UNIVERSITY OF TWENTE.

Bachelor Thesis

To what extent is the perception of taste influenced by packaging design?

Is the perception of healthiness and perceived level of sweetness influenced by the packaging texture and color?

B.Sc. in Communication Science
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Submission Date
June 28, 2019

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Abstract

Research has shown that packaging has a strong influence on perception and product evaluation. Nevertheless, research has so far not investigated the interaction relationship of texture and color on taste perception. Considering the current increase in obesity, which is the life threatening issue that this research more or less indirectly desires to improve. In order to test the taste perception, four kinds of sampling cups were fabricated with the help of a 3D-printer. More precisely, two sampling cups with a smooth surface and two with a rough surface one of each in blue or red. Generating four comparable testing conditions. Results showed that a red colored packaging would enhance the sweetness and lower the perceived healthiness. Whereas a blue colored package maximizes the perception of healthiness and lowered the sweetness perception regardless of the surface texture. Furthermore, practical implications regarding future research are addresses as well as the limitations of this research.

1. Introduction

In todays world the threat of health related issues is tremendous and increasing at a freighting rate. As of 2012 obesity for instance has emerged as a major global health problem (Malik & Hu, 2012). Causing life-threatening health issues such as high blood pressure increasing the risks of strokes, diabetes, and gallbladder diseases, breathing problems including asthma and even causes some forms of cancers ("10 Health conditions & diseases linked to obesity", 2018). The significance of this problem is undermined by the fact that more than one in two adults and one in six children are considered overweight or obese (Obesity Update, 2017). More concretely in Germany for example 23,6 present of the population ages 15 years and over are reported to suffer from obesity (Obesity Update, 2017). Sugar has been identified as one of the main causes of obesity when the consumption exceeds the recommended intake levels (Malik & Hu, 2012). Additionally researches have proven the negative link of a high sugar intake and health related issues as mentioned previously (Mundt, et al., 2006; Part, Ayala, Sharkey, & Blanck, 2017).

One attempt to tackle these health issues is shown by a recent trend that can be observed in the supermarket shelves; the reduced sugar products. Even though pricing and convenience are still prioritised, many consumers are beginning to search for healthier snacking alternatives (Kneebone, 2017). Research by Shepherd, Sparks, and Raats (1991) also emphasizes the fact that visual appearance of the food packaging is the first contact between the consumer and the food itself, influencing both the expectations and liking. This observed trend could help reduce the number of individuals suffering the consequences of obesity. If it wasn't for the fact that 'less sugar' products are considered as less rewarding and less satisfying as the product containing the higher levels of

sugar. According to Tijsesen et al. (2017) healthier food options are associated with conscious efforts towards weight loss and diets. Therefore, the reward properties of healthier foods seem to diverge from the higher-level sugar foods. Making these sugar reduced products just as rewarding, sweet and satisfying, as the higher-level sugar products can possibly aid in the struggle of reducing our obese population. Nevertheless, the gap between the visual perception leading to higher satisfaction levels and the taste of sugar reduced products needs to be explored and the effect of color and texture determined. As for example by Rompay, Finger, Saakes and Fenko (2017), where the outcome was that rounded, smooth surfaces increase the perceived sweetness and lowered the bitterness perception.

In order to make the implementation of sugar-reduced products successful and enhance the subsequent customer satisfaction levels there are several influential factors that need to be addressed and subsequently altered. Beginning with the analysis of the decision-making process of individuals purchasing a product. Whilst consumers are purchasing their everyday goods, their choices are often based on both extrinsic factors as well as intrinsic factors (Becker, Rompay, Schifferstein, & Galetzka, 2011; Tijssen, Zandstra, Graaf, & Hager, 2017). Extrinsic factors (visual appearance) are usually packaging, brand and context of a product. Whereas the intrinsic determinates of food preferences encounter the flavour, taste, odour and texture of a product (Tijssen, Zandstra, Graaf, & Jager, 2017). However it is important that sight is still a very important sense for the decision-making process when buying products, especially if an individual is buying this product for the first time (Schifferstein, Fenko, Desment, Labbe, & Martin, 2013). Hence, according to research taste as well as the decision-making process is influenced by visual cues. A combination of visual cures with tactile cues could further boost the impact of packaging. According to research packaging is important and is used more and more as a tool to increase customer satisfaction and subsequently influence the consumer's decision-making process (Hawkes, 2010). Furthermore, the shelf life of a product is significantly influenced and determined by the packaging design and right selection of materials (Marsh & Bugusu, 2007). Disregarding the decision-making process and the shelf life time of a product, factors such as likability and taste intensity are also important and interesting to investigate. For example as research by Rompay and Groothedee (2019) shows that a rough surface enhances the taste intensity impressions.

The aim of this paper is to determine the most suitable packaging design that will enhance consumer's willingness to purchase the healthier food choices and at the same time maintain the satisfaction level of the higher-level sugar products. The central questions underlying this research paper are: to what extent is the perception of taste influenced by packaging design? More precisely

is the perception of healthiness and perceived level of sweetness influenced by the packaging texture and color?

Before presenting the outcomes of the experiment conducted, we will elaborate on the theoretical assumptions and present several hypotheses. Followed by the creation of packaging variants differing in texture and color. Those were thereafter used in the experiment testing the participant's perception on the taste and evaluation of gummy bears.

