BACHELOR THESIS

Cheese Intake: Effect of Background Music and Color Filter on a Cooking Video of Mac and Cheese on Taste Experience

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25th of June 2021

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Abstract

Purpose: Inspired by trends towards health issues and the growing interest in cooking videos, this study investigates if, and to what extent, the use of background music and color filter in a mac and cheese cooking video on TikTok influence the intended intake of sodium and fat (in cheese), after a change in perceived taste experience in terms of perceived saltiness, creaminess, and healthiness.

Design & Methods: To investigate this effect, a study with a 2 (staccato/salty vs. legato/sweet) x 2 (blue color filter vs. orange color filter) between-subjects design was conducted. Data were collected through an online questionnaire, in which 210 participants were randomly assigned to watch one of four cooking videos on TikTok that had been manipulated in terms of color and background music.

Findings: The results showed that no effect of either salty or sweet music was found on the taste experience of mac and cheese. However, the main effect of color filters on perceived saltiness, perceived creaminess, and taste intensity was found to be significant in people who watched the orange-edited video. No interaction effect was found between background music and color filter on mac and cheese taste experience nor on the intended food intake.

Conclusion & Implications: The findings presented suggest that the use of background music and color filter in a cooking video of mac and cheese was unsuccessful in influencing the intended food intake through changes in taste experience. However, the use of a color filter alone in a cooking video had an effect. Thus, it is recommended for marketers and food stylists to apply a color filter that is aligned with the color of the food itself in a cooking video as it will evokes and intensifies the perceived taste experience. As the findings do not manage to achieve all objectives, future experiments are recommended to focus on the issue of excessive salt and fat intake and consider the other external factors that might play a role.

Keywords: Multisensory Food Experience; Cross-modal Correspondences; Intended Food Intake; Taste Experience; Healthy Eating Behavior

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1 Introduction

It is an indisputable fact that the Coronavirus pandemic has turned our lives upside-down, particularly with the global #StayAtHome campaign (Louise, 2020). It has led to several societal changes, including the closure of businesses and a transition to working from home. These changes have also led to alterations in individuals' food practices, such as a shift in consumption patterns to home-cooked meals and order takeout to eat at home (Murphy et al., 2021). According to a survey conducted by an American communication firm specializing in food and beverage, 54% and 46% of consumers, respectively, reported cooking and baking more at home (Shoup, 2020). Correspondingly, the impact of the pandemic on online searches for recipes have increased across all social media platforms, including on YouTube and TikTok, with food and how-to videos as the most popular content (Augenthaler, 2020; Fanbytes, n.d.; Influencer MarketingHub, 2021; YouTube Culture & Trends, 2020). This is also supported by the presence of features on social media today that make it easier for someone to make cooking videos, such as color filters, background music, and transition effects. Examples of some TikTok cooking videos that went viral were mac and cheese, Dalgona coffee, pancake cereal, and many others (Kim, 2020).

With an increase in the number of people watching cooking videos, there is also an increase in the subjects of weight gain due to overeating and calorie underestimation (Zachary et al., 2020). At the same time, several studies have reported an increase in the consumption of healthy food due to increased cooking activity (Murphy et al., 2021). Many people are still uninformed that the negative consequences of overeating are also due to excess consumption of healthy food (Provencher et al., 2009). Numerous studies have explained that the consumers' categorization of healthy and unhealthy food can easily confuse consumers and subconsciously make them less likely to calculate the calorie intake of healthy food they consumed. Thereby,

this circumstance is commonly referred to as the "Health Halo" effect as consumers report a higher intake of food they generally perceived as healthy (e.g., Chandon & Wansink, 2007; Provencher et al., 2009; Spence et al., 2013).

One example of foods that easily confuse consumers in terms of health perceptions is cheese. Cheese is generally known to provide essential nutrients such as calcium and protein, but it is also high in saturated fat and salt. Studies show that eating cheese in excess on a regular basis can lead to high cholesterol, high blood pressure, and increase the risk of heart disease (Heart Matters, n.d.). Moreover, studies suggest that some of the most pressing health concerns when it comes to food and beverage consumption are the over intake of sodium (salt) and fat. Evidently, no European country has managed to meet the recommended salt intake level of < 5g per day and fat intake level of < 20g per day (BMJ, 2015; Van Rompay & Groothedde, 2019). The general consensus is that people generally entertain a preference for salted and fatty foods such as mac and cheese and tend to perceive low-sodium foods as bland or tasteless (Stein et al., 2012). Mac and cheese can be introduced as an ambiguous dish as it includes both healthy and unhealthy aspects. The healthy aspect is that the mac and cheese recipe use several healthy ingredients such as milk and cheese. However, people often categorize the overall dish as an unhealthy food due to the high fat and calorie. There are two schools of thought about macaroni and cheese; most people are delighted by the smooth and creamy texture of mac and cheese, while others prefer it crusty and extra cheesy (Moskin, n.d.). People claim that they are easily tempted to add lots of cheese when making mac and cheese, as they believe using different cheeses allows them to taste different layers of flavors (Walansky, 2020). Also, when the cheese is put together with milk, it forms a creamy texture that most people love (Kirkmeyer & Tepper, 2003). However, it is important to understand that both options will certainly be detrimental to our health as both cooking methods will increase fat and salt intake. And this

applies not only to mac and cheese but also to any other cheese cuisines and to the consumption of the cheese itself.

Over the years, researchers have conducted studies that have focused on decreasing the overconsumption of healthy foods through various design manipulations that ultimately encouraging healthy eating behaviors, for instance sound and color. The combination of both was found to successfully evoke certain taste and increase taste perceptions that eventually influence the taste experience and food intake. For example, a study by Pineli et al. (2016) demonstrated a reduction sugar intake in orange nectar juice while maintaining consumer satisfaction through intrinsic factors (i.e., red coloring, orange-colored water solution) and extrinsic factors (i.e., sweet-legato soundtrack). The stated argument was that the color of red/orange and the legato soundtrack used in this study represented the taste of sweetness, and sweetness is undoubtedly related to sugar. Consequently, the increase in sweetness caused by both factors has met the consumers' taste expectations and can eventually compensate for the decreased amount of sugar. Raghunathan et al. (2006) suggested that enhancing the taste through design manipulations can activate the perception of taste intensity and healthiness, and therefore can be an essential tool for overcoming the overconsumption of healthy food. Hence, it can be argued that background music (e.g., legato and staccato) and color (e.g., red, orange, blue) representing the same taste attributes (i.e., salty and sweet taste) can be used to reduce the overconsumption of healthy food.

Considering the aforementioned findings and the growing interest in cooking videos, this study focuses on reducing the overconsumption of fat and salt intake by investigating whether the use of background music and color filter[1] in a cooking video of mac and cheese on TikTok

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[1] The term 'color filter' used in this study is defined as a feature in a photo or video editor which, if applied, can change the appearance of an image/video by altering the shades and colors of the pixels. One example is the Instagram filters such as Paris, Los Angeles, dan Oslo.

can impact consumer's taste experience. The perceived taste experience will be measured by the perceived saltiness and perceived creaminess due to the salt and fat content in cheese. The use of sound and color symbolism in the ambiguous mac and cheese recipe video is also expected to enhance the imagined salty and creamy taste of mac and cheese, and therefore, may influence the health perception. An increase in the level of taste experience is expected to nudge a reduction in the intended intake levels of mac and cheese ingredients. In other words, the actual formulation of products (in this case, mac and cheese) can be modified to meet the latest health targets as the stimuli used will compensate for the reduced amount of salt and fat (Spence & Ngo, 2012). Considering all the above, the main research question of this study is:

To what extent do background music and color filter in a cooking video of mac and cheese influence the intended food intake through changes in taste experience in terms of perceived saltiness, creaminess, and healthiness?

To answer this research question, a 2 (background music: staccato/salty vs. legato/sweet) x 2 (color filter: blue vs. orange) between-subjects design was employed to study consumers' taste evaluation through an online questionnaire. The stimuli used for this study (i.e., background music, color filter, a TikTok video) were selected based on pre-tests conducted prior to the main study. Social media users aged 16 years and over were the target participants of this study, where participants had to watch one of the four designed TikTok videos and filled out the questionnaire systematically. The afterward chapter will discuss in detail the rationale of using these stimuli in this study.

2 Theoretical Framework

2.1. Multisensory design and cross-modal correspondence

Food products are a unique part of consumer needs in that sensory experiences during interactions with them can involve all five senses (e.g., sight, touch, sound, smell, and taste), which are often referred to as multisensory experiences (Schifferstein et al., 2020). It is also important to note that all the senses involved contribute directly to taste perception. Brakus et al. (2009) pointed out that sensory perception is the starting point for taste evaluation of a food product in terms of the cognitive associations, the meaning it evokes, the action it triggers, and the emotional responses it may elicit. Several researchers have shown that there is a correspondence between taste and other extrinsic cues such as music (Guetta & Loui, 2017), packaging color (Piqueras-Fiszman & Spence, 2011), the touch of shape (Van Rompay & Fennis, 2019), and scent (Schifferstein, 2002).

It is often argued that multisensory experiences are related to the concept of cross-modal correspondence. Multisensory experiences are usually more of an automatic process, while cross-modal correspondence focuses more on expectations or perceptions triggered by one modality (e.g., vision, auditory) transfer to impressions derived from another modality (e.g., taste). The concept of cross-modal correspondences itself is a still-growing topic within several disciplines, including experimental psychology and marketing (Northey, 2016). Spence (2011) defined this term as "a compatibility effect between attributes or dimensions of a stimulus (i.e., an object or event) in different sensory modalities". One well-known example of cross-modal correspondence is proposed by Calvo et al. (2001), in which the study found that the intensity of perceived flavor increases with increasing concentration of food coloring. Likewise, taste is influenced by more than just the color of the food. Instead, the external color cues such as the plating (Cho et al., 2019), food packaging (Van Doorn et al., 2014), or cutlery (Harrar & Spence, 2013) is likely to shape an individual's taste experience.

The effect of cross-modal correspondences on taste experience can be observed in both offline and online settings. For instance, Spence et al. (2014) did a study on wine drinking experience, in which the wine was perceived fresher under the green lighting while listening to sour music. Similar effects were also reported in online settings. For example, a study by Elder and Krishna (2010) showed that food advertising that engaged multiple senses (i.e., sight and sound) was effective in generating positive and better taste perceptions. The general argument of why such cross-modal correspondences between sound and color on taste exist is still obscure. However, Spence et al. (2014) provided a few possible explanations. One of them is that the distinctive features such as color and sound used in both offline and online settings can elicit a change in starvation and inadvertently trigger customers' perception of the product experience, or what marketers often refer to as the pre-purchase effect (Seva et al., 2007, as cited in Northey 2016).

With regard to the mac and cheese, the sensory cues used in this study (i.e., color filters and background music) will be discussed in relation to three different dimensions of the mac and cheese taste experience: perceived saltiness, perceived creaminess, and perception of health. As this study believes that enhancing taste can be an important tool for dealing with overconsumption of healthy foods, the use of background music and color filters is expected to evoke and intensify the imagined taste of saltiness and creaminess of mac and cheese, and therefore, influence health perceptions. Moller (2003) argued that food taste is the major determinant of food intake. Therefore, the expected scenario of this study is that intense taste experience will decrease the intention to enhance the taste experience through adding more ingredients of mac and cheese such as salt, cheese, and milk. Thus far, it is not yet known whether sound (background music) and visual (color filter) that are used in cooking videos can modulate the taste experience. With that being the case, this study will combine the research results of sound and color used in general on taste experience to formulate the hypotheses. This

paper will first discuss the cross-modal between sound and taste, and color and taste before zooming in on the combination of these sensory cues.

2.2. Sonic seasoning and taste experience

Previous research has long shown that what and how we eat can be swayed by what we may be listening to at the same time. For instance, consumers tend to think of sour-tasting foods such as lime, lemon juice, vinegar and pickles when listening to a high-pitched sound that played on a clarinet, violin, and trumpet (Crisinel & Spence, 2009). Researchers typically refer to this as "sonic seasoning" to describe the tendency for background music with congruent taste attributes to influence people's food and taste perception, which arises from cross-modal correspondences (Knöferle & Spence, 2012; Knöferle et al., 2015; Mathiesen et al., 2020; Peng-Li et al., 2020; Wang & Spence, 2018). Professor of Experimental Psychology, Charles Spence argued that sonic seasoning can be used to enhance certain taste and thereby encourage consumers to healthier eating behaviors. For instance, eating a cake with less sugar and calorie whilst listening to a piece of music composed specifically to enhance a sweet taste would make the consumers experience the same taste experience as the one who eat a cake without any sugar reduction (Morrison, 2019).

