**LOG BOOK**

Late January to early February - Bought materials for science fair.

Late January - Got a rough draft for science fair process and stuff.

February 8, 13:30 (approx) - Started log book.

February 8, 13:43-14:00 (approx) - Experimented with colouring 1 cup of apple juice; it works surprisingly well. I turned the apple juice lime with green, blue, and yellow dyes.

February 14, 16:05 (approx) - Started using this process: When they don’t see the drink, we will do it in this order: Apple juice, Apple juice, Lemonade Lemonade, and when they do we will reverse the order which will make it harder for them to realise they all taste the same. Additionally, I decided on colours Black Pink Green Blue. (Thanks to my friend Liam Courtney for suggesting a few of those colours!)

February 14, 16:19 (approx) - Changed process to - Randomise order. 4 colours per drink (so 8 total) - I opted for more work for a more accurate experiment.

February 14, 17:10 (approx) - Start updating procedure document.

February 14, 17:17 (approx) - Take a break on the procedure document.

February 15, 14:20 (approx) - Work on procedure document. Start preparing juice.

February 15, 14:40 (approx) - Take break.

February 15, 15:00 (approx) - Continue procedure document; continue preparing juice

February 15, 15:20 (approx) - Take break. Ended at about 15:30.

February 15, 15:35 (approx) - Take a look at the Science Fair Guide and judging info to make sure I’m doing everything correctly. Ended at about 16:05.

February 20, 16:30 (roughly) - Start thawing juice - we left it out for much too long so it’s frozen. Tomorrow morning we will cool it for 45 minutes, and take its temperature for accuracy purposes.

February 20, 17:20 (approx) - Add the previous log entry; my mom had taken the juice in without telling me, so I put in the log entry late.

February 21, 7:50 (approx) - Start cooling drinks again. Ended at about 10:20.

February 21, 10:20 (approx) - Warm up juice. Ended at about 11:00.

February 21, 11:01 (approx) - Make the subjects go upstairs so they don't see the colours. And pour them out.

February 21, 11:12 (approx) - Taste test to make sure the temperature doesn’t make it taste bad and start colouring the drinks.

February 21, 11:13 (approx) - Experiment with 1 drop of Green; we decided on 2 drops. Experiment with 2 drops of Blue; we decided on 3. For red, 2 Drops of red.

February 21, 11:16: Observation: Lemonade colours easier which makes sense - it’s see through. Additionally, pink looks more like red, so we decided on red instead. For red, lemonade actually worked worse which is interesting. Black looks pretty good on apple juice but suboptimal on lemonade.

February 21, 11:15 - 11:50 (approx) - Continue setting things up.

February 21, 11:51 (approx) - Probably back up to slightly less than room temperature. Bring in the first subject.

February 21, 12:00 (approx) - Send subject back up; Start lemonade batch for first subject. Update instructions to subject a bit.

February 21, 12:05 - Fetch second subject. Ended 12:12

February 21, 12:12 - Prepare for Third subject.

February 21, 12:15 - Fetch third subject. Ended 12:19

February 21, 12:19 - Prepare for spot check and batch 2 (subject 1)

Feb 21, 12:26 - Get subject 1 for spot check and batch 2 - ended at about 12:40

Feb 21, 12:40 - Prepare for subject 2 spot check and batch 2

Feb 21, 12:?? - Get subject 2 for spot check and batch 2. Ended at about 12:52

Feb 21, 12:52 - Prepare for final subject spot check and batch 2.

Feb 21, 12:57 - Get subject

Feb 21, 12:59 - subject arrives. Ended 13:08

13:08 - Started analysing data and reading about colours and their related emotions and creating graphs.Ended at about 14:30??? Not exactly sure; got distracted. Didn’t get much work done since I found the science fair guide unclear.

15:36 - Work on the table that I started.

16:00 (approx) - Break. Ended 16:19

16:19 - Continue the table

17:10 - Take break

18:04 - Continue the tables and get distracted once or twice ;) - Ended about 18:20

23 February 2021, various times (9:30, noon, 17:00, 19:00): Finish tables!

23 February 2021, 19:40: Start reading about colours and how they affect our emotions, since it’s related. Also, I started work on the discussion/conclusion, and did some misc minor changes. Ended 21:26.

24 February 2021, 18:15: Start work on Google Drawing of backboard. Ended about 18:40 (??).

19:34: Continue work on backboard. Ended 19:42.

20:30 (roughly): Continue work on backboard. I got very distracted though for about 20 minutes or so? Well, I continued at 21:13. Finished once and for all tonight at 22:24. Show it to my dad. Add an acknowledgements placeholder section before I forget. Good-night!

