

Nutella: Australia vs Europe

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Abstract. Since the dawn of time (or at least since the invention of Nutella), the human kind has strived for the hamletic question “Can human distinguish different version of Nutella sold in different countries.” In this paper we present a simple empirical experiment to shed some light on this important and vital question. Inspired by early experiments to find if humans can distinguish the Nutella sold in the US from the one sold in Europe, we designed and conducted an experiment to find if Nutella sold in Australia is different from the Nutella sold in Europe. Results are inconclusive: no statistically significant evidence has been found for supporting the thesis that humans can/can not distinguish the two Nutellas. Further investigations (and jars of Nutella) are needed.

1 Introduction

Nutella is probably one of the most well-known brand names of a sweetened hazelnut cocoa spread. Since its introduction to the market in the second half of the 20th century it has become the source of happiness (and heart attacks) for countless people. Nutella nowadays is appreciated all over the world and it can be found in many disparate countries. Nutella has indeed a huge follow-up and plenty of fans all over the world. There is even an official Nutella day (5th of February), i.e., a celebration day when many tasting events, thematic parties, and challenges are held in honor of Nutella.

The spread of Nutella¹ in the entire world triggered the appearance of high intensity discussion about:

1. Who are the best eaters of Nutella?
2. Which is the best hazelnut cream rival of Nutella?
3. Which jar size is better (400 g, 450, . . . , 1Kg, 5kg)?
4. Are the Nutella produced in different countries different, and if so, can the human distinguish them?

These questions leave margin to a huge debate. For instance, the answer to the first question depends on the meaning attributed to the word “best”. If by best we mean “who is eating more”, French should be leading since France is the country that consumes the most jars of Nutella per person. If instead by best we mean the ones appreciating the quality the most, probably the answers will be Italians since an Italian was the creator of Nutella and because in Italy people still eat Nutella even though plenty of well-known alternatives are available.

¹ Here spread is used as a verb, not to be confused with Nutella “spread”.

There is no common consensus on the best rival of Nutella. Certainly different prestigious rivals exist such as “Crema cuor di cacao” by Venchi, “Crema Novi” by Novi, or “Crema di Nocciole” by Guido Castagna. Unfortunately previous studies such as [5] were inconclusive in determining the best one. No common consensus exists either for the size of the Nutella jar since clearly a bigger jar usually has a better quantity- price ratio but, thanks to the fact that Nutella can be addictive, having a big jar could also mean eating a lot of Nutella, thus increasing the stress for the upcoming swimsuit season.

As far as the last question is concerned, rumors speculate that the Nutella produced in different countries differs [2, 6]. In one of our earlier works [3], we put under test the hypothesis that the Nutella sold in the US is different from the Nutella sold in Europe. The results were encouraging, indicating that humans seem to be able to spot the difference.

In this work we are focusing again on the differences between Nutellas by trying to discover if humans can spot the difference between a Nutella produced and bought in Australia from one bought and produced in Europe (Germany to be precise and stay in the middle). We report the result of an empirical test where test subjects were asked to eat two samples of Nutella taking inspiration and improving the previous test conducted in [3].

Empirical evidence seems to indicate that the test subjects have difficulties in perceiving the differences between the different version of Nutella. Further investigations are however needed to confirm the statistical significance of the experiment.

2 Background

Following World War II, in 1946 the shortage of supplies in the chocolate and cocoa industry had a big impact on European bakeries. An Italian baker named Pietro Ferrero found a solution to the shortage of cocoa and demand for chocolate. Inspired by the Gianduia chocolate spread invented in Turin during Napoleon’s regency, Pietro created a spread mixing sugar, hazelnuts and just the slightest bit of cocoa powder. He called it *Giandujot*. Giandujot became a wild success and on the 14th of May 1949 Ferrero became an official trademarked company. Around 1951, the spread was remastered to be easily spread onto bread and called *SuperCrema*.

In 1964, following the death of his father, the son of Pietro Ferrero, Michele, created a new recipe for the SuperCrema: the first jar of Nutella was born. Nutella spread from only Italy to across Europe. Germany fell in love with the spread and led to its cultural diffusion across the eastern hemisphere. In 1965 Nutella reached France, expanding further into Europe. This was the start of a continuous growth that led Nutella to be produced in various facilities worldwide. For the European and South Africa markets Ferrero has two plants in Italy, one in France, one in Germany, one in Poland, one in Turkey. For the North American market, Nutella is produced in Canada and Mexico. For Australia and New Zealand, Nutella has a plant in Australia. Finally, for the Brazilian market Ferrero has a plant in Brazil.

Nutella is made from sugar, palm oil, hazelnuts, cocoa, skimmed milk powder, whey powder, lecithin, and vanillin. The receipt is kept as a secret by the Ferrero company

which also uses special designed machines to guarantee the quality of the production of every Nutella jar.