Other studies also confirm that adding music to an eating experience can affect the intensity level of taste that people perceive from their food. For instance, participants in the study of Hobkinson (as cited in Baumlier, 2013) were asked to eat a dish of warm caramelized goat cheese while blindfolded and listening to a soundtrack that already designed. There is no clear description of how many soundtracks were used and the composing process. However, staccato music, which is one of the soundtracks used, is said to have succeeded in enhancing the texture and flavor of cheese. Hobkinson explained that the quick tempo and the drumming noise being played have made people aware of the salt crystals in cheese, and hence cause a higher

perceived salty taste (Sedacca, 2016). Therefore, this study used staccato music as one of the conditions with the expectation that it will evokes the salty taste and intensifies the perceived saltiness of mac and cheese.

Furthermore, as previously stated, this research will also consider the other essential component of the tasting experience on mac and cheese, which is the perceived creaminess. Studying the effect of music on the perceived creaminess of chocolate, Carvalho et al. (2017) found that the 'creamy soundtrack' strongly enhanced the perceived creaminess of the chocolate, as opposed to the 'rough soundtrack'. The 'creamy soundtrack' was represented by long-consonant-legato notes where each individual note is played in a continuous motion and seems to flow into another note like a fluid, whereas the 'rough soundtrack' was represented by short-dissonant-staccato notes in which each individual note is sounded briskly and jauntier. It appeared that there was a direct relationship between ratings of sweetness and creaminess, with the two being positively correlated. In other words, this study used the creamy soundtrack to measure the taste of sweetness. Further analysis revealed that the expectations triggered by the soundtrack also intensified the enjoyment of the music and enhanced the chocolate liking when it is congruent. Following the conclusion of Carvalho et al. (2017), this research study decided to use legato music to evokes and intensifies the perceived creaminess of mac and cheese.

In addition, the perceived health perception of mac and cheese as a result of increased levels of saltiness and creaminess perceived by consumers after exposure to music is also considered. The study of Padulo et al. (2020) have shown the influence of music on health perceptions and food selection. In the study, participants were given two soundtracks (sweet and salty music) to listen to before deciding which food they would prefer to consume, which included sweet and salty foods with low and high-calorie exemplars. The results showed that the selection of

low-high calorie of salty food was greater while listening to salty soundtracks, whereas the selection of low-high calorie sweet food was greater when listening to the sweet soundtracks. However, these findings also suggested that these results may be restricted to low-calorie food exemplars, as the high-calorie food could be motivationally stronger than the soundtracks in food selection, masking the musical impact (e.g., Drewnowski & Almiron-Roig, 2010; Padulo et al., 2020; Spence et al., 2016). Thus far, there is still no consistent evidence on how background music varying in articulation (staccato/salty vs. legato/sweet music) will impact healthiness perception. Therefore, it would be interesting to explore how these types of music affect perceived healthiness.

Based on the findings of Hobkinson (n.d.) and Carvalho et al., (2017), it can be argued that a salty soundtrack will lead to a higher perception of saltiness and a sweet soundtrack will lead to a higher perception of creaminess in taste experience.

H1: A TikTok video with salty music will enhance the taste experience of mac and cheese as opposed to a TikTok video with sweet music.

Furthermore, if music can affect the perceived saltiness and creaminess of mac and cheese, then it is also plausible for music to influence consumers' health perception towards the dish. One of the intentions of this study is to see whether music used can enhance the taste experience of mac and cheese. Given the fact that creamy foods do not necessarily mean unhealthy foods like creamed spinach for example, it is reasonable to hypothesize that salty music will lead to increased saltiness and thus lower health perceptions.

H2: A TikTok video with salty music will lead to a lower health perception of mac and cheese as opposed to a TikTok video with sweet music.

2.3. Eating with your eyes

Experimental psychologists, food scientists, sensory scientists, and food marketers have long been interested in the relationship between taste and color. The majority of experimental studies have reported the psychological impact of color (e.g., hue, intensity) on consumers' taste perception food and beverages and their intensities (Lynch et al., 2017; Spence, 2015; Wei et al., 2012). For instance, Akyol et al. (2018) discovered that red and black plates increased the amount of food consumed compared to the food served on a white plate. The general explanation is the red and black plates were perceived more appetizing and appealing which in turn intensified the taste experience. Such associations can be formed as a result of daily experiences with comparable items and colors, or a consequence of learned stereotypes and color symbolism (Elliot et al., 2010; Grossman & Wisenblit, 1999; Hanss et al., 2012).

With respect to perceived saltiness, it seems that there is a scarcity of experimental studies that focused on the association of food colors and salty taste. One of the classic studies by Maga (1974), announced that salty foods were available in a variety of colors, but no particular color could be linked to a salty taste as people may have different direct color associations with saltiness. Other findings from the study of Wadhwani and McMahon (2012) revealed a similar conclusion. In their study, participants were asked to rate a color liking of the low-fat cheese itself. Results showed that the color-liking of low-fat cheese was increased with color changes from white to orange but decrease when the orange color of the cheese becomes too intense. Some of the participants explained that when the orange became too intense, they no longer perceive it as a cheese anymore. Thus, the conclusion that can be drawn is the effect of color on saltiness perception varies depending on the type of food and the color of the food itself (Sukkwai et al., 2018). However, Wan et al. (2014) later spotted that salty taste was associated with white color. Thenceforth, similar results have been reported. Spence et al. (2015)

conducted a cross-modal matching study where the participants have to pair individual colors and basic taste. The study has shown that people associate salty taste with white and blue color, while orange and red are associated with a sweet taste. Nevertheless, it should be pointed out that some diet experts usually recommend using blue color as it is known as an appetite suppressant for people who are trying to lose weight (Akyol et al., 2018). For this reason, it does not rule out that consumers would lose their appetite and not accept the perception of saltiness with the blue color.

Looking specifically at the case of creaminess of cream cheese, Frost & Janhoj (2007) have investigated the general aspects of creaminess that apply to this particular dairy product. They tested the color of white, grey, green, yellow, and blue as a descriptor for cream cheese. Initially, cream cheese is said to be associated with the color white, grey, yellow, and blue. However, when the correlation was tested between the individual sensory properties and creaminess, the results changed. Findings showed that cream cheese is positively correlated only with yellow and not with the other colors. Altogether, it can be said that the creaminess of cream cheese can be represented by yellow color. In contrast to the findings (Frost & Janhoj, 2007), the study from Northey (2016) explored the impact of color on taste experience from another point of view, namely by applying a color filter to one product image and resulted in a different color in terms of creaminess. In his study, the participants were shown a single product image of snack food to test the perceived crunchiness and creaminess. The image was manipulated using a color filter so that it would appear either red or blue. Results found that the product image that is colored in blue perceived higher crunchiness and higher perceived creaminess when the participants saw the red-colored image.

Furthermore, it is worth noting that not only the color of the food itself, but environmental colors could also affect consumers' food perception, such as through the packaging design of

a certain product. Several studies have demonstrated that colors in terms of packaging design can influence the perception of food healthiness. In the study of Huang and Lu (2015), each participant was exposed to four products by two package colors namely blue and red. Afterward, they had to report their perception of healthiness and purchase intention towards the products. The researchers distinguished two types of food in this study, namely hedonic and utilitarian food. Hedonic food refers to foods that are consumed to derive effective pleasure from savory emotional experiences. Meanwhile, utilitarian food is food that is consumed to quench thirst or satisfy hunger, fill nutritional deficiencies, or reduce the risk of certain diseases. Results indicated that food in the blue package was perceived as healthier compared to the red package, especially for utilitarian food. The findings clarified that participants perceived the blue color as light and lower calories.

With respect to the mac and cheese product, starting in 2015, Kraft company has announced to remove the use of artificial preservatives or synthetic colors. Kraft claimed that they will use paprika, annatto, and turmeric as substitutes for yellow synthetic colors, which means the mac and cheese delicacies will no longer be bright orange. Consumers seem to be pleased with the decision of Kraft company since the orange hue that they have come to know is very vivid that it almost looks plastic (Mullins, 2015). Considering all the findings above, this study decided to use the extrinsic cues of food coloring specifically the color filter of blue and orange as the second stimulus. Despite the fact that yellow and red color represents creaminess (Frost & Janhoj, 2007; Northey, 2016) and unhealthy food (Huang & Lu, 2015), this study decided to use the orange color as it is aligning with the color of the mac and cheese itself and still under the warm color categories.

It is important to underline that many studies have failed to demonstrate any interaction between color and the presence or intensity of a particular taste. Maga (1974) explains that the

effect may still ambiguous because it appears to depend on the factors used. In this regard, this study used the findings found above as the basis of the expectation that the orange-edited video will enhance the taste experience as opposed to the blue color. In addition, it will lower the perception of healthiness especially when the color is too bright orange or yellow.

H3: The orange-edited video will enhance the taste experience of mac and cheese as opposed to the blue-edited video.

Color is commonly known can amplify the marketing message to buyers on an emotional level, and therefore, be more effective in persuasion. For instance, one color used in food advertising can persuade customers that it tastes better than the same product with a different color applied (Kramer, 2019). However, the impact of applying color filters to a cooking video on taste experience is still not yet known. Therefore, it is interesting to explore whether adding color filters to cooking videos may influence viewers' taste experience as a sub-research question.

RQ: Does applying color filter (such as blue and orange) to a cooking video affect the taste experience in regard to mac and cheese and to what extent does it affect?

2.4. Sound-color congruency

Since the ground-breaking study of audio-visual correspondences by Marks (1989), there has been growing literature on this specific cross-modal correspondence (Peng-Li et al., 2020; Cho et al., 2019). Numerous studies showed that these cross-modal correspondences could affect consumers in terms of taste experience. For instance, a study by Spence et al. (2014) revealed that the taste of red wine became more intense when drunk under red lighting room and sweet music.

Cross-modal correspondences have often been demonstrated using congruency/ incongruency effects between pairs of stimuli (e.g., audio and visual) in different sensory modalities (Brunetti et al., 2018). Supporting this notion, Spence (2011) explained that consumers tend to associate different features of stimuli across the senses subconsciously and thereby influence their reactions to a particular product. This in(congruency) concept is often applied in various products, including food products. For instance, Elder and Krishna (2010) have explored the effect of extrinsic cues on taste perception from another point of view, namely through multi-sensory advertisements. Participants were randomly presented to one of two advertisements. One advertisement involved multiple senses while the other one only involved one single sensory. The results suggested that food advertising that included multiple sensory attributes such as vision, sound, smell, texture, and temperature had a significant impact on taste perceptions of the food product. However, it is crucial to note that the sensory components cues incorporated in the advertisement should be congruent with the food. For example, one of the popcorn advertisements used in the Elder and Krishna study presented the perfect amount of butter and salt in the visual form and the sound of crunchy popcorn as music to participants' ears. Thus, it can be said that multi-sensory advertisements that present sensory qualities that are congruent with a food product can evoke taste perceptions of the food.

Currently, there is a lack of research regarding the effects of sound and color combined specifically on perceived saltiness, perceived creaminess, and health perceptions. However, on a general level, recent studies have discovered that music and color could encourage healthy eating behavior through the increase level of taste intensity. Reciting the study by Pineli et al. (2016), the use of red/orange food colors and legato music can enhance the perceived sweetness of orange nectar juice as the two stimuli represent the taste of sweetness, and thus compensate for the reduction in sugar. Based on the theory from this study, sweet music and orange/red

color can also be considered as a congruent condition (Spence et al., 2015; Woods & Spence, 2016).

Furthermore, Cho et al. (2019) have explored the effect of arousal fit between music and color on food evaluations perspective. The findings of this study showed that when the two stimuli had congruent arousal qualities (i.e., high and low), participants tended to rate the product liking and perceived quality higher than when the two stimuli had incongruent arousal qualities. More specifically, participants that were exposed to high arousal music gave higher evaluations for a food item served on the red plate. Conversely, when a piece of low arousal music was played, a food item served on a blue plate received higher food evaluations. High arousal music is believed related to fast tempo music, while low arousal music is related to music with a slow tempo. Moreover, warm colors, especially red, usually are associated with high arousal (i.e., excitement), whereas cool colors, such as blue, are associated with low arousal (i.e., calm, peaceful). According to this account, congruence among product elements may be essential to facilitate the process of product evaluation (Van Rompay & Pruyn, 2011).

In light of the findings, it can be expected that salty music that is congruent with video edited in blue will lead to a more intense taste because the color of blue and staccato/salty music represent the taste of salty that fits the taste of mac and cheese.

H4: A congruent condition of salty music and blue color filter will lead to a more intense taste experience as opposed to a congruent condition of sweet music and orange color filter.

Additionally, it is also interesting to explore whether the incongruent condition will also have an impact, as the salty music and orange color filter condition may also considered suitable with the mac and cheese context.