1.1 Packaging color and taste perception

Over the years many researchers have explored the influences of product packaging color and the effect on taste perception. One example of which was a research study conducted by Tijssen, Zandstra, Graaf, & Hager, (2017) showing that the effect of the color hue, brightness and situation of packaging color altered the expectations of sweetness and flavour intensity greatly. Therefore increasing the color brightness will increase the expected and perceived level of sweetness. Furthermore research has also proven that highly saturated, warmer colored containers boost the perception and liking of beverages compared to beverages served in white colored containers (Piqueras-Fiszman & Spence, 2012; Hogg, 1969). Another research by Deliza and MacFies (2001) showed a similar relationship between the packaging color and the determined level of sweetness, more precisely consumers perceived a product as sweeter when presented in packaging in the color range of orange to red rather than white. Another outcome from Schuldts (2013) research stated that the products in the blue to green color range were perceived as healthier than any other color. And therefore due to the perceived higher level of healthiness also decreasing the reward and satisfaction levels (Tijsesen et al., 2017). Accordingly, deducted from these findings and combination of different researchers outcomes, the packaging color enhancing sweetness will be a color along the gradient of red. Thus, the packaging color that will effect the sweetness perception negatively and enhance the perception of healthiness will be from the color in the range of blue. Another research by Pangborn (1960) undermines the effect of green and blue colors on the judgment of sweetness influencing it negatively. Pangborn (1960) also found out that red/pink colored solutions generated the highest perception of sweetness. Deducted from these findings the first two testing conditions can be determined. The packaging that will be tested in the following research will be containing the identical product, one in a red packaging color and the other in a blue package.
Based these findings from literature and previous research the first hypothesis can be defined:

H1: Product packages with warmer colors (red) will enhance the perceived level of sweetness and the satisfaction level however lowers the perception of healthiness.

1.2 *Packaging texture and taste perception*

The importance of product packaging in relation to product liking and success amongst consumers is strongly linked (Spence, 2016). Which leads us to the second intervention of this research the product materials, more specifically product texture and its influence on taste perception. Previously there has been a lot research conducted exploring exactly this, the impact of texture on taste. For example the research conducted by Ngo. et. al (2011) showing that sweetness is associated with more smooth organic shapes in comparison to rough material textures. Another research has shown that the material of a container significantly influences the way consumers experience a beverage (Schifferstein, 2009). Additionally as reported by Tu, Yang, & Ma (2015) packaging is most successful when the selected material, design satisfies the products needs and characteristics, fulfilling its marketing purpose, environmental responsibility and cost. Interestingly, participants in a taste experiment conducted by Piqueras-Fiszman and Spence (2012) rated the tested goods with an increased likelihood when presented in a smooth rather than rough packaging. As Schifferstein (2009) found out, that the material of a container influences the overall taste experience especially regarding abstract taste attributes (e.g.; temperature, sweetness). Also, the research concluded that package appearance is a considered driver of taste perception and therefore proves to be a powerful tool to influence the consumers (Schifferstein, 2009). Similarly, the taste of vanilla ice cream was evaluated as sweeter when tasted from a smooth sample rather than from a sharp-feeling sample cup (Van Rompay et al., 2018). Studies conducted by Van Rompay et al. (2017, 2018) have indicated paring between textures and our evaluations of taste regarding bitterness and sourness. Conclusively derived from the existing literature and previously conducted research, it is possible to determine that when presenting food in smooth more organic looking textured containers the ratings regarding liking and sweetness will be higher (compared to rough feeling containers). This may, as explained by Van Rompay et al. (2018), be due to the line of reasoning that roughness is linked to experienced friction and therefore smoothness is linked to a more pleasurable experience frictions. Therefore for this intervention two different kinds of packages will be presented to participants, one will have a rough surface and the other a smooth one. Which leads directly to the next formulated hypothesis:

H2: Packages with a smooth surface will be perceived as sweeter, fully satisfying but less healthy than packages will a rough surface.

H3: A red, smooth package will be perceived even sweeter and hence less healthy but grand the full satisfaction, in comparison to a blue rough package, which will taste less sweet, healthier and therefore lower the satisfaction level.

In order to test these three hypotheses, a between subject design is conducted. In total there will be four different sampling cups used for testing, two will be red and the other two blue. One of the two red sampling cups will have a smooth texture and the other will be rough. The same applies for the blue cups. Testing both for the effect of the color on taste perception and the effect of texture on taste perception as well as the interaction effect of both taste and color on the perception of health and sweetness.

2. Method

2.1 Materials

In order to conduct this research four sample cups two with a smooth surface and the other two with a rough surface were 3D-printed (see Fig. 1 & Fig.2). The stimuli were manufactured from polylactic acid (PLA) using a Fused Deposition Modelling 3-D printer (Rompay, Finger, Saakes, & Fenko, 2017). The Ultimaker 2 printer enabled the creation of highly detailed and accurate sampling cups, designed to fit a small paper cup that to be replaced for hygienic purposes.

Fig. 1. Sample packages used in pre-test and main study color blue and two different materials (rough & smooth)

Fig. 2. Sample packages used in pre-test and main study color red and two different materials (rough & smooth)

2.2 Participants

Prior to conducting this research permission was obtained from the ethics committee of the University of Twente (see: https://www.utwente.nl/en/bms/research/ethics/). In total 103 randomly selected German-speaking individuals from the city of Bonn participated, 42 male, 61 female, the

age ranging from 14-59 years; mean age of 29 years. All participants were unaware of the research purpose and participated voluntarily.

2.3 Procedures

Participants were approached in Bonn Centre in front of the university of Bonn. Individuals were kindly asked for five minutes of their time in order to participate in a short 'taste test' and subsequently asked to fill out a questionnaire. After agreeing to participate they were presented with one of the four sampling cups filled with yellow gummy bears, each sampling cup contained identical flavoured gummy bears. Participants were explicitly asked to hold the sample cup into their own hands and to concentric on the taste of the product. After which the participants were asked to complete the questionnaire. After having answered all twenty questions, the participants were thanked for taking their time to complete the questionnaire.