3 Methodology

The experiment performed was designed to check if humans are able to distinguish a Nutella spread produced and sold in Australia and a Nutella spread produced and sold in Europe. For this reason we bought a random sample of the Nutella jars with an expiration date posterior to August 2019.

By the nutrition information given on the jars, the declared ingredients were similar. The big external difference between the two jars was that the European one comes in a glass jar while the Australian comes in a plastic jar. To create fair and equal test conditions, we kept the two jars for months in a dark location at room temperature. We then gathered volunteers to be used as test subjects. No compensation was promised to them.

The experiment consisted in one session of Nutella testing for every test subject. In every session the test subject was exposed to two plastic teaspoons of Nutella simultaneously. The probability to be exposed to different spreads was $1/2$. When the spread selected was the same we select the Australian (Aus) spread with probability $1/2$ and the European (EU) spread with probability $1/2$. To assign the sample to every test subject in a randomic way we used the functionality provided by `www.random.org` that allows to generate random bytes from atmospheric noise, which for many purposes is better than the pseudo-random number algorithms typically used in computer science. The information about the probabilities was communicated to the test subjects before the experiments.

The tests subjects were first grouped in a room where a questionnaire was presented to them. The questionnaire was given to evaluate their generalities and their attitudes toward chocolate. In particular, the following questions were presented to the test subjects:

- Age (expected answer an integer value between 0 and 150)
- Instruction level (expected answer in { none, bachelor degree, master degree, PhD })
- Sex (expected answer a value in { male, female, yet unknown })
- What is your attitude towards chocolate (expected answer in { I hate it, I am neutral, I like it, I love it, I can not live without it })
- How many times do you eat chocolate in average in a month (expected answer in { never, between 1 and 5, between 6-50, too much })

Additionally, we required the test subject to mark if the following statement applied to them.

- I am not clinically mad.
- I am over 18 or my mother gave me the permission to participate in this experiment.
- I am over 18 or my father gave me the permission to participate in this experiment.
- I am not a terrorist.
- The doctor did not forbid me to participate in chocolate spread experiments.

- I will not going to tamper the chocolate spread testing experiments, nor provide false answers on purposes. I will use all my skills to perform to the best as possible the required tasks.

The test subject having an age below 2 were discarded to avoid possible communication bias. We also discarded people older than 111 years as a safety precaution. For security reason, we discarded also the chocolate haters. This was done to prevent possible outburst of violence between them and the chocolate lovers. The test population thus obtained was constituted by 43 people.

The test subjects were blindfolded and were exposed using two plastic teaspoons to a small amount of Nutella (i.e., 5 g). Sample A was given on their right hand, sample B on their left hand. They were allowed a time limit of 64 seconds to perform what they liked with the samples (e.g., eat them, smell them, lick them, touch them) but without any interaction with the external public nor the possibility to remove the blindfold. After this period, or when the subject was ready, they were asked the following questions:

1. Do you believe that the spreads of Nutella are different (expected answer a boolean value)²
2. Which sample do you like the most ? (expected answer in { first, second, undefined })

Test subjects were allowed to consume liquids, or food before the sessions. For common decency, test subjects were offered a paper towel after the experiment to clean up the traces of Nutella that finished in not targeted places (e.g., chin). No discount on the testing time was allowed despite the hilarity of certain attempts to grasp the plastic teaspoon and sample the Nutella.

The experiments were conducted at the University of Southern Denmark, Thursday the 28th March, 2019. A sunny day was chosen to perform the experiment, to avoid attracting too many test subjects interested in the Nutella to compensate for the blues of the Danish weather typical of this time of the season.

4 Results

The results of the experiment are shown in Table 1. For every test subject we reported its unique identifier in the first column. In the second and third columns we report which sample of Nutella was given to the test subject. In the fourth column we report if the answer to the previous question (i.e., were the two samples different) was correct (†) or wrong ✓. The last column shows instead the preference given by the test subject provided that the samples were different and that the test subject identified this fact correctly.

During the experiments the test subjects could commit two kinds of errors: saying that the samples were different while instead they were equal (false positive), and saying that the samples were equal while they were different (false negative). There have been 9 false positive and 9 false negatives out of 43 trials (23 times out of 43 the spreads were different).

² Considering the effect of using three values or fuzzy logics is left as a future work.