H5: The incongruent condition of salty music and orange color filter will lead to a more intense taste experience as opposed to an incongruent condition of sweet music and blue color filter?

To repeat, it is not yet known whether background music (i.e., staccato, legato) and color filter (i.e., blue, orange) specifically used in a cooking video of mac and cheese can impact the taste experience. Likewise with the congruity effect of the two stimuli. Thus, to discover the influence of background music and color filter, this main research question will be investigated.

To what extent do background music and color filter in a cooking video of mac and cheese influence taste experience in terms of perceived saltiness, creaminess, and healthiness?

Moreover, in light of the facts that (in)congruency effects of sound and color could also influence consumers' perception, decisions and behaviors (Peng-Li et al., 2020; Van Rompay & Pruyn, 2011), this study also measures the consumers' evaluation in terms of product liking and individuals' intention towards the overall cooking video which will further be discussed in methods section.
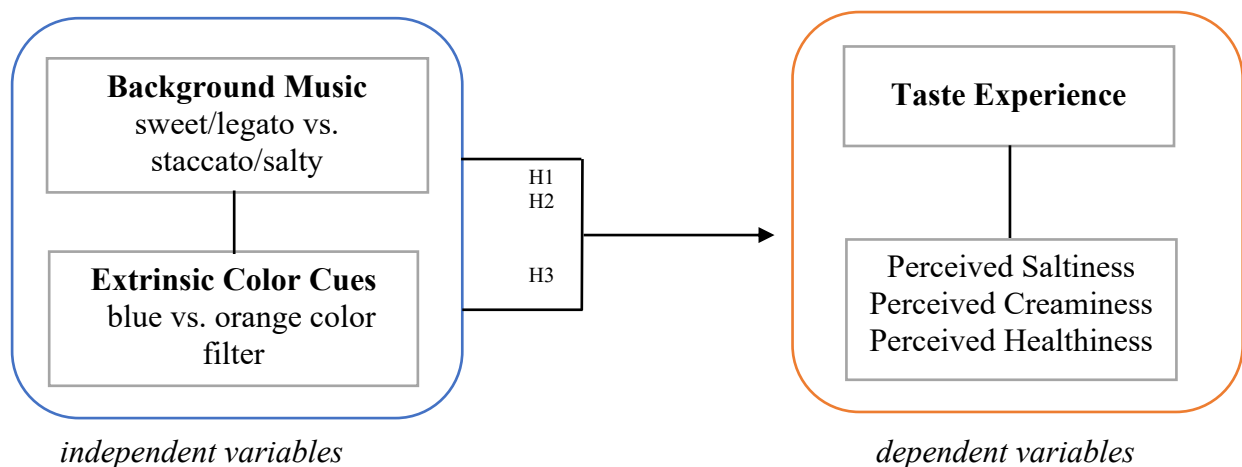

Figure 1. Conceptual research model.

3 Methods

To answer the main research question, an experimental study was conducted. The design of the experimental study is a 2 (background music: staccato/salty vs. legato/sweet) x 2 (color filter: blue vs. orange) between-subjects design.

3.1. Pre-tests

Two pre-tests were conducted to select the most appropriate background music to represent salty and sweet music, the right color filters in terms of color warmth, and one cooking video of mac and cheese from TikTok.

In the first pre-test, four participants (2 female, 2 male; mean age: 21.5 years) were invited to participate in an online interview using Google Meet. The interviews were opened with the discussion about music with the aim of selecting and validating the salty vs. sweet music pieces for the main study. For that reason, the music pieces used were varied in terms of articulations (staccato vs. legato), tempo (quick vs. slow), and harmony (dissonant vs. consonant) to represent the salty and sweet music (Guetta & Loui, 2017; Wang et al., 2015). There were seven music pieces being played to the participants in total, the first four music pieces were taken from the study of Wang et al. (2015) and the other three music pieces were taken from YouTube. First, participants were asked to rate the seven pieces of music (i.e., 3 sweet music and 4 salty music) ranging from 1 to 10 (from 1 being the lowest and 10 being the highest) in terms of music liking and the appropriateness with the mac and cheese context after listening to each music. Thereafter, participants were asked to indicate the taste attributes (e.g., sweet, salty, sour, and bitter) that the music represents. Subsequently, the participants moved to the discussion of color filters and videos. The four participants were shown to seven different TikTok videos (i.e., 3 were edited in orange and 4 were edited in blue using VCSO Filters). Note that there were different filters of blue and different filters of orange used in this pre-test

and they were varied in terms of color warmth and brightness. Color warmth levels will differ due to the different brightness levels, thereby, the aim of this pretest was to select and validate a blue and orange color filters that have the appropriate cool and warm color levels for the mac and cheese cooking video. The participants were asked to watch the video without volume and rate all the videos from 1 to 10 in terms of video liking, video attractiveness, the willingness to share, and cooking intention. In the end, the stimulus that received ratings below seven were eliminated. The results of the first pre-test were three sweet music, two salty music, two orange filters, two blue filters, and three TikTok videos.

The second pre-test was conducted in the form of focus group to select the final stimuli. Four different people from the first pre-test (2 female, 2 male; mean age: 20 years) were asked the same questions as the first pre-test to evaluate five music (i.e., 3 sweet music and 2 salty music). The results of the second pre-test were one sweet music and one salty music which were both rated over seven in terms of music liking and music appropriateness. Additionally, three out of four people were able to indicate the taste attributes of these two music correctly (i.e., salty and sweet). As for videos and color filters, participants were shown to three TikTok videos edited using four different filters (i.e., two orange filters and two blue filters) and were asked the same questions as the first pre-test. The outcome of the first selection were two videos, one blue filter, and one orange filter. Then, the two videos were presented again with both blue and orange filters that have been selected from the first selection. Participants were asked to answer the same questions again to determine the final video. As a result, all four participants chose the same video as the final video and gave a rating of over seven in terms of video liking, video attractiveness, the willingness to share, and cooking intention. All in all, the pre-tests validated the sweetness and saltiness of the two selected background music pieces. Moreover, the pre-tests showed that both music were comparable in terms of overall appeal and the appropriateness to the mac and cheese context. For the color filters, the pre-tests

validated the selection of two color filters as the most appropriate filters in terms of color warmth for the context of mac and cheese. All the TikTok videos and color filters used in the pre-tests of this study can be seen in **Appendix A, Figure 5 and 6**.

3.2. Final Stimuli

Based on the findings from these pre-tests, four videos of cooking mac and cheese were used for the main study, varying in background music and color filters in a 2 (salty music vs. sweet music) x 2 (blue color filter vs. orange color filter) between-subjects factorial design. All the videos used were edited using VSCO, iMovie, and InShot.

Figure 2. The finalized video.

3.2.1. Background Music

Adopted and modified from the study of Wang et al. (2015), two soundtracks were used for this experiment, one corresponding to saltiness, and the other to sweetness. The soundtracks (i.e., salty and sweet music) used were originally composed by Jialing Deng and Harlin Sun, as part of Deng's Master of Arts Thesis Project, 2016. The aim of using these soundtracks for this study was to evoke specific tastes (i.e., sweet and salty), with the intention of subconsciously influencing the taste experience and the intended food intake of consumers. Additionally, the sweet music used was also able to measure its impact on the perceived

creaminess of mac and cheese as it has a positive correlation with perceived sweetness (Carvalho et al., 2017).

The first soundtrack called 'salty music' is characterized by medium pitch, a quick tempo with staccato articulation, and dissonant harmony. While the second soundtrack namely 'sweet music' is characterized by legato articulation with more emphasis on the higher notes and consonant harmony. The two soundtracks, which were originally lasted for 15 seconds long, became 22 seconds after combined with the edited video. The soundtracks can all be listened at https://soundcloud.com/janicewang09/sets/taste-soundscapes-test.

3.2.2. Color and TikTok Video

Four identical videos were used for this study, two were edited with a blue filter called BBMA, and the other two videos were edited with an orange filter called Sumac Soft from Sumac preset pack. All of these filters were obtained from the VCSO filters and were applied without any alteration in color contrast, brightness, or saturation. The cooking video was taken from the TikTok platform and created by a cooking website called So Yummy. The video, which initially lasted for 59-seconds, was cut down to 22-seconds when combined with the music using two apps called InShot and iMovie. Moreover, this video was also cut to fit the most common and simple mac and cheese recipe. All edited videos can be accessed by way of this link: http://bit.ly/BachelorThesisStimuli_JacquelineFransputri

3.3. Participants and Procedure

3.3.1 Participants

A total of 210 participants (126 female, 82 male; age range: 16-56 years; mean age= 24.14 years) participated in this online experimental study, with 41% reporting to often watch cooking videos and using YouTube as the main social media channel to watch the videos (61.4%). These participants were recruited using two different sampling methods. First,

voluntary response sampling, where the questionnaire was distributed on the social media platforms and the participants volunteered themselves to complete it. Specifically, the participants were randomly recruited through their personal social media (i.e., Facebook, Instagram, Twitter, and LinkedIn) and received a dedicated URL to access the online questionnaire created with Qualtrics online survey tool. The second sampling method used was the convenience sampling, in which participants were approached personally to complete the questionnaire. In order to obtain a clean and valid data set, the following criteria were applied to get 210 out of 730 data entries; (a) participants should be 16 years of age and above, (b) participants are active users of social media, (c) participants were in an appropriate place to watch and listen to the video given without any disturbance or distraction, (c) the participants were able to listen and watch the video, and (d) the participants completed the questionnaire in greater than or equal to 4 minutes. Besides these fixed criteria, responses that were not filled out completely were also removed because the stimuli were deemed unable to work effectively and eventually led to unreliable responses.

Table 1

Number of participants in groups based on condition, gender, age and nationality

Factors	Condition 1: Salty-Blue	Condition 2: Salty-Orange	Condition 3: Sweet-Blue	Condition 4: Sweet-Orange	Total
Gender					
Male	27	20	18	17	82
Female	32	32	29	33	126
Other					2
Age					
16-20	18	19	13	15	65
21-30	34	30	30	29	123

31-40	5	2	4	4	15
45-50	3	2	0	2	7
Nationality					
Indonesian	36	28	26	33	123
Dutch	6	5	5	2	18
German	5	6	8	8	27
Other	13	14	8	7	42

3.3.2 Procedure

In the beginning, participants had to read the introduction and the informed consent. Researcher had informed that the data obtained will be used exclusively for this research, and all information is anonymous and treated confidential. If the participants agreed, the online questionnaire started. It started with the questions related to the appetite of the participants, the liking level towards cheese, and cooking videos. When the participants finished answering these questions, they entered the main part of this study. Participants had to indicate whether they encounter any disturbance in their sense of hearing. Then, the participants were randomly assigned to watch and listen to one of the four TikTok videos that have been edited. Beforehand, participants were instructed to watch the video at full volume and had to report whether the video and audio worked properly. Afterwards, participants had to fill out the questionnaire systematically by indicating to what extent they agreed with the statements given. Completing the questionnaire was expected to take approximately 7 to 10 minutes. At the end, participants could fill in their personal data such as gender, age, nationality, and email as an optional. After completion, participants were thanked for their participation.

3.4. Measures

3.4.1. General questions

Initially, participants were asked to rate their degree of hunger on a 7-point rating scale ranging from "not at all" to "very hungry". Participants were also asked to rate how much they enjoyed cheese on a scale from 1 to 7. Subsequently, participants had to fill in multiple-choice questions related to cooking videos, namely how often they watched cooking videos, which platform they use to watch cooking videos, and how often they cooked. Following that, participants were asked whether they were in an appropriate location to watch a video without being disturbed or distracted, as well as if the video worked and that the participants could hear the audio clearly. Thereafter, participants were asked to fill out certain questions according to a cooking video of mac and cheese from TikTok that has been edited and uploaded to YouTube. At the end of the questionnaire, personal information such as gender, age, nationality, and email if they want to join the raffle for a gift card were kindly asked.

Given that this questionnaire had 39 questions and took approximately 7 to 10 minutes to complete, the remaining questions below were measured using 5-point rating scales to simplify possible responses and increase the completion rates.

3.4.2. Basic tastes

Participant's perceived saltiness was measured with one single item related to basic taste ("I think the mac and cheese would taste salty"). However, given that mac and cheese can have a variety of flavors, this study also took into account the other three basic tastes "I think the mac and cheese would taste sweet", "I think the mac and cheese would taste sour", and "I think the mac and cheese would taste bitter". Participants had to indicate to what extent they agreed with these single items. Responses were recorded on a 5-point rating scales ranging from "strongly disagree" to "strongly agree".

3.4.3. Perceived creaminess

The perceived creaminess was measured with two items "I think the mac and cheese looks creamy" and "I think the mac and cheese looks heavy/full". Using 5-point rating scales, participants had to indicate to what extent they agreed with each of these statements. Responses to these items were summed and averaged ($\alpha = .64$). to arrive at a general perceived creaminess. In addition, one item was removed to increase the alpha level "I think the mac and cheese doesn't looks as creamy as I'd like" (reverse scored).

