory dimension that affects the perceived aesthetics of the food item [18] and ultimately the food acceptance and rejection [13].

Nevertheless, aesthetics is not always perceived positively. Cake 2 for example, received several negative hashtags such as #uninteresting and #bland which may be attributed to the earthy yellow and brown colours of the cake. In contrast, presence of more than two colours in the cake are very well perceived by the users. Cake 1 and Cake 3 receives hashtags complimenting on the variety of colours as well as perceived beauty and attractiveness. Cake 3 particularly reminded them of the rainbow and has the most perceived aesthetic thoughts due to its appearance.

2) Flavour

‘Flavour’ dimension refers to how users make taste perception (61%) and its overall flavour (39%). There were 41 hashtags describing the cakes flavour with Cake 1: 16 hashtags; Cake 2: 14 hashtags and Cake 3: 11 hashtags. We found it very interesting that participants were able to perceive taste from the cake image. Nevertheless, we believe that the cue utilized by participants in perceiving the taste came from the names of the cakes, which was indicated at the Instagram cake image. Both Cake 1 and Cake 3 have the name Masam Manis which means sweet sour. This indicates that food name is influential in making taste perception.

One user attributed the combined green and yellow hue of the Cake 1 as buttery (cue: yellow) screwpine (cue: green) flavour. Plain butter cakes are usually yellow which may have helped user tap into their experience in making such taste perception. Additionally, Malaysian local desserts with green hue appearance often use screwpine leaves (locally known as *Daun Pandan*) for its fragrant flavour and colour. Some example of local desserts using screwpine leaves are *Kuih Cara*, *Kuih*

Ketayap and *Bingka Kemboja* which are commonly available as street food throughout Malaysia and are green in colour. The user may have experience consuming such dish serving as a “reference point” to gauge the new food items in a foreign setting [18].

Generally, users created positive sounding hashtags when making flavour perceptions of the cakes. Examples include #tasty, #fluffyAndTasty and #looksTasty.

3) Texture

Food texture is attributed to the structural elements of the food which is primarily sensed by the feeling of touch. The underlying foundation to the concept is, with a tactile interaction with the cake, one can sense the deformation, disintegration, and flow of the food under a force [22].

For Sarawak Layer Cakes, textures are largely attributed to formation (79.3%), integration/disintegration of the cake (17.3%) and ingredient element (3.4%). 29 hashtags describing the cakes texture can be found from the data with Cake 1: 11 hashtags; Cake 2: 7 hashtags and Cake 3: 11 hashtags. In terms of formation perception, hashtags included #soft, #moist, and #fluffy. On the other hand, for integration/disintegration, hashtags included #delicate, #solid, and #sticky. Only one hashtag was used to describe texture in terms of ingredient and it was #softAndGreasy. The ingredient element is highlighted through the word ‘greasy’ which is associated with oil and/or butter – a common ingredient in making cakes.

Overall, texture is generally described with common cake descriptors which is moist and fluffy. It is also the dimension with the least number of hashtags, with some users have opted not to describe some of the cake textures at all. Also, the descriptors are largely repetitive making it an insignificant dimension.

C. Distribution of User Perception

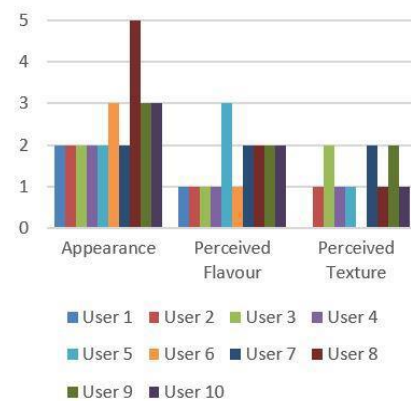


Figure 2. User Perception on cake 1.

Fig. 2 shows user perception on Cake 1. From our data analysis of Cake 1, we found an average of 6.3 hashtags to every user. A further analysis showed that participants have created 2.6 hashtags for ‘appearance’, 1.6 hashtags for ‘flavour’ and 1.1 hashtags for ‘texture’ of Cake 1. User 8 tops the list with the most hashtags by having created 8 hashtags. User 1 on the other hand has the least number with only 3 hashtags created to describe Cake 1. Most of the hashtags perceived the cake positively with most commenting on the cheerful colours. Some interesting

hashtags of the cake included #classic, #uniformed, #brightlyStriking, and #butteryScrewpineFlavour.