2.4 Measures

A short questionnaire was used to measure four different aspects regarding the taste product. Participants were asked to indicate to what extent they agreed with the presented statements using a 7-point rating scale, ranging from "not at all" to "very much so".

2.4.1 Liking, feeling and buying intention evaluation measures

We used seven statements order to measure the liking, the feeling and the buying intention of the tasted product. Participants were asked to indicate their agreement with the following seven statements belonging to three different items. First, in order to measure taste and liking, we used two items: "I like the taste of these gummy bears" and "they taste just right for my liking" (alpha = 0.62). Participants also rated how they felt after eating the gummy bear also using two items ("I am satisfied after eating these gummy bears" and "I feel bad after eating these gummy bears") (alpha = 0.70). Finally, the buying intention was measured on hand of three separately treated items first "I am interested in this product", secondly "I would consider buying this product" and lastly by the statement; " I would recommend this product to others".

2.4.2 Sweetness and sourness perception evaluation measures

The perception of sweetness was measured using the following three statements grouped into two different measuring items. Firstly, sweetness was measured using the following two statements: "These gummy bears taste sweet" and "these gummy bears taste like they contain a lot of sugar" (alpha = 0.68). Followed by "these gummy bears taste sour" as a single item measuring sourness.

2.4.3 Healthiness perception evaluation measures

Healthiness was measured on hand of the agreement level towards these three statements as one measuring item: “These gummy bears do not taste natural”, “these gummy bears are bad for my health” and “these gummy bears contain artificial ingredients” (alpha = 0.74).

2.4.4 Taste intensity evaluation measures

Participant’s perception of taste intensity was measured with one items. The following three statements: “these gummy bears do not taste bland”, “these gummy bears have a strong taste”, “these gummy bears have a powerful taste” were used to measure taste intensity (alpha = 0.78).

3. Results

In order to investigate the effect of the independent variables ‘texture’ and ‘color’ on the dependent variables (‘liking’, ‘feeling’, ‘buying intention’, ‘sweetness’, ‘sourness’, ‘healthiness’ and ‘taste intensity’) an analysis of variance was conducted. Further an analysis of the interaction effect, testing for the main effects of color, texture and the combination of both was carried out.

3.1 Liking

The ANOVA with the perceived ‘liking’ of the gummy bears as dependent and ‘texture’ and ‘color’ as independent variables produced an insignificant main effect for ‘texture’ on ‘liking’ ($F(3, 99) = .13$, $p < .73$). Confirming hat a rough texture ($M = 5.70$; $SD = .78$) does not enhance liking, in relation to a smooth texture ($M = 5.64$; $SD = .82$). The main effect of ‘color’ was not significant either ($F(3, 99) = 1.38$, $p < .24$), proving that a red colored cup ($M = 5.76$; $SD = .76$) will not significantly enhance liking compared to a blue colored cup ($M = 5.58$; $SD = .82$). More importantly however is the significant interaction effect of ‘texture’ and ‘color’ on ‘liking’ ($F(3, 99) = 23.30$, $p < .00$, $R^2 = 0.20$), showing that a smooth texture and red color enhances the perceived liking the most ($M = 6.08$; $SD = .69$), where as a smooth blue colored cup resulted in the lowest liking levels ($M = 5.22$; $SD = .71$).

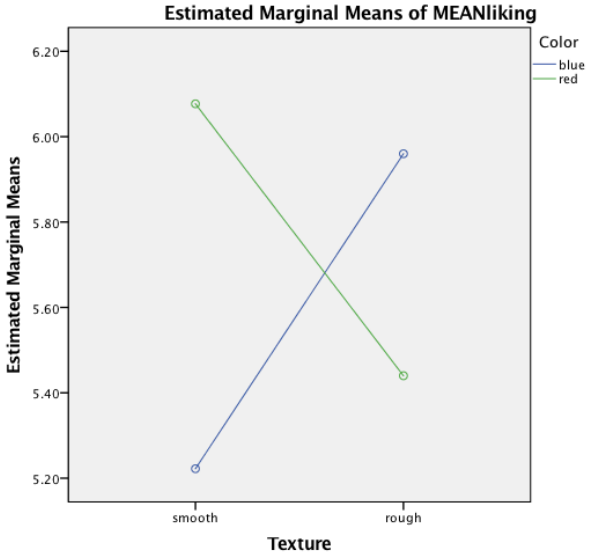

Fig. 3. Interaction between texture and color on liking.

3.2 Feeling

An ANOVA with 'feeling' as dependent variable with again 'texture' and color' as independent variables revealed a significant main effect for 'texture' on 'feeling' ($F (3, 99) = 62.77$, $p < .00$), meaning that a rough texture ($M = 5.41$; $SD = .70$) does significantly enhance the 'feeling' compared to a smooth textures cup ($M = 4.53$; $SD = .75$). Where as the main effect of 'color' on the independent variable 'feeling' is insignificant ($F (3, 99) = .99$, $p < .32$), hence a red cup did not portrait a better feeling ($M = 5.03$; $SD = .54$) than a blue cup ($M = 4.88$; $SD = 1.07$). The interaction effect of 'texture' and 'color' on 'feeling' proved to be significant ($F (3, 99) = 71.35$, $p < .00$, $R^2 = .58$). Finding out that a blue rough textured cup improved the feeling the most ($M = 5.82$; $SD = .66$) and a blue smooth cup the least ($M = 4.02$; $SD = .47$).