3.4.4. Taste intensity

Taste intensity was measured with the items 'Mac and cheese seems to have an intense taste", "Mac and cheese seems to have a strong taste", "The taste of the mac and cheese seemed mild" (reverse scored), and "The taste of the mac and cheese seemed bland" (reverse scored). Participants had to indicate to what extent they considered these items descriptive of the mac and cheese taste with a 5-point rating scales ranging from "strongly disagree" to "strongly agree". Responses on the individual taste items were summed and averaged ($\alpha = .75$) in order to arrive at a general taste intensity measure.

3.4.5. Perceived healthiness

Participants' perception of health towards the mac and cheese was measured with a scale comprising the statements "The mac and cheese looks healthy to me", and "I would eat mac and cheese as one of my healthy (diet) menu" ($\alpha = .85$). Using 5-point rating scales, participants had to indicate to what extent they agreed with each of these statements. Additionally, one item was removed "I think the color of the mac and cheese looks plastic to me" (reverse scored) in order to increase the alpha and proceed with reliable measures for perceived healthiness.

3.4.6. Food intake

To measure the food intake, participants were shown a short recipe of mac and cheese that complies with the consumption standards according to the FDA in terms of calorie, sodium, and fat. This one serving recipe contains more or less 314 calories, 0.583 g of sodium, and 14 grams of fat (Healthline, 2020).

The mac and cheese recipe: 340 g fusilli or elbow pasta, 1 1/2 cup of milk of choice (360ml), 1 cup of shredded cheddar (125 grams or 1 1/4 cheese block), 1/2 teaspoon of salt and pepper

According to the video, participants had to answer shortly one single item with a 5-point rating scales before reading the recipe. Afterwards, participants were requested to imagine if they were cooking mac and cheese, how much would they use out of each ingredient. They answered these questions by filling out the other three single-items. "I think the serving size shown in the video would be fulfilling", "How many additional cheese blocks would you like to add?", "How many cups of milk are you going to pour?", and How much spices (salt and pepper) are you going to add?

For the question regarding milk, 1 cup of milk indicates that the participant will pour less milk than the FDA's healthy standard, two cups indicate normal/standard recipe of mac and cheese, and 3 cups represent a higher than recommended amount. For cheese and spices, the more the participants added, the lower the perceived saltiness. Similarly, one item was removed to increase the reliability measures of food intake "I think I can keep on eating this mac and cheese" (reverse scored).

3.4.7 Product liking

Taste liking was measured using three items "I think the mac and cheese is tasty" and "I think I would like the taste of this mac and cheese", "I think I will never like this kind of mac and

cheese" (reverse scored). Using 5-point rating scales, participants had to indicate to what extent they agreed with each of these statements. Responses to these items were summed and averaged ($\alpha = .80$) to arrive at a general taste liking measure.

Music liking was measured using three items "I enjoy the background music", "I think the background music fits well with the content (mac and cheese)", and "I think the background music fits with the video as a whole". Responses were recorded on 5-point rating scales ranging from "strongly disagree" to "strongly agree". Responses to these items were summed and averaged ($\alpha = .90$) to arrive at a general music liking measure.

As an additional measure reflective of participants' attitude towards the overall product, video liking was included. Using 5-point rating scales, participants had to fill out three items measuring the video liking "I like the video", "I would watch the video again", and "I would press the like button for this video". Responses to these items were summed and averaged ($\alpha = .81$) to arrive at a general video liking measure. To increase the alpha level, one item was removed "I didn't watch the video till the end" (reverse scored).

3.4.8. Individuals' intention

Cooking intention was measured with four items "Watching the video makes me crave for mac and cheese", "I want to cook mac and cheese after I watch this video", and "I will use this video as a guidance for me to cook mac and cheese", and "I want to buy the ingredients to cook the mac and cheese on my own" ($\alpha = .83$). Responses to these items were summed and averaged to arrive at a general cooking intention measure.

After watching the video, participants filled out these two items to measure purchase intention "I want to order mac and cheese via food delivery" and "I want to buy instant mac

and cheese" using 5-point rating scales. Again, ratings were summed and averaged ($\alpha = .79$) to arrive at a general purchase intention measure.

To this end, participants' willingness to share to a wider audience was measured with one single item "I would like to share this video to my family or friends". Participants had to indicate to what extent they agreed with this single item. Responses were recorded on a 5-point rating scale ranging from "strongly disagree" to "strongly agree".

4 Results

Data were analyzed using a 2 (background music: staccato/salty versus legato/sweet) × 2 (color filter: blue versus orange) between-subjects design. In total, five multivariate analyses of variance (MANOVA) were conducted using the statistical program SPSS to investigate the differences in terms of dependent variables.

4.1 Basic Tastes

Before conducting the analysis, assumption checks were performed in regard to the dependent variables. Findings showed that the assumptions of linearity were not met, as assessed by scatterplot except the salty taste. There was no evidence of multicollinearity as assessed by Pearson correlation ($|r| < 0.9$) and no univariate outliers in the data of sweet taste, as assessed by inspection of a boxplot. In addition, the assumption of normality for all basic tastes were violated, as assessed by Shapiro-Wilk's test ($p < .05$). However, the assumption of homogeneity of covariance matrices, as assessed by Box's M test ($p = .655$), and homogeneity of variances, as assessed by Levene's Test of Homogeneity of Variance ($p > .05$) were met. Given the fact that MANOVA test statistics were robust against these violations, this study decided to continue with the data analysis (Field, 2009).

The analyses revealed that there were no significant main effects of the two-way MANOVA ($p > 0.05$) were found. The main effect of background music on the basic tastes was not statistically significant, $F(4, 203) = 1.515$, $p = .199$, Wilks' $\Lambda = .971$, partial $\eta2 = .029$. The main effect of color filter almost reach significance for the combined basic tastes, $F(4, 203) = 2.132$, $p = .078$, Wilks' $\Lambda = .960$, partial $\eta2 = .040$. However, the univariate analyses showed a statistically significant main effect of color filter on perceived saltiness, $F (1, 206) = 8.304$, $p = .004$, partial $\eta2 = .039$, but not for other basic tastes, indicating that participants do perceive the salty taste of mac and cheese higher when exposed to the orange-edited video ($M = 3.53$,

SD = 1.15) compared to the blue-edited video (M = 3.10, SD = 1.11). The interaction effects between background music and color filter on the basic tastes also did not reach significant, $F(4, 203)$ = 1.144, p = .337, Wilks' Λ = .978, partial η2 = .022, indicating that no interaction effects were obtained. No other effects were found. All the values of univariate effects for basic tastes can be seen in **Appendix C, Table 2**.

4.2. Perceived Creaminess, Taste Intensity, and Healthiness

A two-way MANOVA was run with two independent variables (i.e., background music and color filter) and three dependent variables (i.e., perceived creaminess, taste intensity, and perceived healthiness).

There was a linear relationship between the dependent variables, as assessed by scatterplot. and no evidence of multicollinearity as assessed by Pearson correlation (|r| < 0.9). Furthermore, the assumption of homogeneity of covariance matrices was met, as assessed by Box's M test (p =.719), and homogeneity of variances was also met, as assessed by Levene's Test of Homogeneity of Variance (p > .05). However, there were some univariate outliers and extreme outliers in the data of perceived creaminess, as assessed by inspection of a boxplot. Also, the assumption of normality for all dependent variables have been violated, as assessed by Shapiro-Wilk's test (p <.05). This study decided to continue with the analysis as MANOVA test statistics were relatively robust to violations of multivariate normality (Field, 2009).

4.2.1. Main effects of background music

The analysis showed that the main effect of background music on the dependent variables was not statistically significant, $F(3, 204)$ = 1.461, p = .226, Wilks' Λ = .979, partial η2 = .021.

4.2.2. Main effects of color filters

There was a statistically significant main color effect on the combined dependent variables, $F(3, 204) = 6.860$, $p < .001$, Wilks' $\Lambda = .908$, partial η2 = .092 indicating that color filters had significant effect on perceived creaminess, taste intensity, and health perceptions. An overview of all values of univariate main effects can be found in **Table 3**.

4.2.2.1. Perceived Creaminess

Univariate main effects analyses showed that there was a statistically significant main effect for color filter on perceived creaminess, $F (1, 206) = 4.331$, $p = .039$, partial η2 = .021, indicating that participants do perceive the creamy taste of mac and cheese higher when exposed to the orange-edited video ($M = 4.30$, $SD = 0.65$) compared to the blue-edited video ($M = 4.08$, $SD = 0.79$).

4.2.2.2. Taste Intensity

A follow-up univariate main effects analysis showed a statistically significant effect of color filter on taste intensity, $F(1, 206) = 18.373$, $p = <.001$, partial η2 = .082, indicating that participants perceive the imagined taste of mac and cheese more intense when exposed to the orange-edited video ($M = 3.71$, $SD = 0.74$) compared to the blue-edited video ($M = 3.27$, $SD = 0.80$).

4.2.2.3. Perceived Healthiness

For *perceived healthiness*, there was no significant univariate main effect between color filter and health perceptions, $F(1, 206) = .109$, $p = .74$, partial η2 = .001.

4.2.3. Interaction effects of background music and color filters

There were also no significant interaction effects found between the background music and color filter on perceived creaminess, taste intensity, and perceived healthiness, $F(3, 204) = 1.188$, $p = .315$, Wilks' $\Lambda = .983$, partial η2 = .017.

Table 3

The values of univariate effects for perceived creaminess, taste intensity, and health perceptions

Effect	Dependent Variable	F	Hypothesis df	Error df	Sig.	Partial η2
Music	Perceived Creaminess	.490	1	206	.48	.002
	Taste Intensity	2.675	1	206	.10	.013
	Perceived Healthiness	.059	1	206	.81	.0005
Color	Perceived Creaminess	4.331	1	206	.03	.021
	Taste Intensity	18.373	1	206	<.001	.082
	Perceived Healthiness	.109	1	206	.74	.001
Music * Color	Perceived Creaminess	1.007	1	206	.31	.005
	Taste Intensity	.872	1	206	.35	.004
	Perceived Healthiness	.454	1	206	.50	.002

4.3. Food Intake

The aim of this study was to reduce the intended food intake through increased taste experiences after background music and color filter exposure. A two-way MANOVA was run with two independent variables (i.e., background music and color filter) and four dependent variables (i.e., perception of satiation, cheese intake, milk intake, and spices intake).

There assumption of linearity was violated as assessed by scatterplot and no evidence of multicollinearity as assessed by Pearson correlation ($|r| < 0.9$). Furthermore, the assumption of

homogeneity of covariance matrices was met, as assessed by Box's M test (p =.968), and homogeneity of variances was also met, as assessed by Levene's Test of Homogeneity of Variance ($p > .05$). However, there were some univariate outliers and extreme outliers in the data except milk intake, as assessed by inspection of a boxplot. Also, the assumption of normality for all dependent variables have been violated, as assessed by Shapiro-Wilk's test ($p <.05$). This study decided to continue with the analysis as MANOVA test statistics were relatively robust to violations of multivariate normality (Field, 2009). An overview of all values of univariate main effects can be found in **Appendix C, Table 4**.

4.3.1. Main effects of background music

The main effect of background music on food intake was not statistically significant, $F(4, 203) = 1.058$, $p = .37$, Wilks' $\Lambda = .980$, partial $\eta 2 = .020$.

4.3.2. Main effects of color filters

The analyses revealed that there was no significant color filter effect on food intake was found, $F(4, 203) = 0.443$, $p = .77$, Wilks' $\Lambda = .991$, partial $\eta 2 = .009$.

4.3.3. Interaction effects of background music and color filters

The interaction effects between background music and color filter on food intake also did not reach significant, $F(4, 203) = 1.295$, $p = .273$, Wilks' $\Lambda = .975$, partial $\eta 2 = .025$, indicating that no interaction effects were obtained.

4.4. Additional findings

Two other MANOVA analyses were run to investigate the effects of background music and color filters on product liking, and individuals' intention. Similar to the previous dependent variables, assumption checks were carried out. The assumptions of linearity for individuals' willingness to share was violated, as assessed by scatterplot. There were some univariate

outliers in the data of all dependent variables except purchase intention, as assessed by boxplot. Furthermore, the assumptions of multicollinearity, homogeneity of covariance matrices, and homogeneity of variances were met but not the assumption of normality. The assumptions of normality were met only for the video liking in salty-blue and sweet-orange conditions, and music liking in sweet-blue condition. Similarly, this study determined to continue with the data analysis as the MANOVA test statistics were robust against these violations (Field, 2009).