Id	Sample A	Sample B	Correct	Preference
1	Aus	Aus	†	
2	Aus	EU	✓	EU
3	EU	Aus	✓	EU
4	EU	Aus	†	
5	Aus	Aus	✓	
6	Aus	Aus	✓	
7	Aus	Aus	†	
8	EU	EU	†	
9	Aus	Aus	✓	
10	Aus	EU	✓	EU
11	EU	EU	†	
12	Aus	EU	†	
13	Aus	Aus	✓	
14	EU	EU	✓	
15	Aus	Aus	†	
16	Aus	EU	✓	EU
17	EU	Aus	✓	EU
18	Aus	Aus	✓	
19	Aus	EU	✓	Aus
20	EU	Aus	✓	EU
21	Aus	Aus	✓	
22	EU	EU	†	
23	EU	EU	✓	
24	EU	Aus	✓	Aus
25	EU	EU	✓	
26	Aus	EU	✓	EU
27	Aus	EU	†	
28	Aus	Aus	†	
29	EU	Aus	✓	EU
30	EU	Aus	†	
31	Aus	EU	✓	Aus
32	Aus	EU	✓	Aus
33	EU	Aus	†	
34	EU	EU	✓	
35	Aus	EU	†	
36	EU	EU	†	
37	Aus	EU	†	
38	EU	EU	†	
39	Aus	Aus	✓	
40	Aus	EU	†	
41	EU	Aus	†	
42	Aus	EU	✓	EU
43	EU	Aus	✓	

Table 1. Experiment Results (Aus stand for Australian Nutella, EU for European Nutella).

Assuming that the null hypothesis is that humans would not be able to distinguish the two chocolate spreads, the answer to the trial questions should be a sequence of

Bernoulli trials with probability 0.5. Given n trials, assuming that user can not distinguish the samples, we would therefore expect $n/2$ wrong answers. In our case we got 18 wrong answers out of 43 trials. To test the significance and see if we can reject the null hypothesis, the binomial test was used [1]. The probability of having 18 or less wrong answers out of 43 trials is $\sim 18.02\%$. Based on the common consensus that establishes that a p-value should be less than 5% to reject the null hypothesis [4], this value is unfortunately not small enough to reject the null hypothesis and therefore we can not claim that humans can not distinguish the two spreads of Nutella. More investigations, with more test subjects and a large amount of samples, are therefore needed and left as a future work.

Another interesting question is to find out what were the preferences of the test subjects when the spreads given to the test subject were indeed different. There have been 13 times where the test subjects were correct and give a preference on the sample: 9 preferred the European Nutella, 4 the Australian one. The p-value in this case is $\sim 13.34\%$ and thus we can not claim with statistical significance that the more liked Nutella is the European one.

We consider also the correlation between the results of the experiments with the answers of the questionnaires. We conjectured for instance that the stress needed to obtain a higher degree would imply a bigger consumption of chocolate as a relief mechanism, thus also improving the capacity to distinguish the spreads. Unfortunately we did not find any support for this thesis. Moreover, despite some suggestion that women can have a more discriminating power for chocolate spreads than man [5], we did not find evidence to support this claim.

We also tried to use the question on the habits of using chocolate or the previous exposure to the Nutella to see if the more chocolate/Nutella you eat the better you become at distinguishing them. The experiment unfortunately does not support this statement. Interestingly enough, for instance, we noticed that the people wrongly claiming that the spreads are different have declared a higher propensity of eating chocolate (average score based on the questionnaire 3.0 on a scale from 1 to 4 - the total average as baseline was close to 2.7). We believe that this phenomenon is probably due to what we call "being cocky" and overestimate the proper ability to distinguish the different Nutella spread. The study of how ego tempers the capacity of distinguishing Nutellas is left as a future work.

We would like to conclude this section by reporting that, based on the statements marked in the questionnaire, we could have included in our group of test subjects 4 clinically mad people and even 1 terrorist. We believe that this is extremely unlikely and probably these answers are due to the strange humor of the test subjects. We would like indeed to note that the majority of the test subjects had a math/computer science environment in which this kind of jokes are often experienced and appreciated. However, despite the math/computer science general background, we regret to notice that in more than 10 occasions, people declared to be older than 18 years old but did not interpret the logical or of the second and third statement in the questionnaire as a logical or. In particular, they fail to state that they were indeed above 18 or that they received the permission to participate to the experiment by their parents. There were also 3 brave people that apparently attended the experiment without not knowing if their doctor explicitly

forbade them to attend any chocolate spread tasting experiment. We thank those brave test subject, ready to immolate themselves (e.g., allergies) for the pursuit of knowledge and for science's sake.

5 Conclusions

Often in science a positive result receives more praise and more citations than a negative one or the description of a failed experiment. Unfortunately, by conducting our empirical experiment, we are not able to offer any statistically significant results. Despite this, we still believe in the worth of presenting negative results and for this reason we provide the description of the failed (but sweet) experiment we designed. We hope in this way to foster a discussion about such important topics as Nutella differences and promote further, larger, and more robust experiments to answer the important questions in life.

Ethical concerns

No animals were killed for these experiments. No students were badly injured. To be eco-friendly no Nutella was wasted since the designers of the experiments offered the remaining Nutella to the two volunteers lab assistants that help to provide and to collect the answers to the test subjects. The designers were not paid to conduct the experiments and sadly are not tied to Ferrero nor any chocolate spread company.

Acknowledgments

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