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Digital Foraging: How Social Media Is Changing Our Relationship with Food and Nutrition?

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Abstract

Since advanced economic growth, the human relationship with food has exceeded the needs for hunger and survival, which develops into infatuation and entertainment. With the development of media technologies, the human obsession with food has extended into the online space. Besides the appealing video advertisements and websites, food images account for a larger content proportion on social media, which is the context that informs the topic for this paper.

Especially on the most popular social media, like Instagram and Pinterest, food-related images, food content and food hashtags are ubiquitous. The abundant and frequent exposure to culinary images could be directly linked to concepts like 'visual hunger' or 'digital satiation', which would influence our food choices and eating behaviours, according to the visual impacts studied by nutritionists and psychologists.

In order to improve daily diet habits, this article took social media as the main research platform, reviewed previous studies about the general features of food photos on Instagram and the possible impacts on eating behaviours and health awareness. It defined the new phenomenon of 'digital foraging' linking the large number of food images in network context to the technological applications for promoting a healthy diet.

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Introduction

The human obsession with food has been constant throughout history, from the earlier enthusiasm for cookery books, the increase in celebrity cooking shows, to the modern growing trend of sharing food photos on social media. Due to the technology of digital screens, visual image becomes vibrant and animated, and with the development of mobile media, information communication turns to be instant and more accessible. All of these make food images become more attractive and ubiquitous. Because of the permanent craving of eating and feeding, taking food photos and posting them on the social media evolved into a popularity. Specifically on the image-based platform, such as 85% photos involved food on Instagram (Holmberg et al. 2016) and 60% images was relevant to food on Pinterest (Kinard 2016).

By searching the hashtag '#food' on Instagram, there are more than 364 million photos, usually following by #foodporn with 212 million, #instafood with 158 million, #yummy with 144 million, #foodie with 138 million, #delicious with 103 million and so on. Especially the hashtag '#foodporn' combining the words of 'food' and 'pornography' attracted a prominent attention of many researchers. Because it contains an obscene meaning but has a rapid spread and large prevalence, which might imply the great attention and indulgence to food for publics. Sociologists worried that the consistent exposure to such kind of images might create harmful effects in long-term, like stimulating the eating excess, raising the addiction of food and increasing the risk of bulimia and obesity (Spence et al. 2016). However, some researchers argued that seeing food could inform an eating simulation in the brain, which might produce a sense of satiation and satisfaction that could reduce the actual eating intake (Hong 2016). In other words, the frequent exposure to food images has a possibility of controlling and decreasing portion sizes rather than promoting consumption.

Analysis of Food Images on Social Media.

In the first instance, two dominant features of social media made it become the main research platform to analyse culinary images:

- The large quantity;
- The ease at which they can be accessed;

Up to January of 2019, three quarters of worldwide population (3.484 billion) has been active on social media in several forms, and this value increased of 9% year-after-year. A large amount of these social media users (3.256 billion) particularly preferred the mobile platform (Chaffey 2019). In addition, this vast population also uses social media quite frequently. In fact, 76% of Facebook users and 51% of Instagram users utilize it every single day (ibid). Furthermore, Holmberg et al. (2016) suggests that the younger generation who grew up in this digital age commonly post or share information on social media as a daily routine.

Given that social media data are not strictly private and most records can be grabbed through Application programming interface (API), including both the user's information (including profile, network, friends, followers, etc.) and some details of the post (involving tags, captions, texts, photos, locations, etc.) (Hu et al. 2014). These provide the possibility to researchers and developers for collecting the multiple data and doing image analysis to learn the general diet habits and aesthetic preference of this demographic.

Considering the vast population on social media, these user-generated food images could provide a pretty accurate picture of society in general (Hamid et al. 2016, Forbush and Foucault-Welles 2016). By analysing these social media culinary images, it is possible to observe typical food choices and eating behaviours of the public. By identifying and understanding the visual clues of food images, researchers could infer and study the common food preferences, diet habits and health awareness of a specific demographic. Even when images are selected or possibly embellished by filters, considering the massive quantity of data, some common food visual qualities can still be concluded even without the whole diet situation (Peng and Jemmott 2018).

The unconstrained and various style tends to be the primary characteristic of food images on social media. According to Mejova et al. (2016), these photos are normally different from the business advertisements. Although some social media food photos are not attractive or even disgusting, they are taken of the real food. However, many commercial culinary pictures might even use fake foods or visual tricks in order to convey a better appearance and be more appealing. In a similar way, these photos are unlike the professional photographs either. They are more like a record of daily life than a photographic artwork, so usually without using many professional techniques for the high aesthetic quality or developing a distinctive personal style (Manovich 2016). Social media is a user-generated platform and ordinary population accounts for the vast majority of users, so these food images could express the general eating situation and common photographic style of the public.