As shown in the Table 5, the analysis showed that the main and interaction effects of background music and color on product liking, and individuals' intention did not reach significance (with all p's = >.13, Wilks' Λ = > .973). Moreover, there were no significant differences on gender and age over the conditions. No further interaction effects were obtained.

Table 5

Results of two-way MANOVA for product liking and individuals' intention

Effect	Dependent Variable	Wilks' Lambda value	F	Hypothesis df	Error df	Sig.
Music	Product Liking	.988	.809	3	204	.49
	Individuals' Intention	.989	.781	3	204	.50
Color	Product Liking	.973	1.882	3	204	.13
	Individuals' Intention	.989	.785	3	204	.50
Music * Color	Product Liking	.992	.515	3	204	.67
	Individuals' Intention	.991	.649	3	204	.58

5 Conclusion and Discussion

Inspired by trends towards health issues, concern for consequences of excessive consumption of healthy and unhealthy foods (Provencher et al., 2009; Wansink & Chandon, 2014) and the growing interest in cooking videos on social media (Fanbytes, n.d.), this research aimed to examine the influence of background music and color filters in a cooking video of mac and cheese from TikTok on consumers' taste experience. First and foremost, the results of these analyses will be treated and interpreted with caution due to the violation of several assumptions. The overview of the results of hypotheses and research questions in this study can be seen in **Appendix C**, **Table 8**.

In this study, no effect of either salty or sweet music was found on the taste experience of mac and cheese. However, the main effect of color filters on perceived saltiness, perceived creaminess, and taste intensity was found to be significant in people who watched the orange-edited video. No interaction effect was found between background music and color filters, indicating that the application of both in a cooking video did not influence the taste experience nor the intended food intake.

Background music

The results showed that the main effect of background music on taste experience did not reach significance, indicating that background music did not influence consumers' perception of taste experience. Therefore, H1 that a TikTok video with salty music will enhance the taste experience of mac and cheese as opposed to a TikTok video with sweet music is rejected. It contradicts the findings of Hobkinson (n.d.) and Sedacca (2016) that salty/staccato music will evoke a salty taste and increase the perceived saltiness. Furthermore, the sweet/legato music which was expected to enhance perceived creaminess was also not proven in this study (Carvalho et al., 2017). The reason for the contradictory result is still not entirely clear, but it

appears that other environmental factors influenced the participants. For instance, the incidental voices heard by participants while filling out the questionnaire could indirectly intercept the effect of salty/sweet music played. Another possible explanation is related to the selection of the music pieces that were adopted and modified from the study of Wang et al. (2015). The salty music used was made with the sound of tearing paper, bass, and brass which may not be pleasant to hear while looking at food video. While the sweet music was made with the sound of piano, synthesizer, and bells, and this combination may not consider fitting to the mac and cheese context. Moreover, a previous study by Wang et al. (2015) did not expose participants to any food, which allowed them to imagine any food and associate the sweet/salty music to a specific taste easily. Therefore, the participants in this study may find it puzzling to process and associate the background music with the mac and cheese context.

Furthermore, H2 that a TikTok video with salty music will lead to a lower health perception of mac and cheese as opposed to a TikTok video with sweet music is also rejected. This finding is in line with the result of a study by Padulo et al. (2020), in which high-fat/ high-calorie food (in this case, mac and cheese) can mask the musical impact on perceived healthiness. In addition, Padulo et al. (2020) also declared that the effect of music and healthy food selection found in most studies is less likely to happen in actual settings where individuals are exposed to numerous foods instead of forced-food choice task. Therefore, it can be argued that these findings are close to the actual results in real settings as this study did not ask participants to choose between two foods. All in all, it can be said that the background music failed in evoking and enhancing the salty and creamy taste of the mac and cheese, thereby the perception of health and food intake that was expected to change did not occur.

Color filters

The third hypothesis of this study focused on the interaction between color filter and taste experience. It was hypothesized that the orange-edited video will enhance the taste experience of mac and cheese as opposed to the blue-edited video. With some cautiousness, the results suggested that the orange color filter influence perceived saltiness, creaminess, and taste intensity, but not on perceived healthiness and food intake. Therefore, H3 can be said to be partially accepted due to the fact that color filters were still proven to enhance the taste experience of mac and cheese, especially in terms of perceived saltiness and creaminess. These findings also addressed the sub-research question from this study on whether applying color filter to a cooking video affect the taste experience of mac and cheese and to what extent.

In the present experiment, the blue color did not transpire in the results, this was undoubtedly due to the color did not seem to fit with the mac and cheese context. This finding confirms the claim from Sukkwai et al. (2018) that the effect of color depends on the type of food and the color of the food itself. Akyol et al. (2018) also suggested that the color blue is commonly known as an appetite suppressant, therefore, it was more likely that the participants in this study who watched the blue-edited video would lose their appetite instead of perceiving the salty taste of mac and cheese. With regard to perceived creaminess, the effect of orange color filter that was found was in line with the previous research (Frost & Janhoj, 2007; Northey, 2016), in which participant who watched the orange-edited video perceived a higher cream perception of mac and cheese as opposed to the blue video. A possible explanation is that the orange color filter applied accentuated the orange color of the mac and cheese itself and made the mac and cheese video look appetizing and appealing (Akyol, 2018). This can also be seen from the increase in the intensity of taste perceived. In addition, the orange color filter used seemed to highlight the mac and cheese properly (the color of the entire video did not look too pale and not to intense either), thereby the increase in taste intensity was not that

extreme to have an effect on health perception as well as the intake levels of mac and cheese ingredients.

Sound-color congruency

The main purpose of the research was to investigate whether background music and color filter in a cooking video of mac and cheese influence the intended food intake through changes in taste experience in terms of perceived saltiness, creaminess, and healthiness. The interaction between background music and color filter did not show a significant effect on taste experience, indicating that the use of background music and color filter in a cooking video of mac and cheese did not influence the taste experience nor the intended food intake. This latter results concurrently reject the remaining hypotheses, H4 that a congruent condition of salty music and blue color filter will lead to a more intense taste experience as opposed to a congruent condition of sweet music and orange color filter, and H5 that the incongruent condition of salty music and orange color filter will lead to a more intense taste experience as opposed to an incongruent condition of sweet music and blue color filter.

The reason for this non-occurring effect between sound and color on taste experience still obscure. However, it seemed that the background music used combined with the color filter is not perceived as universal attributes, thereby, both stimuli did not work on triggering any perceptions or behaviors of participants. Spence (2011) explained that the underlying key of all such cross-modal correspondences is the stimuli used should be known and shared by a large number of people or perceived as universal. The two pieces of background music used in this study were not the kind of music that people usually listen to, nor is it the kind of music that one would expect to hear in a TikTok cooking video. Therefore, the use of these stimuli in the cooking video of mac and cheese had no effect on the taste experience, and only the color filter alone had an effect. It appeared that the participants tended to focus on the visual side of

a given cooking video once they noticed that the background music was unusual. That is probably the starting point where the mac and cheese masking the background music and made the color filter stand out more (Padulo et al., 2020).

Considering that this study had several limitations and needs further research to address the lack of correlation in this study, the following section will discuss the limitations and future implications more thoroughly.

5.1. Limitations

As with the majority of studies, the design of the current study is also subject to several limitations. The first concerns the non-probability sampling used. Since both voluntary response sampling and convenience sampling methods were used for this study, there was a likelihood that selection bias has occurred. For example, those participants (i.e., a participant from the pre-test, a Communication Science student) who chose to volunteer themselves for the study may already know about the study's purpose in advance. They might be more health-conscious to begin with and may know how to fill out the questionnaire following the theory. As a result, the collected responses may not be the actual opinions of the participants arising from the manipulation of the design provided. In addition, although participants have been randomly assigned to one condition to minimize selection bias, it was still possible that the pool of people being randomly assigned was not very representative of the wider population (Institute for Work & Health, 2014). Therefore, although efforts have been made to minimize selection bias and to increase objectivity, the results obtained may still be affected by the unavoidable selection bias. Applying a different sampling method such as probability sampling might minimize the selection bias and address the population concerns more effectively in any future study.

The second limitation concerns the wording of the questionnaire. There were several input and questions that came in regarding the questionnaire questions from the participants. For instance, the question regarding the intended cheese intake is considered as an obscure question. The cheese cube meant is not written in detail whether it was a small cube or a large one. Aside from that, questions for measuring perceived creaminess and healthiness also contained confusion. Some participants did not understand the word full/heavy, which was used to measure the perceived creaminess, and the word plastic, which was used to measure perceived healthiness. These all undeniably confused some of the participants and led to unreliable responses. Therefore, performing a test to ensure the questionnaire is clear and no problems occur can be a preventive solution to this limitation.

Another limitation of this study was the effectiveness of design manipulations which can be maximized. For instance, the TikTok videos that were attached to the questionnaire. It might be better to present the video on TikTok instead of YouTube, therefore, participants can get real experience, and the effect of stimuli will be maximized. There were also some external factors that might play a role in the effectiveness of design manipulations. For example, the mood of the participants. Some participants may not in the mood to watch a mac and cheese cooking video and therefore lower the effectiveness (Yahoo UK, 2017). In addition, there were minor violations of assumptions in this study. Consequently, these results were interpreted with caution, and these limitations should be borne in mind. Specific acknowledgment of the need for future studies will be discussed in the following section.

5.2. Theoretical implications

Several studies have been conducted to investigate the cross-modal correspondences between multisensory modalities on consumers' taste experience. Recent studies focusing on cross-modal compensation effects have demonstrated that one sensory modality (i.e., visual,

olfactory, tactile) can compensate or satisfy desires related to another sensory modality (i.e., gustatory) (Biswas & Szocs, 2019; Van Rompay & Groothedde, 2019). For instance, the use of color in product packaging was proven effective in compensating for the reduction of salt content in food products by enhancing salty taste (Van Rompay & Groothedde, 2019). Thus far, studies that use auditory and visual to counterbalance sodium/fat reduction in solid food through watching a cooking video have been hard to find or may not yet exist. Thence, this study was conducted to address this issue. However, the present study was unsuccessful in proving that the use of background music and color filter in a cooking video of mac and cheese will impact the taste experience. Instead, the results showed that the use of a color filter alone in a cooking video was successfully enhancing the taste experience. Specifically, the participants who watched the cooking video edited using an orange color filter perceived the saltiness and creaminess of the mac and cheese and a more intense taste. A reasonable explanation for this is perhaps the mac and cheese featured in the cooking video and the orange color filter used mask the background music playing, which made the music too subtle to have an impact. By doing so, this study builds on findings of color-taste correspondences and contributes new significant findings in relation to the online setting (in this case, cooking video and color filter). Further research can explore and reaffirm the result of this study by conducting experimental studies using other social platforms such as Instagram and YouTube.

Moreover, as the results of this study did not demonstrate a significant effect of background music and color filter towards taste experience and failed to encourage the reduction of fat and salt in cheese, further research is highly recommended. Several studies have revealed that music and color could evoke a certain emotion and eventually altering consumers' taste experience (Kontukoski et al., 2016; Biswas et al., 2019). These emotional factors seemed to play a role in this present study, and perhaps future studies could take this into account and could explain why the effect expected did not occur. In addition, it will also be of interest to

explore whether tone sensitivity[2] and turophile[3] also influence taste experiences. Future studies could consider these factors and may update the theoretical model.

Inspired by the study from Hagtvedt and Brasel (2016), future studies could conduct multiple studies in both online and offline settings to test whether background music and color filter could alter consumers' taste experience. Conducting experimental studies offline can provide more valid and reliable results in terms of food intake as the researchers can monitor the consumers directly. In other respect, the effectiveness of the cooking video can be tested before they are finally used for online studies. For instance, an experimental study could be conducted in a supermarket where participants have to watch the cooking video while also eating a free cheese sample. Thereby, participants can easily measure the food intake as they do not fully presuppose an imaginary taste. Moreover, participants would likely to share their thoughts subconsciously regarding the cooking video and therefore give new insights to the researchers for the next experiment. Finally, further research could investigate whether this effect also applies in an online setting and food advertising.

5.3. Practical implications

Consumers are at all times surrounded by internet advertisements, product packages, and television commercials that continue to spread. From a marketer's standpoint, color is an influential design element as it is undeniably crucial to attract consumers' attention and convey information about its quality (Jansson-Boyd, 2010). These advantages of color can also be found in food marketing as the color serve as cues for consumers. It creates a psychological expectation for a certain flavor, the level of refreshment, and flavor intensity (Zellner & Durlach, 2003). The findings of this study have confirmed the notion that the use of color filters

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[2] Tone sensitivity refers to participants who may have received musical training, which gives them higher knowledge about musical notes (Guetta & Loui, 2017).