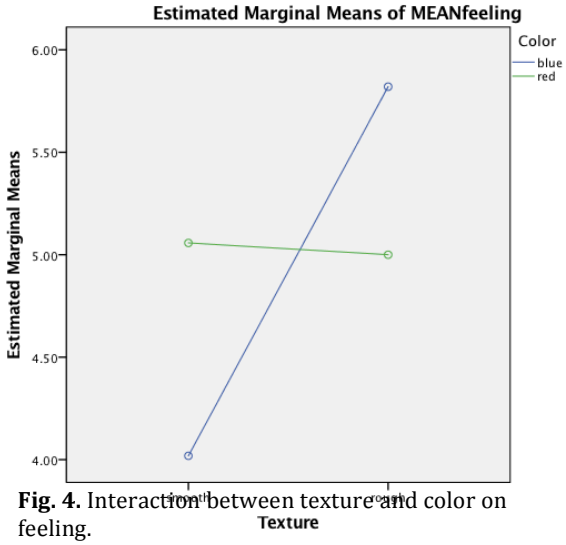

Fig. 4. Interaction between texture and color on feeling.

3.3 Buying intention

For 'buying' intention the main effect of 'texture' was unfortunately insignificant (F (3, 99) = .89, p < .35), showing that a rough texture (M = 5.48; SD = .60) does not enhance the buying intention, compared to the smooth texture (M = 5.37; SD = .59). On the other hand, the main effect of 'color' on the 'buying intention' is significant (F (3, 99) = 4.13, p < .04), confirming that the red colored sampling cups (M = 5.54; SD = .63) influenced the buying intention positively more than the blue colored sampling cups (M = 5.31; SD = .54). More importantly the interaction effect of 'texture' and 'color' on the 'buying intention' is significant (F (3, 99) = 12.20, p < .001, R^2 = .15), proving that a red smooth textured cup enhances the buying willingness the most (M = 5.68; SD = .56), where as a smooth blue cup does quiet the opposite (M = 5.07; SD = .46).

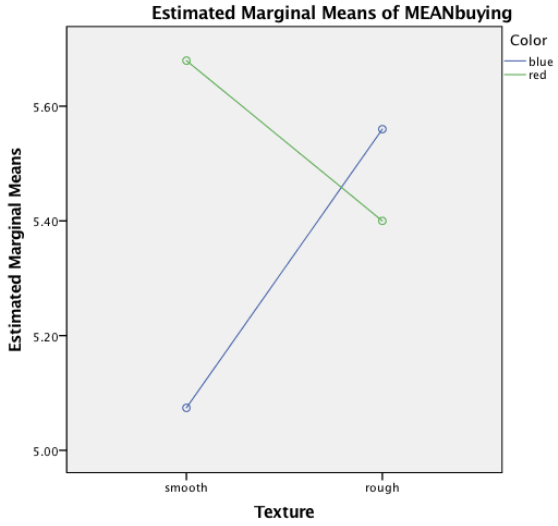

Fig. 5. Interaction between texture and color on buying intention.

3.4 Sweetness perception

The ANOVA with 'sweetness' as dependent variable and 'texture' and 'color' as independent variables, proved to have a significant main effect for 'texture' on 'sweetness' (F (3, 99) = 38.24, p < .00), showing that a rough texture (M = 4.77; SD = 1.07) enhances the sweetness perception versus a smooth texture (M = 5.42; SD = .93). Also, again the main effect of 'color' on 'sweetness' proved to be significant (F (3, 99) = 245.46, p < .00), confirming that red colored cups (M = 5.04; SD = .65) enhances the perceived sweetness levels versus blue colored cups (M = 4.28; SD = .61). More importantly the interaction effect of 'texture' and 'color' on 'sweetness' proved to be insignificant (F (3, 99) = 1.03, p < .31, R^2 = .74).

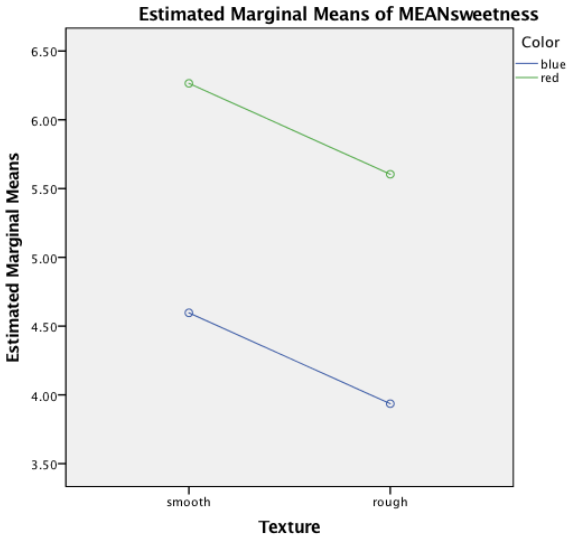

Fig. 6. Interaction between texture and color on perceived sweetness.

3.5 Sourness perception

The dependent variable 'sourness' which was treated as a single item. The main effect of 'texture' on sourness' perception can be confirmed to being significant ($F (3, 99) = 4.48$, $p < .04$), certifying that a rough textured cup is perceived as slightly more sour ($M = 4.09$; $SD = 1.2$) than a smooth textured sampling cup ($M = 4.40$; $SD = 1.23$). Also the main effect of 'color' on 'sourness' also yielded significance ($F (3, 99) = 157.82$, $p < .00$), reinforcing that the gummy bears are perceived as more sour from a blue cup ($M = 5.19$; $SD = .77$) compared to a red cup ($M = 3.27$; $SD = .80$). More importantly is the insignificant interaction effect of 'texture' and 'color' on 'sourness' ($F (3, 99) = .00$, $p < .99$, $R^2 = .62$).