On Instagram, the majority of food images have some common visual characteristics. Most of them are close-up shots of food without humans (Mejova et al. 2016). In order to have sophisticated aesthetics qualities and look more appealing, the photographic style of cooking books is often imitated (Peng and Jemmott 2018). As for the composition, they are mainly still life photos with a central focus to emphasis the food. In general, the rule of one third composition is followed (ibid). As a key element among the visual clues and has a dominant impact on perception, colour is always emphasized the sharpness and saturation in digital photos (Mejova et al. 2016). Furthermore, colourful photos are usually more popular than the pictures in black and white, especially with arousing colours (e.g., red, orange) rather than relaxing colours (e.g., green, blue). Foods of arousing colour are always associated with meat or those containing high protein, which can provide more energy. As a result of the evolution we have more sensitivity to these kinds of coloured foods (Peng and Jemmott 2018).

Another aspect that can be observed is that people have specific favours about visual presentation of food. For instance, by analysing 1000 food images from Instagram, most cake photos were taken from a low viewing angle with a close distance to the object. Whereas, the pizza usually showed in the image from the looking-down viewing angle, which Szocs and Lefebvre (2017) claimed as 90°, and with a far distance. In addition, a large number of food photos with hashtag '#breakfast' and '#smooth' were also shot in the same photographic techniques. As for the food images showing dinner, they seemed to be photographed more casually, from the angle siting at the table (42°) with a medium distance to the food, basically from the perspective of the eater (ibid). This is also one of the most dominant features among all the food images, taking photos from the first person perspective. The food showing from the third person perspective (rather than the eater perspective) was less than 5% of the total. If the food has an explicit point or angle, the 'away' oriented pointing from the eater is preferred (Michel et al. 2015).

In addition, a link between the food visual characteristics and the food perception can be established based on the eating memory and experience. According to Harrar and Spence (2013), if the yogurt has red colour, it was more likely associated with the flavour of strawberry and perceived sweeter. The perception of saltiness would be stronger when the popcorn was packaged in a blue box, whereas it would be perceived sweeter with a red container. Furthermore, the perception of portion size could also be changed by visual clues. From Szocs and Lefebvre (2017), the quantity of food would be perceived more when using horizontal plating than being presented in vertical way. König and Renner (2018) suggested that the number of multi-coloured sweets would be perceived less when compared with single colour, with a meal that includes more colours thought to be healthier (ibid).

As for the content of culinary photos on Instagram, abundant studies has revealed that the food with high calorie but low nutriment are dominant. This kind of images occupied 67.7%, whereas those containing fruits and vegetables only account for 21.8% of the total (Holmberg et al. 2016). Besides that, Peng and Jemmott (2018) manifested that bizarre or rarer food usually has more likes and attentions globally.

In addition, the hashtags could provide another source of useful information to understand food habits and behaviours. '#foodporn', which is one of most popular hashtags on Instagram, the topics related to sweets, fast food or other heavy foods are mentioned mostly out of the 72 investigated countries (Mejova et al. 2016). For instance, the photos involving chocolate accounted for 78% and cake pictures occupied 41%. It is also interesting to observe that if we rank the food by categories and type, the top fruit is strawberry, while among the non-sweet foods on the tops are usually pizza, salad, sushi, and burgers. Although this kind of ranking detail is not always the same in different countries because of the cultural and environmental factors, the preference for high-calorie and high-energy foods is a common feature (ibid).

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In conclusion, the food choices and eating behaviours are various for individuals and are influenced by complex factors, but they still have many common characteristics and universal rules, which supports the feasibility and validity of quantitative study of social media food images.

Digital Foraging: The Impact of Food Images

The first to suggest the link between vision and taste were the zoologists. By researching the behaviour of the primate, they found that the initial taste information would converge at orbitofrontal cortex and might trigger the feeling of hunger or satiety (Critchley and Rolls 1996). Finding food is one of the key functions for the brain that determines whether the body can obtain enough energy to survive or not, so after being stimulated by food cues, the brain would become activated and simulate the process of eating the food automatically. This aims to inform the body to prepare for receiving food and a feeling of hunger possibly emerges (Spence et al. 2016). According to Basso et al. (2018), 'visual hunger' is not only provoked by watching the real food, but also can be induced by seeing food images or even reading food-related words.