[3] Turophile is the official word for the lover of cheese.

in cooking videos can influence consumers' taste experience. Thence, it is recommended for food stylists and marketers to apply a color filter that is aligned with the color of the food itself in a cooking video as it will evokes and intensifies the perceived taste experience.

At this point, no other concrete recommendations for communication practitioners or marketers can be derived yet. However, inspired by the studies of Van Rompay and Groothedde (2019), and Pineli et al. (2016), this study may provide a practical implication for controlling food intake. Since in some cases healthy and unhealthy foods can have negative effects if consumed excessively, controlling food intake helps to prevent unhealthy eating behavior. This study suggests that the use of an orange color filter in cooking videos may have built up the expectation of increased taste experienced which will make the consumers unaware of the ingredients reduction when they eat the dish.

To finalize, there are a wide variety of behaviors that consumers have towards reducing overeating. By gathering more information and creating cooking videos that are unconsciously effective in compensating for the reduction of ingredients in one dish, the goal of stimulating healthy eating behavior among people can be achieved.

References

Akyol, A., Ayaz, A., Inan-Eroglu, E., Cetin, C., & Samur, G. (2018). Impact of three different plate colors on short-term satiety and energy intake: A randomized controlled trial. *Nutrition Journal, 17*(1). doi: 10.1186/s12937-018-0350-1

Augenthaler, T. (2020). *The top 10 YouTube trends in 2020*. The Influence Marketer. Retrieved from https://theinfluencemarketer.com/blog/the-top-10-youtube-trends-in-2020/

Baumlier, K. (2013). Food as art: Caroline Hobkinson and experimental dining [Blog post]. Retrieved from https://kristenbaumlier.com/2013/01/27/food-as-art-caroline-hobkinson-and-experimental-dining/

Biswas, D., Lund, K. & Szocs, C. (2019). Sounds like a healthy retail atmospheric strategy: Effects of ambient music and background noise on food sales. *Journal of the Academy of Marketing Sciences, 47*, 37–55. Retrieved from https://doi-org.ezproxy2.utwente.nl/10.1007/s11747-018-0583-8

Biswas, D., & Szocs, C. (2019). The smell of healthy choices: Cross-modal sensory compensation effects of ambient scent on food purchases. *Journal of Marketing Research, 56*(1), 123-141. https://doi.org/10.1177/0022243718820585

BMJ. (2015). Global, regional, and national consumption levels of dietary fats and oils in 1990 and 2010: A systematic analysis including 266 country-specific nutrition surveys. Retrieved from https://doi-org.ezproxy2.utwente.nl/10.1136/bmj.h1702

Brakus, J. J., Schmitt, B. H., & Zarantonello, L. (2009). Brand experience: What is it? How is it measured? Does it affect loyalty? *Journal of Marketing, 73*(3), 52–68. doi:10.1509/jmkg.73.3.052

Brunetti, R., Indraccolo, A., Del Gatto, C., Spence, C., & Santangelo, V. (2018). Are cross-modal correspondences relative or absolute? Sequential effects on speeded classification. *Attention, Perception, & Psychophysics, 80*, 527-534. https://doi-org.ezproxy2.utwente.nl/10.3758/s13414-017-1445-z

Calvo, C., Salvador, A. & Fiszman, S. (2001). Influence of colour intensity on the perception of colour and sweetness in various fruit-flavoured yoghurts. *European Food Research and Technology, 213*, 99-103. https://doi.org/10.1007/s002170100359.

Carvalho, R.F., Wang, Q., Van Ee, R., Persoone, D. & Spence, C. (2017). "Smooth operator": Music modulates the perceived creaminess, sweetness, and bitterness of chocolate. *Appetite, 108*, 383-390. doi: 10.1016/j.appet.2016.10.026

Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research, 34*(3), 301-314. https://doi.org/10.1086/519499

Cho, C.H., Mattila, A., Bordi, P. and Kwon, E. (2019). It tastes better when Bach meets red: The role of music and plate color on food evaluation. *British Food Journal*, 122(1), 14-25. https://doi.org/10.1108/BFJ-02-2018-0100

Crisinel, A. S., & Spence, C. (2009). Implicit association between basic tastes and pitch. *Neuroscience Letters*, *464*(1), 39–42. doi: 10.1016/j.neulet.2009.08.016

Drewnowski, A., & Almiron-Roig, E. (2010). Human perceptions and preferences for fat-rich foods. In J. P. Montmayeur & J. le Coutre (Eds.), *Fat detection: Taste, texture, and post ingestive effects* (pp. 265–289). Boca Raton: CRC Press.

Elder, R.S., & Krishna, A. (2010). The effects of advertising copy on sensory thoughts and perceived taste. *Journal of Consumer Research*, *36*(5), 748–756. Retrieved from https://doi-org.ezproxy2.utwente.nl/10.1086/605327

Elliot, A. J., Niesta, K.D., Greitemeyer, T., Lichtenfeld, S., Gramzow, R. H., Maier, M. A., & Liu, H. (2010). Red, rank, and romance in women viewing men. *Journal of Experimental Psychology: General, 139*(3), 399–417. doi:10.1037/a0019689

Fanbytes. (n.d.). *The evolution of TikTok during COVID-19*. Retrieved from https://fanbytes.co.uk/evolution-of-tiktok-coronavirus/

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed.). SAGE Publications Ltd.

Frøst, M., & Janhøj, T. (2007). Understanding creaminess. *International Dairy Journal*, *17*(11), 1298-1311. doi: 10.1016/j.idairyj.2007.02.007

Guetta, R., & Loui, P. (2017). When music is salty: The crossmodal associations between sound and taste. *PLoS ONE, 12*(3), e0173366.

Grossman, R. P., & Wisenblit, J. Z. (1999). What we know about consumers' color choices. *Journal of Marketing Practice: Applied Marketing Science, 5*(3), 78–88. doi:10.1108/EUM0000000004565

Hagtvedt, H., & Brasel, S.A. (2016). Cross-modal communication: Sound frequency influences consumer responses to color lightness. *Journal of Marketing Research, 53*(4), 551-562. https://doi-org.ezproxy2.utwente.nl/10.1509/jmr.14.0414

Hanss, D., Böhm, G., & Pfister, H.R. (2012). Active red sports car and relaxed purple–blue van: Affective qualities predict color appropriateness for car types. *Journal of Consumer Behaviour, 11*(5), 368–380. https://doi.org/10.1002/cb.1380

Harrar, V. & Spence, C. (2013). The taste of cutlery: How the taste of food is affected by the weight, size, shape, and colour of the cutlery used to eat it. *Flavour, 2*(21), 1-13. https://doi.org/10.1186/2044-7248-2-21

Healthline. (2020). *How many calories are in mac and cheese*? Retrieved from https://www.healthline.com/nutrition/mac-and-cheese-calories

Heart Matters. (n.d.). *7 cheese facts that will surprise you*. Retrieved from https://www.bhf.org.uk/informationsupport/heart-matters-magazine/nutrition/cheese

Huang, L., & Lu, J. (2015). The impact of package colour and the nutrition content labels on the perception of food healthiness and purchase intention. *Journal of Food Products Marketing*, *22*(2), 191-218. Retrieved from https://www.tandfonline.com/doi/full/10.1080/10454446.2014.1000434

Influencer MarketingHub. (2021). *Top 21 TikTok video ideas to gain more followers*. Retrieved from https://influencermarketinghub.com/tiktok-video-ideas/

Institute for Work & Health. *Selection bias*. (2014`). Retrieved from https://www.iwh.on.ca/what-researchers-mean-by/selection-bias

Jansson-Boyd, C. (2010). *Consumer psychology*. McGraw-Hill Open University Press.

Kim, Y. (2020). *17 TikTok challenges that have gone viral during times of self-isolation.* HypeBae. Retrieved from https://hypebae.com/2020/4/viral-tiktok-challenges-trends-dances-recipes-savage-megan-thee-stallion-say-so-doja-cat

Kirkmeyer, S.V., & Tepper, B.J. (2003). Understanding creaminess perception of dairy products using free-choice profiling and genetic responsivity to 6-n-propylthiouracil. *Chemical Senses, 28*(6). 10.1093/chemse/28.6.527

Knöferle, K.& Spence, C. (2012). Crossmodal correspondences between sounds and tastes. *Psychonomic Bulletin & Review, 19*, 992-1006. doi: 10.3758/s13423-012-0321-z

Knöferle, K.M., Woods, A., Käppler, F., & Spence, C. (2015). That sounds sweet: Using crossmodal correspondences to communicate gustatory attributes. *Psychology and Marketing*, *32*(1), 107-120. https://doi.org/10.1002/mar.20766

Kontukoski, M., Paakki, M., Thureson, J., Uimonen, H., & Hopia, A. (2016) Imagined salad and steak restaurants: Consumers' colour, music and emotion associations with different dishes. *International Journal of Gastronomy and Food Science, 4*, 1-11. https://doi.org/10.1016/j.ijgfs.2016.04.001.

Kramer, L. (2019). *How to use colours in marketing and advertising.* 99designs. Retrieved from https://en.99designs.nl/blog/tips/colors-marketing-advertising/

Louise. (2020). *31 things to do at home and fun activities to keep you busy during your coronavirus quarantine*. Honeycombers Bali. Retrieved from https://thehoneycombers.com/bali/things-to-do-at-home-coronavirus-quarantine/

Lynch, C., Koppel, K. & Reid, W. (2017). Sensory characteristics and consumer acceptance of black walnut gelato. *International Journal of Food Science and Technology, 52*(7), 1594–1603. https://doi.org/10.1111/ijfs.13432

Maga, J.A. (1974). Influence of color on taste thresholds. *Chemical Senses, (1)*1, 115–119. https://doi.org/10.1093/chemse/1.1.115

Marks, L.E. (1989). On cross-modal similarity: The perceptual structure of pitch, loudness, and brightness. *Journal of Experimental Psychology Human Perception & Performance, 15*(3), 586-602. doi:10.1037//0096-1523.15.3.586

Mathiesen, S., Mielby, L., Byrne, D., & Wang, Q. (2020). Music to eat by: A systematic investigation of the relative importance of tempo and articulation on eating time. *Appetite, 155.* doi: 10.1016/j.appet.2020.104801

Mullins, J. (2015). *R.I.P., Childhood: Kraft macaroni & cheese won't be bright orange anymore.* E! Online. Retrieved from https://www.eonline.com/news/648215/r-i-p-childhood-kraft-macaroni-cheese-won-t-be-bright-orange-anymore

Murphy, B., Benson, T., McCloat, A., Mooney, E., Elliott, C., Dean, M., & Lavelle, F. (2021). Changes in consumers' food practices during the COVID-19 lockdown, implications for diet quality and the food system: A cross-continental comparison. *Nutrients, 13*(20). https://doi.org/10.3390/nu13010020

Moskin, J. (n.d.). *Creamy macaroni and cheese*. Cooking New York Times. Retrieved from https://cooking.nytimes.com/recipes/1015825-creamy-macaroni-and-cheese

Moller, P., Sorensen, L.B., Flint, A., Martens, M., & Raben, A. (2003). Effect of sensory perception of foods on appetite and food intake: A review of studies on humans. *Int J Obes Relat Metab Disord, 27*(10), 1152-1166. doi: 10.1038/sj.ijo.0802391.

Morrison, O. (2019). *Could music hold the key to discovering healthy food that tastes good?* Food Navigator. Retrieved from https://www.foodnavigator.com/Article/2019/06/13/Could-music-hold-the-key-to-discovering-healthy-food-that-tastes-good#

Northey, G.A. (2016). Bitter cold, sharp cheese, and loud colours: The chromatic cacophony of cross-modal sensory perception [Doctoral Dissertation, Western Sydney University].