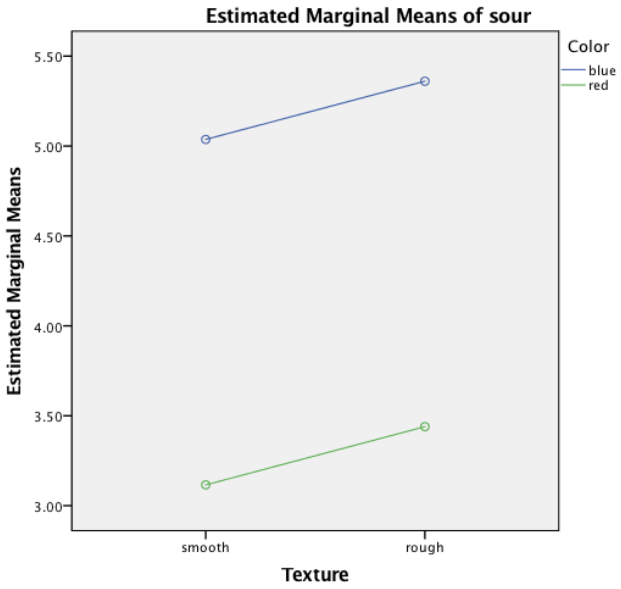

Fig. 7. Interaction between texture and color on sourness.

3.6 Healthiness perception

Likewise, the ANOVA with 'health perception' as dependent variable and 'texture' and 'color' as independent variables yielded an insignificant main effect for 'texture' on 'healthiness' ($F (3, 99) = 1.1$, $p < .09$), confirming the fact that a rough texture ($M = 5.13$; $SD = .76$) will not enhance or lower the perception of a product being healthier similarly to a smooth texture ($M = 5.33$; $SD = .91$). More importantly though is the significant main effect of 'color' on 'healthiness' ($F (3, 99) = 84.55$, $p < .00$), showing that a red color ($M = 5.13$; $SD = .76$) decreases the perception of healthiness compared to the color blue ($M = 4.68$; $SD = .51$) which has proved to enhance the healthiness perception slightly. The interaction effect of 'texture' and 'color' on 'healthiness' however has yielded to being insignificant ($F (3, 99) = 3.71$, $p < .06$, $R^2 = .48$).

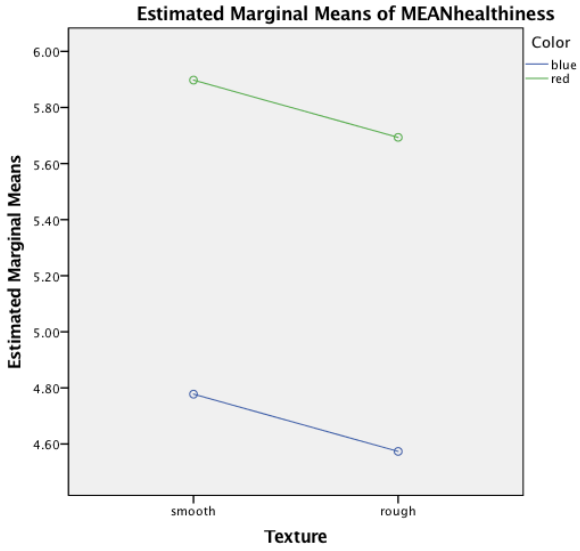

Fig. 8. Interaction between texture and color on Healthiness.

3.7 Taste intensity perception

The ANOVA with 'taste' as dependent variable and 'texture' and 'color' as independent variables proved a significant main effect of 'texture' on 'taste' intensity ($F (3, 99) = 7.83$, $p < .01$), showing that a gummy bear tested from a rough textured sampling cup ($M = 4.65$; $SD = .93$) will taste more intense then from a smooth cup ($M = 4.92$; $SD = .91$). Also, the main effect of 'color' on taste intensity proved to be highly significant ($F (3, 99) = 234.68$, $p < .00$), meaning that a red color cup ($M = 5.56$; $SD = .62$) will enhance the taste intensity substantially compared to a blue cup ($M = 4.03$; $SD = .40$). Where as the interaction effect of 'texture' and 'color' happened to be insignificant ($F (3, 99) = .15$, $p < .70$, $R^2 = .71$).

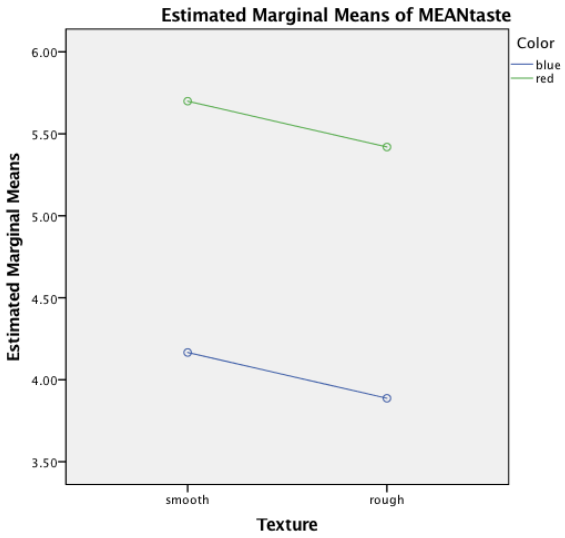

Fig. 9. Interaction between texture and color on taste intensity.