25 February 2021, misc times: Work on misc stuff.

20:55 Start work on NSMB interface. Ended 21:57 - still not much game D:

22:00 - Get feedback from mom and dad. Ended 22:23

26 February, 8:42 : Add a small sentence to discussion. Ended 8:45

Misc times at 26 february: Small minor changes to reflect given feedback.

26 february 2021, 14:40: Continue working on game thingy

28 February 2021, 11:50 approx - Continue working on platformer.ended about 17:00 (??)

First few days of March, misc times: Work on and finish the video, finally!!

4 March, 22:40: Start uploading video. Ended a long time after that. Our internet is slow.

4 March, 22:45: Start updating google classroom data. Ended about 23:00 - I don’t know, since I have to make a copy of the doc, and haven’t finished yet. And even if I do add this I’d have to add it to both docs which would be a waste of time. Ok, fine, I added it: ended about 22:56.

5 March, 16:04: Replace discussion on backboard with results section. Later I decide on not doing either discussion or results, and just putting a link to the virtual notebook downloadable.

**PURPOSE**:

The purpose of this experiment was to determine whether or not people like or dislike drinks due to their colour. This information could help people make drinks that will be wasted less, since people will drink them more. I’m doing this because I saw the science fair idea and was curious.

**HYPOTHESIS**:

I hypothesise that the colour will affect whether people will want to drink it, but not whether they like it or not so the ratings would be about the same. I base that on the fact that once it’s in their mouth, it won’t matter what colour it is.

**PROCESS**:

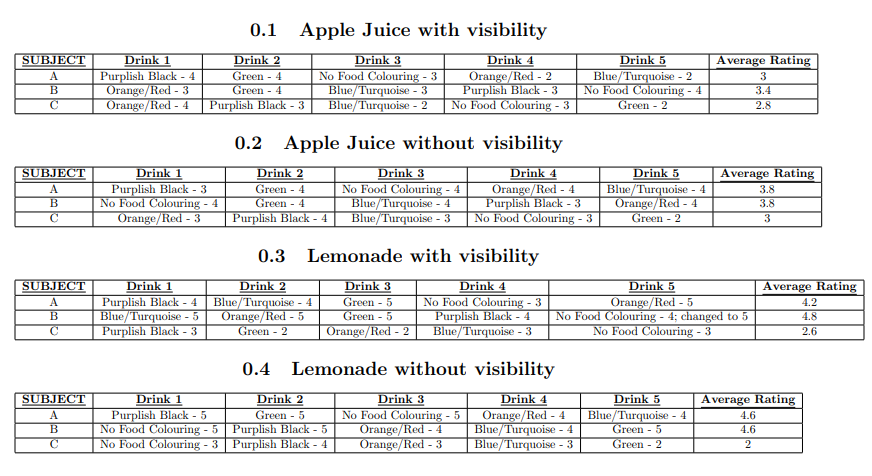
1. Cool the bottles off. We kept them outside at about -5 to 0 degrees for 2 hours together, and then warmed them up for 40 minutes at room temperature, plus time to set up to make it slightly cooler than room temperature. This is to make sure the two drinks have the same temperature, so that temperature won’t make a difference between the two.
2. Make five drinks of food coloured apple juice - the colours are Black Orange Green Blue and Normal in glass cups. Each cup should have about 125 mL of the drink.
   1. To make the colours, use:
      1. 3 Blue, 3 Red, 1 Green for purple/black;
      2. 3 drops of Blue for blue;
      3. 2 drops Red for orange/red;
      4. 2 drops Green for green.
3. Make five drinks of food coloured lemonade - the colours are Black Orange Green Blue and Not Coloured in glass cups. Each cup should have about 125 mL of the drink.
   1. To make the colours, use:
      1. 3 Blue, 3 Red, 1 Green for purple/black;
      2. 3 drops of Blue for blue;
      3. 2 drops Red for orange/red;
      4. 2 drops Green for green.
4. Pour approximately 25 mL into five glasses for each subject.
5. Repeat this for each subject:
   1. Tell them the process:
      1. In front of you are five drinks. Drink each one, and rate it on a scale of 1 to 5, where 1 is you didn't like it and 5, you loved it. Drink a glass of water in between. You can drink the drinks in the order you think will taste the best. So to recap, drink each drink in the order of most appetizing to least appetizing, and rate each one. \*\*You don't have to use all the numbers 1 - 5; you're just rating each.\*\* Additionally, please do not drink all of each cup if possible.
      2. That last part was due to my mom wanting to have to pour drinks less, she could just pour the contents of the glass into a bigger one and get them to drink it instead of getting the full amount of juice.
      3. The second last part is due to subject A thinking she had to use a different number per drink.
   2. Place the drinks for apple juice down and ask them to pick the one that is most appetizing first. Note that down.
   3. Ask them to drink that.
   4. **IN BETWEEN EACH DRINK, GIVE THEM A DRINK OF WATER.** This will make it more accurate since they won’t have the taste of the previous drinks stuck in their mouth.
   5. Repeat for each different cup.
   6. Then repeat for lemonade.
   7. Then repeat a), c), d), and e) with the subject's eyes closed.
   8. Write down what they like and don’t like.
   9. Wash cups; pour new juice inside if there are more subjects.
6. Use the data!