Padulo, C., Mangone, M., Brancucci, A., Balsamo, M., & Fairfield, B. (2020). Crossmodal congruency effects between sound and food pictures in a forced-choice task. *Psychological Research*. doi: 10.1007/s00426-020-01406-0

Pineli, L., Aguiar, L., Botelho, R., Zandonadi, R., Melo, L., & Fiusa, A. (2016). Sensory impact of lowering sugar content in orange nectars to design healthier, low sugar industrialized beverages. *Appetite, 96*, 239-244. doi: 10.1016/j.appet.2015.09.028

Piqueras-Fisman, B., & Spence, C. (2011). Crossmodal correspondences in product packaging: Assessing colour–flavour correspondences for potato chips (crisps). *Appetite*, *57*, 753– 757. doi: 10.1016/j.appet.2011.07.012

Peng-Li, D., Byrne, D., Chan, R., & Wang, Q. (2020). The influence of taste-congruent soundtracks on visual attention and food choice: A cross-cultural eye-tracking study in Chinese and Danish consumers. *Food Quality and Preference*, *85*, 103962. doi: 10.1016/j.foodqual.2020.103962

Provencher, V., Polivy, J., & Herman, C. P. (2009). Perceived healthiness of food. If it's healthy, you can eat more! *Appetite, 52*(2), 340-344. https://doi.org/10.1016/j.appet.2008.11.005

Raghunathan, R., Naylor, R.W., & Hoyer, W.D. (2006). The unhealthy: Tasty intuition and its effect on taste inferences, enjoyment, and choice of food products. *Journal of Marketing, 70*(4), 170-184. Retrieved from https://doi.org/10.1509/jmkg.70.4.170

Sedacca, M.C. (2016). *"Sonic seasoning" is the growing scientific field that uses sound to make food taste better.* Quartz. Retrieved from https://qz.com/871605/sonic-season-changing-taste-with-sound/

Schifferstein, H. N. (2002). The signal function of thematically (in)congruent ambient scents in a retail environment. *Chemical Senses*, *27*(6), 539-549. https://doi.org/10.1093/chemse/27.6.539

Schifferstein, H., Kudrowitz, B.M., & Breuer, C. (2020). Food perception and aesthetics: Linking sensory science to culinary practice. *Journal of Culinary Science and Technology*. https://doi.org/10.1080/15428052.2020.1824833

Shoup, M.A. (2020). *Survey: Cooking more at home could become the new normal post-pandemic*. Food Navigator USA. Retrieved from https://www.foodnavigator-usa.com/Article/2020/04/15/Survey-Cooking-at-home-will-become-the-new-normal-post-pandemic

Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics, 73*(4), 971–995.

Spence, C., & Ngo, M.K., (2012). Assessing the shape symbolism of the taste, flavour, and texture of foods and beverages. *Flavour, 1,* 1-12. Retrieved from https://doi.org/10.1186/2044-7248-1-12

Spence, M., Livingstone, M., Hollywood, L. E., Gibney, E. R., O'Brien, S. A., Pourshahidi, L., & Dean, M. (2013). A qualitative study of psychological, social and behavioural barriers to appropriate food portion size control. *International Journal of Behavioural Nutrition and Physical Activity, 10*(1), 92. https://doi.org/10.1186/1479-5868-10-92

Spence, C., Velasco, C. & Knoeferle, K. (2014). A large sample study on the influence of the multisensory environment on the wine drinking experience. *Flavour, 3*(8). https://doi.org/10.1186/2044-7248-3-8

Spence, C., Wan, X., Woods, A., Velasco, C., Deng, J., Youssef, J. & Deroy, O. (2015). On tasty colors and colorful tastes? Assessing, explaining, and utilizing crossmodal correspondences between colors and basic tastes. *Flavor, 4*(23). https://doi.org/10.1186/s13411-015-0033-1

Spence, C. (2015). On the psychological impact of food color. Flavor, 4(21). https://doi.org/10.1186/s13411-015-0031-3

Spence, C., Okajima, K., Cheok, A. D., Petit, O., & Michel, C. (2016). Eating with our eyes: From visual hunger to digital satiation. *Brain and Cognition, 110*, 53–63. https://doi.org/10.1016/j.bandc.2015.08.006

Stein, L.J., Cowart, B.J., Beauchamp, G.K. (2012). The development of salty taste acceptance is related to dietary experience in human infants: A prospective study. *The American Journal of Clinical Nutrition, 95* (1), 123-129. doi: 10.3945/ajcn.111.014282

Sukkwai, S., Kijroongrojana, K., Chonpracha, P., Pujols, K., Alonso-Marenco, J., Ardoin, R., & Prinyawiwatkul, W. (2018). Effects of colorant concentration and 'natural colour' or 'sodium content' claim on saltiness perception, consumer liking and emotion, and purchase intent of dipping sauces. *International Journal of Food Science & Technology, 53*(5), 1246-1254. doi: 10.1111/ijfs.13704'

Van Doorn, G., Wuillemin, D. & Spence, C. (2014). Does the colour of the mug influence the taste of the coffee? *Flavour, 3*(10). https://doi.org/10.1186/2044-7248-3-10

Van Rompay, T., & Fennis, B. (2019). Full-bodied taste: On the embodied origins of product perception and sensory evaluation: Designing new product experiences. In Velasco, C., & Spence, C (Ed.), *Multisensory Packaging: Designing New Product Experiences* (pp. 163–190). doi:10.1007/978-3-319-94977-2_7

Van Rompay, T., & Groothedde, S. (2019). The taste of touch: Enhancing saltiness impressions through surface texture design. *Food Quality and Preference, 73*, 248-254. Retrieved from https://doi.org/10.1016/j.foodqual.2018.11.003

Van Rompay, T.J.L., & Pruyn, A.T.H. (2011). When Visual Product Features Speak the Same Language: Effects of Shape-Typeface Congruence on Brand Perception and Price Expectations. *Journal of product innovation management, 28*, 599-610. https://doi.org/10.1111/j.1540-5885.2011.00828.x

Wadhwani, R. & McMahon, D.J. (2012). Color of low-fat cheese influences flavor perception and consumer liking. *Journal of Dairy Science, 95*(5), 2336–2346. doi: 10.3168/jds.2011-5142

Walansky, A. (2020). *Making mac and cheese? Avoid these 9 common cooking mistakes.* Today. Retrieved from https://www.today.com/food/common-mistakes-people-make-when-making-mac-cheese-t186112

Wan, X., Woods, A.T., Bosch, J., Mckenzie, K.J., Velasco, C. & Spence, C. (2014). Cross-cultural differences in cross-modal correspondences between tastes and visual features. *Frontiers in Psychology: Cognition, 5*, 1365. doi: 10.3389/fpsyg.2014.01365

Wansink, B. & Chandon, P. (2014). Slim by design: Redirecting the accidental drivers of mindless overeating. *Journal of Consumer Psychology, 24*(3), 413-431.

Wang, Q.J., Woods, A., & Spence, C. (2015). "What's your taste in music?": A comparison of the effectiveness of various soundscapes in evoking specific tastes. *i-Perception*, *6*(6). https://doi.org/10.1177/2041669515622001.

Wang, Q.J. & Spence, C. (2018). "A sweet smile": The modulatory role of emotion in how extrinsic factors influence taste evaluation. *Cognition & Emotion, 32* (5), 1052-1061. https://doi.org/10.1080/02699931.2017.1386623

Wei, S.T., Ou, L.C., Luo, M.R. & Hutchings, J.B. (2012). Optimization of food expectations using product color and appearance. *Food Quality and Preference, 23*(1), 49–62. doi: 10.1016/j.foodqual.2011.07.004

Woods, A., & Spence, C. (2016). Using single colours and colour pairs to communicate basic tastes. *I-Perception*, *7*(4), 204166951516588. doi: 10.1177/2041669516658817

Yahoo UK. (2017). Emotional context could make digital ads 40% more effective according to Yahoo research [Blog post]. Retrieved from https://yahoo.tumblr.com/post/158393152734/emotional-context-could-make-digital-ads-40-more

YouTube Culture & Trends. (2020). *Watching the pandemic: What YouTube trends reveal about human needs during COVID-19*. Retrieved from https://www.youtube.com/trends/articles/covid-impact/

Zachary, Z., Brianna, F., Brianna, L., Garrett, P., Jade, W., Alyssa, D., & Mikayla, K. (2020). Self-quarantine and weight gain related risk factors during the COVID-19 pandemic. *Obesity Research & Clinical Practice*, *14*(3), 210-216. doi: 10.1016/j.orcp.2020.05.004

Zellner, D.A. & Durlach, P. (2003). Effect of color on expected and experienced refreshment, intensity, and liking of beverages. *The American Journal of Psychology, 116*(4), 633-647.

Appendix A

Screenshots of the TikTok videos

Final Videos

Figure 3. The blue filter-edited videos.

Figure 4. The orange filter-edited videos.

All edited videos can be accessed by way of this link:

http://bit.ly/BachelorThesisStimuli_JacquelineFransputri
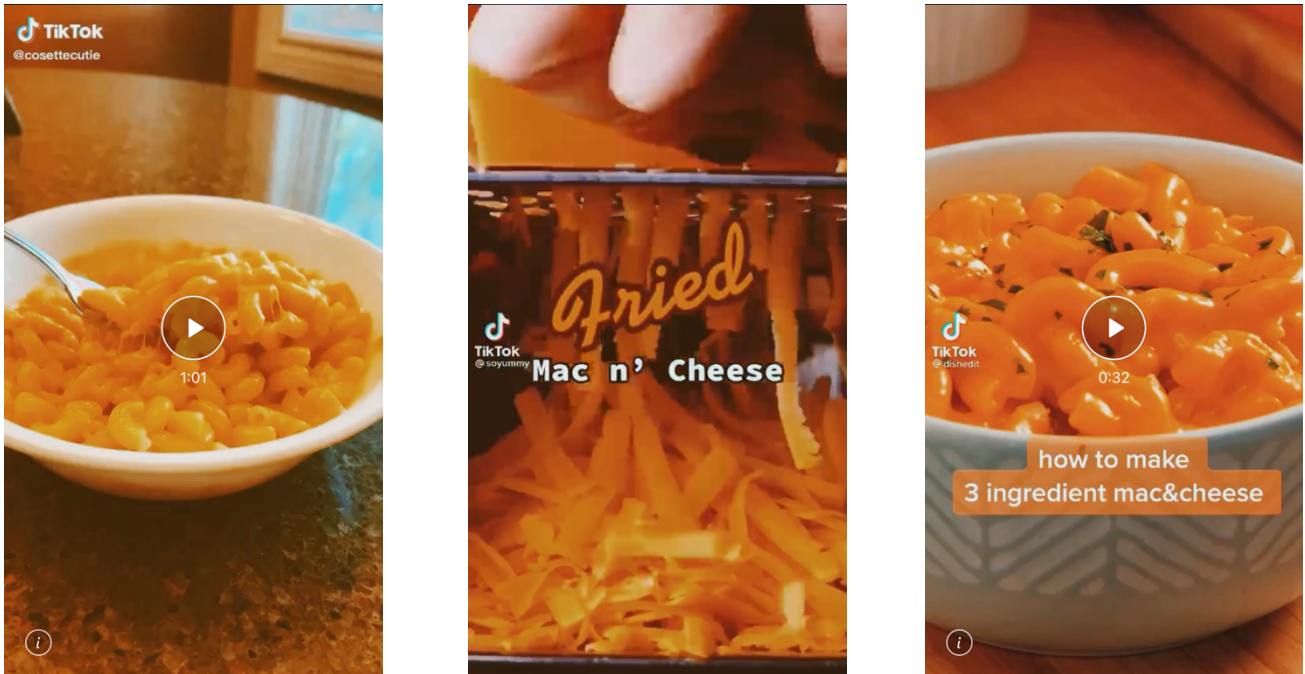
Screenshots of the TikTok videos

Pre-Tests
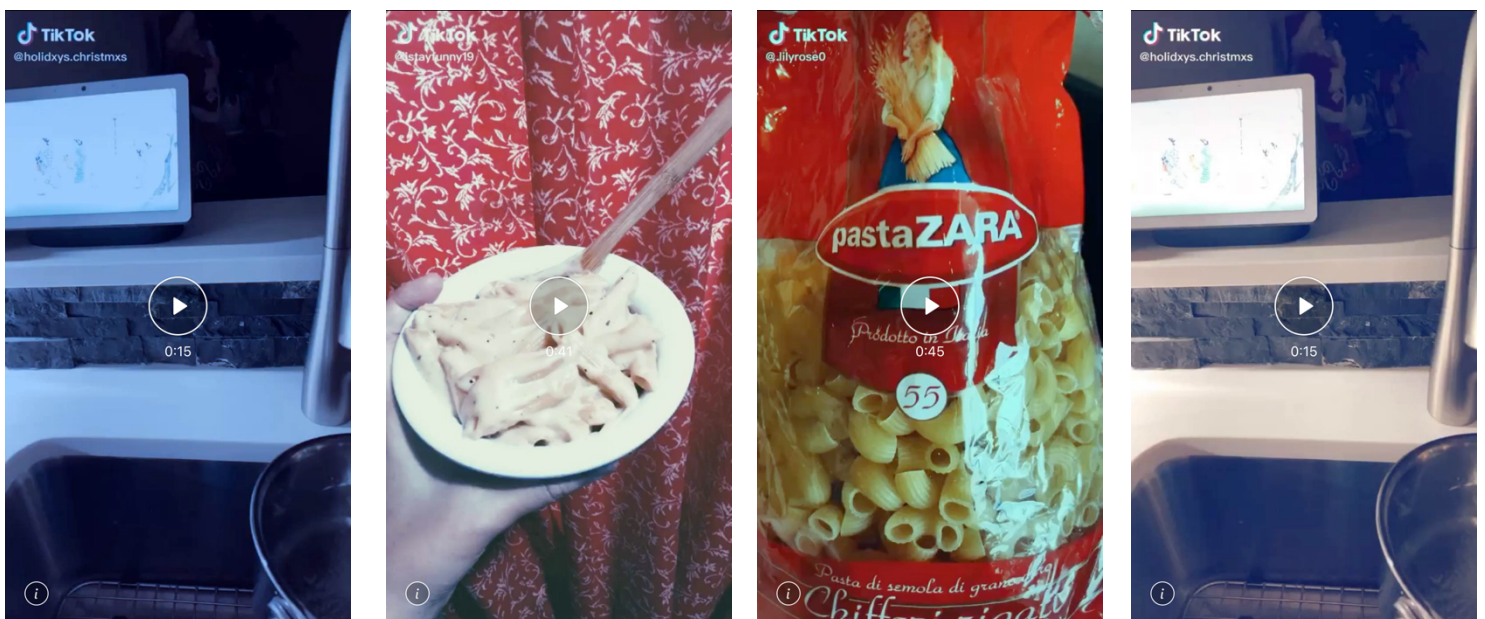

Figure 5. The orange filter-edited videos for pre-tests.