Therefore, we can establish that the most common effect of seeing a large amount of food images is feeling hungry, this is a phenomenon known as 'visual hunger' (Spence et al. 2016). Accordingly, this kind of influence could be expanded and enhanced by social media via numerous food images, as food is showed more frequently in quite attractive and appealing presentation formats, with more vibrant colour and higher resolution caused by the high definition of digital screens.

Furthermore, the ubiquity of social media on mobile platforms increases the convenience and frequency of being exposed to food. Thus, a series of related neurological, physiological and behavioural responses tends to aggravate the physiological hunger more often than usual, which potentially triggers the growth of consumption and overeating issues (Spence et al. 2016).

However, the intake amount of specific food or flavour might be able to reduce under the same principle of simulating of feeding, just like 'digital satiation' (Spence et al. 2016). According to Redden and Haws (2012), the eating imitation in the brain could evoke the related enjoyment and pleasure based on previous memories and experiences , which could produce a virtual feeling of satisfaction. This could reduce the desire of that kind of food or taste and then potentially drop the actual intake. From the experiments carried out by Larson et al. (2014), the desire and delight of salt decreased after seeing 60 pictures rather than 20 of salty foods, and similarly, those people ate less candies after imagining consumed a great amount of sweets. Accordingly, the result of being exposed to numerous food images might be opposite, which might depend on the degree of visual stimulation and if a specific taste is perceived constantly. From the different impacts on eating behaviours, it provides the possibility of improving dietary habits by changing the visual perception.

On the other hand, the food images on social media might influence food awareness. Based on previous eating experience and knowledge, the link between visual characteristics (colour, shape, texture, glossiness, etc.) and food traits (flavour, portion size, freshness, ripeness and even nutrient) have already been connected (Spence et al. 2016; Kontukoski et al. 2016; Peng and Jemmott 2018). According to the theory of evolution, both perceived taste and assumed value could be obtain at a glance, as we have to estimate if the food is edible or toxic and evaluate if it can provide more energy before the actual consumption. This is similar with the phrase, "we eat first with our eyes" (Spence et al. cited Delwiche 2016, 53). For instance, people tend to eat a meal containing multi-colour foods, as more diversity of colour are usually considered to be healthier (König and Renner 2018), and avoid eating the food decorated with red colour as the stereotype of the relevance with unhealthy or fast food (Spence 2018). However, this awareness can be influenced and changed through food education and health knowledge. Due to one of significant features of social media is information communication, the food knowledge might be improved by nutritional information and the awareness could be affected by authoritative opinions via posts. According to Peng and Jemmott (2018), some individuals use social media as a source for collecting health and food information posted from peers, celebrities, communities or other accounts. Inan-Eroglu and Buyuktuncer (2018) suggested that professional dietitians and nutritionists have indeed contributed to disseminate food-related knowledge and produced some positive impacts of promoting diet and health to the public in a way.

According to Koy and Plotnick (2007), foraging behaviour is survival instinct of all animals, which involves all means of finding and collecting energy and nutrient. By reason of survival and growth, every creature would learn and assess the environment persistently, in order to find more food sources and nutritional substitution with higher energy. Internet, in this sense, could be regarded as an effective supplement in this process, since both nutritional knowledge and visual satiation can be gained easily. As mentioned above, food images can induce a kind of virtual satisfaction and eating pleasure, which could be considered as an excellent complement of food source when the desire of food is more like a greed rather than necessity. On the other hand, as modern technologies provide a possibility of controlling and using the impacts of visual hunger, satiation and awareness, the diet habit and health could potentially promoted in the process of technological management and intervention. This new phenomenon is what the authors defines as 'digital foraging', using digital technology to improve diet and health via influencing the food perception and eating behaviours. In the following section, some examples of 'digital foraging' are provided, taking into account technologies of 3D printing, virtual reality and interactive devices.

Potential Applications

According to visual stimulation of food images, the impact of 'visual hunger' might be able to promote the appetite of eating vegetables for children by increasing the exposure of vegetable images (Spence et al. 2016). On the other hand, combining modern technologies with the impact of food perception, some new solutions to eating issues could potentially be provided.