4. Discussion

The findings clearly show that the surface texture, as well as the color has a strong influence on the perception and taste evaluation of a product. Starting off with the findings regarding the interaction effect of texture and color on liking. Proving that a combination of both texture and color will influence the perception. Just as Ngo. et al. (2011) had suggested, that sweetness is more likely to be associated with smooth organic shapes or as Pangborn (1960) stated that warmer colors would grant a higher sweetness perception than colder colours. After all, for practical implications this means that when wanting to maximise the liking of a product one should present it in a smooth textured red packaging.

Of further interest, is the effect of texture and color on the feeling of individuals after testing the product. The findings showed that a rough texture enhances the feeling compared to a smooth texture in a positive way. Also, surprisingly changing the color did not alter the feeling. However on a theoretical level, these findings suggest that maintaining a rewarding feeling after the consumption of a product is very important (Shepherd et al., 1991), especially when wanting to maintain the maximum reward level with a reduced sugar product for example. Our findings also clearly show that the interaction effect was influential towards the feeling of individuals. More precisely, a blue colored rough textured cup revealed the highest, most positive feeling; where as a blue colored smooth sampling cup presented the lowest level. In practical terms this would mean that when wanting to generate a high satisfaction level after consuming a low sugar product, it should be

presented in a red smooth textured packaging (have a low value towards the variable feeling). However if you want to generate a positive feeling with an 'unhealthy' product it would be wise to have a blue rough textured packaging, giving the consumers the perception that the unhealthy product as less harmful hence has a better feeling.

Then of course, also very important to consider is the buying intention of individuals. Specifically in line with our previous findings, a red sampling cup positively enhanced the buying intention regardless of the texture. Nevertheless, the results also proved that a red smooth textured cup gave individuals the highest willingness to purchase the product where as a blue smooth sampling cup presented the exact opposite. Therefore in order to maximise the buying intention a package should be designed in a smooth red colored material. Leading back to the theoretical background stating that as mentioned by Shepherd et al. (1991), the visual appearance is the first contact of a customer with a product influencing both the expectations and the likability. Similarly as specified by Becker, Rompay, Schifferstein and Galetzka (2011) as well as by Tijssen, Zandstra, Graaf, and Hager (2017), extrinsic factors such as visual appearance strongly influence the purchasing choices.

Clearly, of high importance is perceived level of sweetness; for which the findings proved that a smooth texture enhanced this perception. Likewise the red colored sampling cup significantly enhances the sweetness level. Surprisingly though, the interaction of texture and color yielded to be insignificant, in practical terms that would mean that in order to increase the perceived level of sweetness, the package should definitely include one of the following factors. Either having a smooth texture or being colored red. In other words when wanting to enhance the sweetness level of a product with lowered sugar levels it is advisable to design a packaging with one of the sweetness enhancing characteristics (smooth texture or red color).

Adverse to the perceived sweetness, the level of perceived sourness was investigated, proving that a rough texture is perceived as a little sourer compared to a smooth texture. The findings also, showed that the color blue is perceived as slightly more sour in comparison to the red colored sampling cups. Meaning for practical implications a package design should, in order to reduce the perception of sourness it should be in the color red and have a smooth texture.

Of equal importance is the health perception that can be altered by the color rather than the texture as the results have confirmed. These effects did not transpire through the analysis, in other words altering the surface texture will not enhance or lower the perceived healthiness level. However, one outcome of the research was that a red color would lower the perceived healthiness significantly. In practice this would suggest that in order to convey a healthy image, the packaging should not be red but rather blue, regardless of the texture. Additionally and in line with Tijsesen et

al (2017) findings, a higher level of healthiness will decrease the reward and satisfaction level, which comes in handy when wanting to manipulate the perception of the consumers in a desired way. One example, in which these outcomes may become useful, is when considering the worldwide obesity problem. Package designers and manufacturers could influence the perception of the consumers, by selling sugar-reduced products and simultaneously granting the full reward and satisfaction levels.

And then of course, the final investigated effect of texture and color on the taste intensity. These findings indicated that gummy bears from a rough textured sampling cup would taste more intense then from a smooth cup. Also, similarly to previous findings a red colored cup will enhance the taste intensity substantially compared to a blue colored sampling cup.

4.1 Limitations and shortcomings

Clearly it is also important to address the limitations and shortcomings of this research. Beginning with the most obvious. A limitation that almost all researchers struggle with is the inability to control the environment, whilst collecting the data it is merely impossible for a researcher to control all external factors (e.g. time of day, hunger, thirst, mood etc.). Nevertheless these may well have had an influence on the outcome of this research. Another shortcoming rooted within the method, would be the improper representation of the target population, which was meant to be a random sample. However, the mean age (29 years) being fairly young may have occurred due to the fact that most participants, willing to participate were students at the university of Bonn. As a matter of fact, it was noticeable that whilst collecting the data most individuals not belonging to the typical age group of students were less willing to participate.

Furthermore, the results yielded several sufficient effects of texture on various categories including: liking, buying intention and healthiness. These insufficient results maybe due to the fact that texture itself has a great influence on all our senses and therefore is difficult to narrow down to the fairly abstract items like, liking, buying intention and healthiness. Also these could have been influenced through the past experiences of the participants purchasing habits. It is unusual, if not even impossible to find goods within a supermarket that are packed in containers with such an extreme texture as the one we tested in this research, perhaps leaving the participants with uncategorised, overwhelming thoughts and feelings.