Figure 6. The blue filter-edited videos for pre-tests.

Appendix B

Screenshots of the questionnaire

UNIVERSITY OF TWENTE.

You are being invited to participate in a study on Macaroni and Cheese on YouTube. This study is conducted by Jacqueline Fransputri from the Faculty of Behavioural, Management, and Social Sciences at the University of Twente.

The purpose of this research is to investigate your desired ingredients for mac and cheese after watching a cooking video on YouTube. This survey will take you approximately 10 minutes to complete. The data will be used for a Bachelor Thesis in Communication Science.

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any question.

We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by storing the data offline and anonymizing all responses.

Study contact details for further information: Jacqueline Fransputri (jacquelinefransputri@student.utwente.nl)

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management, and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

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I have read the information stated above and agree to participate in this research study.

○ Yes
○ No

→

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Welcome to this study! You are about to participate in a study where you can share your honest opinion on one cooking video. Imagine that you are scrolling through your social media and come across this cooking video. Before you watch the cooking video, please kindly answer these introductory questions. Later, you will be asked several questions about your expectations and experiences after watching the video.

Please rate how hungry or full you are right now.
1 represent "Not hungry at all" and 7 represent "Very Hungry".

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Level of Hunger

Please rate on how much do you love cheese.
1 represent "Not at All" and 7 represent "Very Much"

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Cheese Lovers

How often do you watch cooking videos?

○ Every day
○ Often
○ Sometimes
○ Never

On which platform do you usually watch cooking videos?

○ TikTok
○ Youtube
○ Instagram
○ Twitter
○ Other:

How often do you cook?

○ Every day
○ 5-6 days a week
○ 3-4 days a week
○ 1-2 days a week
○ Only special occasions
○ Never

Are you in an appropriate location to watch and listen to a video without any disturbance or distraction

○ Yes
○ No
○ Maybe

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You will now be shown a video. Please watch this video at full volume.

Is the video and the audio work properly for you?

○ Yes
○ No

Figure 7. Sweet-Blue Condition.

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Based on the video that you have just watched, please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I think the mac and cheese would taste Salty	○	○	○	○	○
I think the mac and cheese would taste Sweet	○	○	○	○	○
I think the mac and cheese would taste Sour	○	○	○	○	○
I think the mac and cheese would taste Bitter	○	○	○	○	○

→

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I think the mac and cheese looks creamy	○	○	○	○	○
I think the mac and cheese looks heavy/full	○	○	○	○	○
I think the mac and cheese doesn't looks as creamy as I'd like	○	○	○	○	○

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
Mac and cheese seems to have an intense taste	○	○	○	○	○
Mac and cheese seems to have a strong taste	○	○	○	○	○
The taste of the mac and cheese seemed mild	○	○	○	○	○
The taste of the mac and cheese seemed bland	○	○	○	○	○

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
The mac and cheese looks healthy to me	○	○	○	○	○
I think the colour of the mac and cheese looks plastic to me	○	○	○	○	○
I would eat mac and cheese as one of my healthy (diet) menu	○	○	○	○	○

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I think the serving size shown in the video would be fulfilling	○	○	○	○	○
I think I can keep on eating this mac and cheese	○	○	○	◉	○

Imagine that you are going to cook a mac and cheese for yourself and you see this recipe,

340 g fusili or elbow pasta
1 1/2 cup of milk of choice (360ml)
1 cup of shredded cheddar (125 grams or 1 1/4 cheese block)
1/2 teaspoon of salt and pepper

How many additional cheese blocks you would like to add?

○ 0
○ 1
○ 2
○ 3
○ More than 3

A
1 cup only

B
2 cups

C
3 cups

How many cups of milk are you going to pour?

○ A
○ B
○ C
○ I will pour according to the recipe mentioned (1 1/2 cups)

How much spices (salt and pepper) are you going to add?

○ 1 teaspoon
○ I will add according to the recipe mentioned (1/2 teaspoon)
○ 2 teaspoon

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According to the video that you watched, please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I think the mac and cheese is tasty	○	○	○	◉	○
I think I would like the taste of this mac and cheese	○	○	○	○	○
I think I would never like this kind of mac and cheese	○	○	○	○	○

Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I enjoy the background music	○	○	○	○	○
I think the background music fits well with the content (mac and cheese)	○	○	○	○	○
I think the background music fits with the video as a whole	○	○	○	○	○

Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I like the video	○	○	○	○	○
I would watch the video again	○	○	○	○	○
I didn't watch the video till the end	○	○	○	○	○
I would press the like button for this video	○	○	○	○	○
I would like to share this video to my family/friends	○	○	○	○	○

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
Watching the video makes me crave for mac and cheese	○	○	○	○	○
I want to cook a mac and cheese after I watch this video	○	○	○	○	○
I will use this video as a guidance for me to cook mac and cheese	○	○	○	○	○

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Please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I want to order mac and cheese via food delivery	○	○	○	○	○
I want to buy instant mac and cheese	○	○	○	○	○
I want to buy the ingredients to cook mac and cheese on my own	○	○	○	○	○

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Lastly, you will be asked some questions about yourself.

What is your gender?

○ Male
○ Female
○ Other

What is your age?

[ ]

What is your nationality

○ Indonesian
○ Dutch
○ German
○ Other: [ ]

→

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Thank you for participating in this study! If you have any questions, you can contact the researcher at jacquelinefransputri@student.utwente.nl

Feel free to share the link to the study with your friends.

If you want to win a gift card (Bol.com or Amazon) with an amount of 10 Euros (if you are Dutch and German) or Gopay with an amount of Rp. 100.000 (if you are Indonesian), then please enter your email. In case you won, you will be contacted and asked what kind of gift card you want.

The information will only be used to inform if you have won.

[ ]

Do you have any remarks?

[ ]

Appendix C

Tables

Table 2

The values of univariate effects for basis tastes

Effect	Dependent Variable	F	Hypothesis df	Error df	Sig.	Partial η2
Music	Salty Taste	3.149	1	206	.07	.015
	Sweet Taste	2.200	1	206	.14	.011
	Sour Taste	.059	1	206	.72	.001
	Bitter Taste	.507	1	206	.47	.002
Color	Salty Taste	8.304	1	206	.004	.039
	Sweet Taste	.135	1	206	.71	.001
	Sour Taste	.209	1	206	.64	.001
	Bitter Taste	.112	1	206	.73	.001
Music * Color	Salty Taste	.370	1	206	.54	.002
	Sweet Taste	1.108	1	206	.29	.005
	Sour Taste	3.543	1	206	.06	.017
	Bitter Taste	.016	1	206	.90	.0005

Table 4

The values of univariate effects for food intake

Effect	Dependent Variable	F	Hypothesis df	Error df	Sig.	Partial η2
Music	Perception of Satiation	.261	1	206	.61	.001
	Cheese Intake	1.029	1	206	.31	.005
	Milk Intake	3.334	1	206	.06	.016
	Spices Intake	.0005	1	206	.99	.0005
Color	Perception of Satiation	1.084	1	206	.29	.005
	Cheese Intake	.0005	1	206	.98	.0005
	Milk Intake	.013	1	206	.91	.0005
	Spices Intake	.719	1	206	.39	.003
Music * Color	Perception of Satiation	.006	1	206	.93	.0005
	Cheese Intake	.104	1	206	.74	.001
	Milk Intake	3.349	1	206	.06	.016
	Spices Intake	1.302	1	206	.25	.006

Table 6

The values of univariate effects for product liking

Effect	Dependent Variable	F	Hypothesis df	Error df	Sig.	Partial η2
Music	Taste Liking	1.424	1	206	.23	.007
	Video Liking	.003	1	206	.95	.0005
	Music Liking	.460	1	206	.49	.002
Color	Taste Liking	2.924	1	206	.08	.014
	Video Liking	1.143	1	206	.28	.006
	Music Liking	3.458	1	206	.06	.017
Music * Color	Taste Liking	.176	1	206	.67	.001
	Video Liking	.430	1	206	.51	.002
	Music Liking	.735	1	206	.39	.004

Table 7

The values of univariate effects for individuals' intention

Effect	Dependent Variable	F	Hypothesis df	Error df	Sig.	Partial $\eta 2$
Music	Cooking Intention	.001	1	206	.97	.0005
	Purchase Intention	1.616	1	206	.20	.008
	Willingness to Share	.182	1	206	.67	.001
Color	Cooking Intention	.464	1	206	.49	.002
	Purchase Intention	.025	1	206	.87	.0005
	Willingness to Share	.285	1	206	.59	.001
Music * Color	Cooking Intention	.176	1	206	.67	.001
	Purchase Intention	.492	1	206	.48	.002
	Willingness to Share	.318	1	206	.57	.002

Table 8

Overview of the results of hypotheses and research questions in the study

	Research Question / Hypothesis	Result
Main RQ	To what extent do background music and color filter in a cooking video of mac and cheese influence the intended food intake through changes in taste experience in terms of perceived saltiness, creaminess, and healthiness?	Non-significant interaction effect
H1	A TikTok video with salty music will enhance the taste experience of mac and cheese as opposed to a TikTok video with sweet music.	Rejected
H2	A TikTok video with salty music will lead to a lower health perception of mac and cheese as opposed to a TikTok video with sweet music.	Rejected
H3	The orange-edited video will enhance the taste experience of mac and cheese as opposed to the blue-edited video.	Partially accepted
Sub-RQ	Does applying color filter (such as blue and orange) to a cooking video affect the taste experience in regard to mac and cheese and to what extent does it affect?	Significant on perceived saltiness, perceived creaminess, and taste intensity
H4	A congruent condition of salty music and blue color filter will lead to a more intense taste experience as opposed to a congruent condition of sweet music and orange color filter.	Rejected
H5	The incongruent condition of salty music and orange color filter will lead to a more intense taste experience as opposed to an incongruent condition of sweet music and blue color filter.	Rejected

Table 9

Final scale items recorded on 5-point rating scales

Scales	Items
Basic Taste	I think the mac and cheese would taste salty
	I think the mac and cheese would taste sweet
	I think the mac and cheese would taste sour
	I think the mac and cheese would taste bitter
Perceived Creaminess	I think the mac and cheese looks creamy
($\alpha = .64$)	I think the mac and cheese looks heavy/full
Taste Intensity	Mac and cheese seems to have an intense taste
($\alpha = .75$)	Mac and cheese seems to have a strong taste
	The taste of the mac and cheese seemed mild
	The taste of the mac and cheese seemed bland
Perceived Healthiness	The mac and cheese looks healthy to me
($\alpha = .85$)	I would eat mac and cheese as one of my healthy (diet) menu
Food Intake	I think the serving size shown in the video would be fulfilling
	How many additional cheese blocks would you like to add?
	How many cups of milk are you going to pour?
	How much spices (salt and pepper) are you going to add?
Taste Liking	I think the mac and cheese is tasty
($\alpha = .80$)	I think I would like the taste of this mac and cheese
	I think I will never like this kind of mac and cheese
Music Liking	I enjoy the background music
($\alpha = .90$)	I think the background music fits well with the content (mac and cheese)

	I think the background music fits with the video as a whole
Product Liking	I like the video
($\alpha = .81$)	I would watch the video again
	I would press the like button for this video
Cooking Intention	Watching the video makes me crave for mac and cheese
($\alpha = .83$)	I want to cook mac and cheese after I watch this video
	I will use this video as a guidance for me to cook mac and cheese
	I want to buy the ingredients to cook the mac and cheese on my own
Purchase Intention	I want to order mac and cheese via food delivery
($\alpha = .79$)	I want to buy instant mac and cheese
Willingness to share	I would like to share this video to my family/friends