3D printing food is a typical example of Digital Foraging, which can easily reshape the visual characteristics to change the perception. By altering the appearance and colour to match the personal favour, the eating pleasure and enjoyment could be enhance. In addition, the taste and nutritive proportion can be customized by individual preferences, and ingredients can also be replaced by particular requirements (Sun et al. 2015). Cookies and candies could be printed by healthy ingredients with an attractive appearance in order to persuade children to eat healthier and natural foods. Furthermore, this revolutionary innovation could manufacture soft-textured meals in fabulous presenting ways for people who with chewing and swallowing difficulties (Lupton and Turner 2018). It could also initiate a convenient and healthy way for daily cooking and reduce food waste during storage and delivery process (Lupton 2017). Additionally, 3D printing extends the possible nutrition sources to more sustainable food, such as insects or artificial meat (Lupton and Turner 2018). It could also provide a potential solution of food supply for astronauts, air travellers, military, or victims of sudden disasters (ibid). For instances, Swedish nursing homes planned to use 3D printing for reshaping the mashed food into the original or natural form to maintain the enjoyment of eating.

Another example is using 3D printing technology to manufacture the products for presenting foods. For instance of the Pastry Art project by Dinara Kasko, she explores novel shapes of cake by using 3D printed moulds, which can both inspire chefs and accomplish a feat beyond the reach of a pastry cook. Thus, 3D printing tends to be a feasible and viable way to investigate and examine the impacts of different colour, shape and other appearance characteristics on the relevant food perception, attitudes, preferences and reactions respectively. It aims to find and eventually present the food in a proper way to make consumers obtain more enjoyment and pleasure in healthy eating.

As food images can generate the virtual satisfaction, which have potential to reduce the actual intake. Using visual illusion might be able to trick the brain to diminish the appetite and decrease mindless eating, which has a possibility of helping to lose weight and obesity treatment. Considering the example of virtual reality (VR) technologies, VR glasses can amplify the visible size to cheat the brain so the eater will feel like he/she has already consumed enough food. Furthermore, it can also be used as changing the eating atmosphere. By immersing in different environments, eater's feeling and emotion might be changed, which potentially impact the food choices and eating behaviours (Klassen et al. 2018). Such as in the project The Aerobanquets RMX by Mattia Casalegno, where he used VR glasses to change the vision into the space and galaxy environment, in order to explore the impacts of changing the visual feeling on food perception, eating experience, sense judgment. The Project Nourished merged the sense of sight, smell and hearing, by using electric stimulation to create flavour. This project is trying to innovate virtual cuisines by using VR technology and sensors, aiming to let the eater obtain equal enjoyment and experience but without worries of calorie intake.

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Accordingly, VR might become a feasible technique of adjuvant therapy for obesities and eating disorders, by using visual illusion to affect their eating experience and intake quantity.

In addition, in order to influence and promote a healthy daily diet, computer scientists focus their efforts on interactive devices. From the discipline of Human Computer Interaction (HCI), a new subfield is emerging, Human Food Interaction (HFI). By using different sensors and Arduino, the attention of food can be increased, and eater's self-consciousness can be enhanced as well, which would reduce the unconscious eating. According to Nelson (2017), when an individual pays more attention to food choice and eating amount, the possibility of selecting healthy and natural food can be increased as well as the intake tends to be controlled in a proper size easily (Harrar and Spence 2013). For instance, the project of 'Pixelate' by Kumar and Porter created an interactive video game for testing user's food knowledge. It demands the contestants to eat the correct food as more as possible in the limited time. By using the form of games, it could educate the dietary knowledge and increase the eating of fruits and vegetables. Ng and Lee designed an Arduino-based project to entertain the experience of eating alone. The computer would play a similar movie clips based on the eater's food in order to enhance the enjoyment of eating and reduce the loneliness, which has possibility of benefit for physical and mental health. Thus, the research area of HFI seems to emphasize on the interaction, intending to strengthen the pleasure of the eating experience and aims to promote for food awareness and knowledge.

Conclusion

Due to the new phenomenon of abundant food images emerging on social media, some controversial impacts of eating and diet are informed. Being stimulated by visual cues of food, both 'visual hunger' and 'digital satiation' can be perceived, so the vast exposure to food images on social media might bring a damage of enhancing the intemperate eating or a benefit of restraining the appetite. In order to manage and use these impacts to promote a healthy diet, this article introduced a new concept of 'digital foraging'.

Based on the eating memories, experiences and knowledge, the food visual characteristics has already linked to the specific food perception and awareness. By reviewing the previous investigations and studies of food images on social media, both visual features and eating impacts of these food images could be gained. Combining modern technologies with these characteristics and impacts, it has the potential to influence food choices and eating behaviours to improve diet habits and ultimately improve our well-being, which was defined as 'digital foraging' by the author. At the end of this article, it presented several examples of 'digital foraging' to show the value and significance of technologies on human relationship with food and nutrition.

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