Then of course, one of the most prominent limitations in this research study was the limited number of 100 participants. A research would benefit from increasing the number of participants. Leading us to the improvement suggestions for future research, first and foremost having larger age groups within the tested participants helping for future implications of the outcomes. Making them more applicable in everyday life. Also a larger sample size will always improve a quantitative

research. Since this research only included approximately 100 participants, it would be advisable to at least double this size to grant more precise and reliable results. Furthermore, it would be highly interesting to test all four sampling conditions on each one of the individuals. Obviously this would require more time and a longer lasting data collection process since all four conditions would have to be tested with a significant amount of time between each other. Nevertheless, it would generate extraordinary data and perhaps even remarkable, surprising outcomes.

5. Conclusion

Concluding with this study we can now answer the original research questions, namely; to what extent the perception of taste is influenced by package design or more specifically is the perception of healthiness and perceived level of sweetness influenced by the packaging texture and color? The aim was also to investigate and veryfy the three formulated hypotheses. Firstly, the hypotheses regarding the effect of packaging color on sweetness and perceived health, which failed to be rejected. Additionally hypotheses two, regarding the texture and its influence on the variables we also fail to reject. And last but not least, the hypotheses testing for the interaction effect we can also only fail to reject. Clearly proving a significant effect of surface texture and color of a product on the perception of taste and more specifically on sweetness and perceived healthiness.

The outcome of this thesis contributes towards existing literature, by exploring the interaction effect of texture and color on taste perception, which had not been explored before hand. Aiding manufacturers and health specialist with respect to practicalities of aiming to undertake the task of tackling the obesity problem. In order for this to be successfully the major limitations (e.g. sample size) need to be disregarded. Therefore concluding, we are confident that by implementing the results shown above, the worldwide obesity issue maybe aided. Moreover by giving the consumers the full satisfaction levels (conveyed though the packaging design), although presented with a reduced sugar product.

6. References

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7. Appendix

7.1 Literature Study Log

Research questions: To what extent is the perception of taste influenced by packaging design? Is the perception of healthiness and perceived level of sweetness influenced by the packaging texture and color?

Criteria preferred materials:

- Materials selected from books but preferably scientific articles
- Language: English
- Regency: 2009–2019

Selected Databases:

- Scopus, Google scholar and psycINFO
- These are most appropriate to my research due to the fact that they all include scientific research papers/articles and psycINFO especially includes articles strongly related to human behaviour, which is highly relevant for my research question.

Literature research log:

	Date	**Database/ Setnumber**	**Search actions + search technique (and/or/truncate/phrases)**	**Total hits**
1	16.05	Scopus	Packaging AND “perceived sweetness”	2
2	16.05	Scopus	Packaging AND “perception of healthiness”	4
3	16.05	Scopus	“Packaging material” AND “perceived sweetness”	1
4	16.05	Scopus	“Packaging material” AND “perception of healthiness”	NONE
5	16.05	Google scholar	“Packaging material” AND “perceived sweetness”	71
6	16.05	Google scholar	“Packaging material” AND “perceived healthiness”	56
7	16.05	Google scholar	Packaging AND “perceived sweetness”	1350
8	16.05	Google scholar	Packaging AND “perception of healthiness”	298
9	17.05	Google scholar	"sugar intake" AND "health problems"	5,290
10	17.05	Google scholar	"negative effect" AND "sugar intake"	1,360
11	24.05	Google scholar	'environmentally friendly' AND 'food packaging'	71,600

12	24.05	Google scholar	'environmental' AND 'food packaging'	1,790,000
13	24.05	Google scholar	'taste perception' AND 'packaging'	66,800

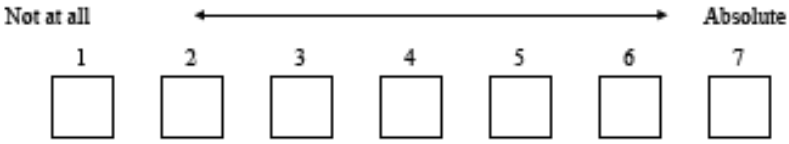
UNIVERSITY OF TWENTE.

Bachelor Thesis – Hannah Paeffgen

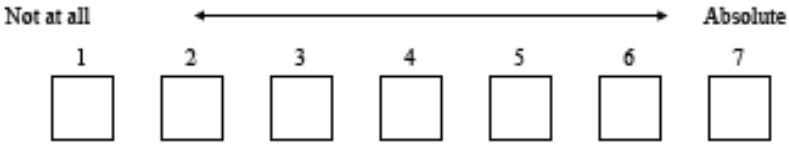
1. Gender
   - Female
   - Male
   - Other

2. Age: _____

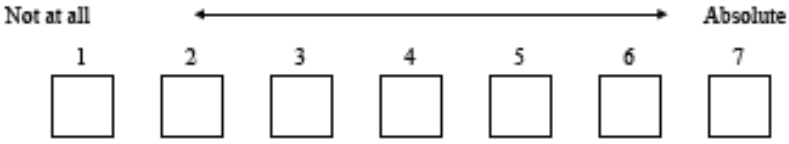
3. „I like the taste of these gummy bears.“



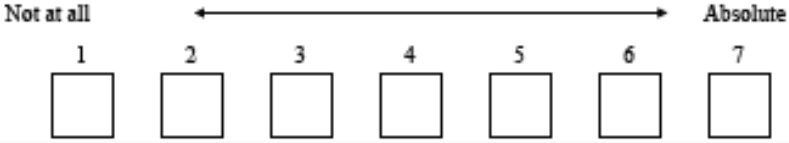
4. “I am satisfied after eating these gummy bears”



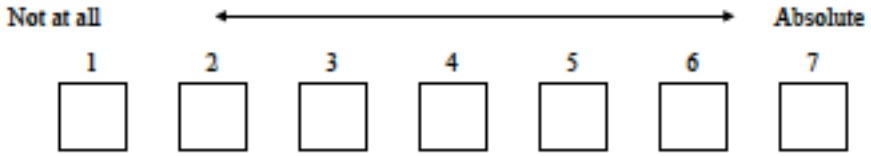
5. “I feel bad after eating these gummy bears”