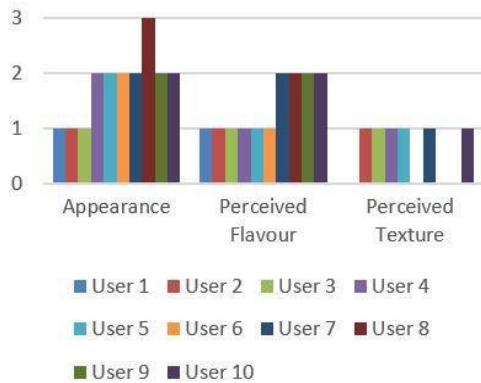


Figure 3. User perception on cake 2.

Fig. 3 shows user perception on Cake 2. From our data analysis on Cake 2, we found an average of 3.8 hashtags to every user. A further analysis showed that participants have created 1.8 hashtags for 'appearance', 1.4 hashtags for 'flavour' and 0.6 hashtags for 'texture' of Cake 2. There was no significant observation in terms of most and least number of hashtags created amongst the user as it was found that users created 3 to 5 hashtags each.

Most of the hashtags perceived the cake unfavourably with most commenting on the bland colours. Nevertheless, this did not affect the perception of the cake's flavour as most of the hashtags perceived the cake as tasty. This is due to the presence of chocolate hue giving them the impression that the cake may have a chocolatey taste. We also noticed that none of the hashtags stood out as compared to the hashtags found for Cake 1.

Fig. 4 shows user perception on Cake 3. From our data analysis for Cake 3, we found an average of 3.7 hashtags to every user, which is not far different from Cake 2. A further analysis showed that participants have created 1.9 hashtags for 'appearance', 1.1 hashtags for 'flavour' and 1.1 hashtags for 'texture' of Cake 3. There was no significant observation in terms of most and least number of hashtags created amongst the user as it was found that users created 3 to 6 hashtags each.

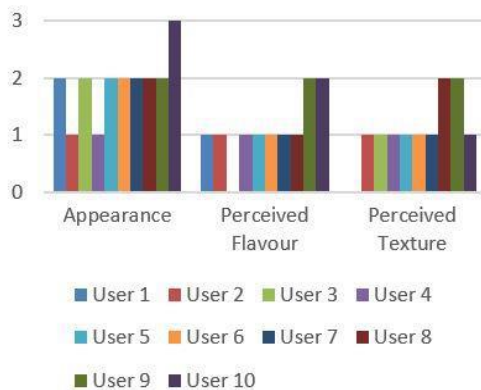


Figure 4. User perception on cake 3.

Most of the hashtags perceived the cake positively with most of them commenting on the cheerful rainbow-like

colours and design which they found extremely attractive and tasty.

Some interesting hashtags of Cake 3 included #coloursOfTheRainbow, #merry, and #sweetButterSugar. The last hashtag is interesting as despite the presence of multiple rainbow-like colours, the perception of flavour is only attributed to buttery flavour. This is different from Cake 1 where the green hue is attributed to Screwpine flavour.

Moreover, despite the presence of pink hue in Cake 3, none of the user attributed it to strawberry or any other red fruit flavouring.

IV. CONCLUSION

The discussion has highlighted on the wordings and frequency of hashtags. However, it must be reemphasized that the analysis was done as such as visualization of user perception were represented in textual forms using hashtags.

Findings from the previous sections implies that users largely share similar perception towards the 'appearance', 'flavour' and 'texture' across all of the cakes image presented to them. In short, users perceive similarly. This is a significant finding implying that visual cues can be perceived similarly and the use of one image alone can convey helpful visual cues.

Our findings illustrate a pattern of cues users seek for when making taste perception. We found that 'appearance' plays a dominant factor with colours attracting users the most. It is also found that dimensions on 'flavour' is somewhat influenced by 'appearance'. This is because, appearances that is bland is perceived to be less tasty. However, if appearance has a favourable perception, the cake is also perceived to be tasty. This could relate to the findings from [23], where due to degree of visual cue acceptance, some food items tended to be more favourably perceived as cognitive and emotional perception is evoked [18].

As a conclusion, visual cues do serve as sensory attributes allowing user to make informed perception on the food taste.

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