6. “They taste just right for my liking”

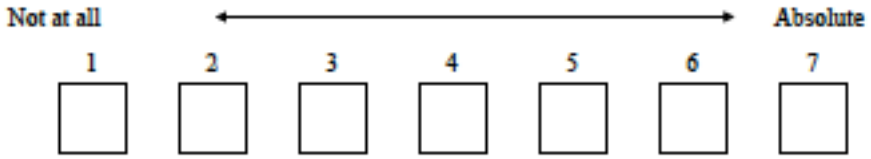


7. "I am interested in this product"

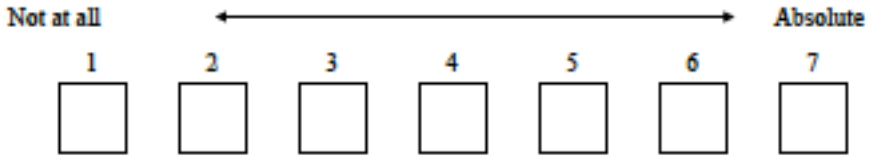


8. "I would consider buying this product"

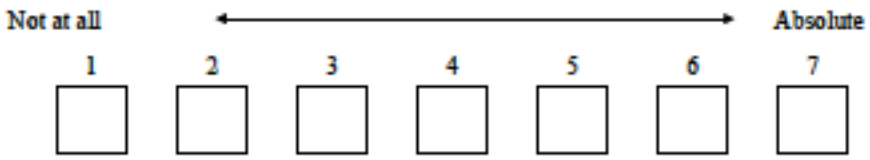
9. "I would recommend this product to others"



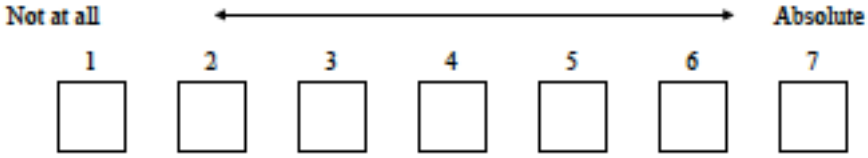
10. "These gummy bears taste sweet"



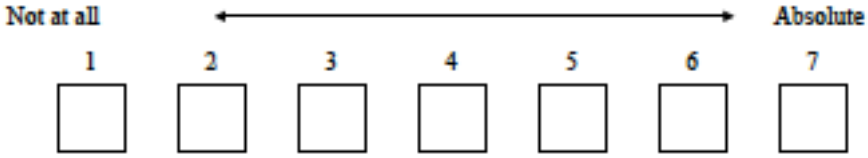
11. "These gummy bears taste sour"



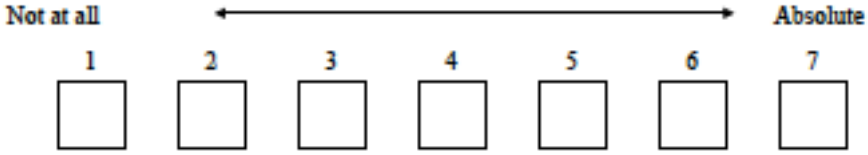
12. “These gummy bears do not taste natural”



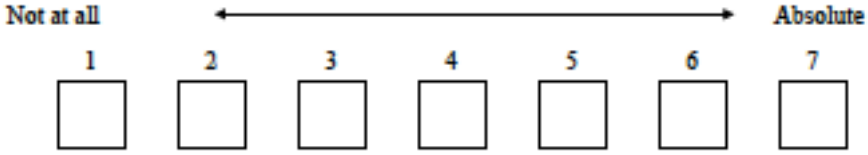
13. “These gummy bears are bad for my health”



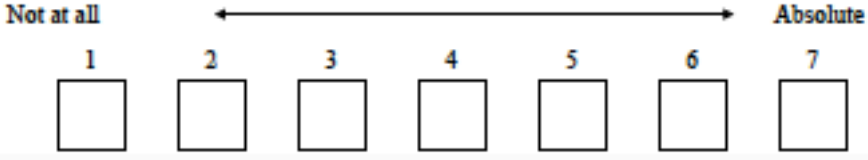
14. “These gummy bears taste like they contain a lot of sugar”



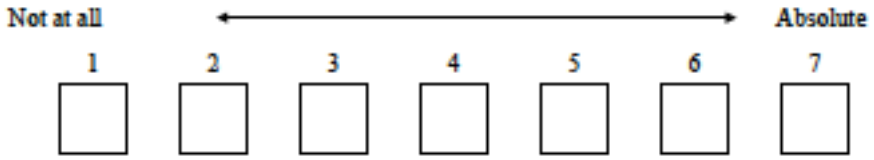
15. “These gummy bears have a strong taste“



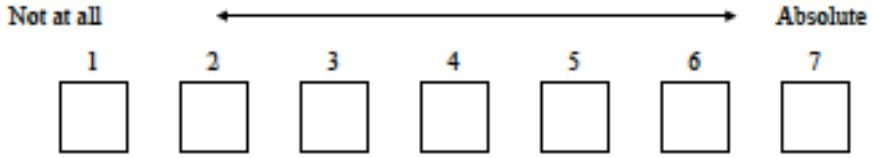
16. “These gummy bears have a powerful taste”



17. "These gummy bears do not taste bland"



18. "These gummy bears do not taste natural"



19. "These gummy bears contain artificial ingredients"