**MATERIALS**

* About a litre of apple juice - we used no-name apple juice from concentrate
* About a litre of lemonade - we used President’s Choice non-concentrated store-bought lemonade
* I used Lemonade and Apple Juice since they’re relatively easy to colour
* 3 people
* Food colouring:
  + 3 drops of Blue, 3 drops of Red, 1 drop of Green for purple/black;
  + 3 drops of Blue for blue;
  + 2 drops Red for orange/red;
  + 2 drops Green for green.
* Five glasses (wash them in between for each subject)
* 10 cups for mixing the colours
* A glass of water for each subject
* Sink for rinsing
* A measuring cup that can measure 125mL
* A measuring cup that can measure about 25mL
* 1 Spoon for each coloured cup
* The glasses should be the ones in this photo:
  + (Since the colours look different between apple juice and lemonade, we have separate photos.)
  +  (apple juice)
  +  (lemonade)
  + From left to right: No Food Colouring, Blue, Orange, Black/Purple, Green

**RESULTS**

(The raw data of my experiment, complete with notes, in a spreadsheet can be found at <https://thetechroboextra.github.io/ScienceFair/FirstOnGithub/RESULTS_SCIFAIR.xlsx>.)



**DISCUSSION**

See above. And we chose glass since a) won’t stain b) see through. We were attempting pink but it came out orange.

Note: The spot checks aren’t considered when I talk about the order of selection - in those, the drinks were put in random order.

The results of my experiment indicate that yes, colour does affect both the selection of drinks and whether they taste good. For the most part, the average rating **was improved when the subjects could not see the drinks**, which lines up with the fact that the colours I used are not the most appetising, at least to me. Additionally, subject B stated after the experiment that **he based which drinks he consumed first based on his knowledge of Gatorade flavours**. Subject A, for both drinks, picked purple/black first, purple being their favourite colour**.** Finally, **all subjects picked colours in similar order** when they picked the order. All this means that colour does affect the selection. Armed with these facts and with more subjects, companies can figure out which colours are best for marketing, and therefore waste less drinks (though I’m questioning the ethics, since most companies will probably use it to make more money).

Orange was typically picked first or third, though the placements did vary. This makes sense, since the colour orange is supposed to have **an attention-grabbing effect**. We were actually trying to make the colour pink, but all we could get was reddish-orange! It goes to show how it must be tricky for companies to make pink lemonade.

Purple/black was picked first **both times** by subject A. This is her favourite colour, so it makes sense even without any background knowledge about purple and its related emotions. It may have also been picked first by subject C once due to him liking Coca-Cola which is black. During the blind test of apple juice, subject C correctly guessed that one of the drinks that he drank was purple/black, citing the nonexistent “grape juice” flavour.

Green was mostly picked second or third. Since it can symbolise health and relaxation, it makes sense that it was one of the first few picked.

Blue was one of the first few for about half the samples. It can make people feel safe in their emotions, but I still wouldn’t feel safe with a blue drink, so I do get why it wasn’t always used in the first few. Subject B picked it first once due to his knowledge of **Gatorade flavours** (he likes blue Gatorade).

I can’t give much explanation for Normal as a whole, since there are two types of drinks that were served without food colouring, with two different colours, so I’ll split it into 2 parts.

* **Normal apple juice** was picked late into the choices, and its average rating is about 3.3. Subject C commented that it looked like urine, though he still gave it a decent rating. Though that could still be why it was picked so late into the choices.
* For **lemonade**, normal was picked even later into the choices, its average rating being about 3.6. I find it a bit strange how it was picked later, yet its average rating is higher. Just another strange psychology thing.

Something to keep in mind: Subject A was very hyper the second time, with subject C being rather grumpy. The food colouring may have had an effect. Additionally, I’m surprised that subject C didn’t like the lemonade. He drinks it a lot at home. Plus, the lemonade tasted bitter to C, and it did colour better too. Red food colouring apparently CAN taste bitter, so that would explain it. Still though, we didn’t add red food colouring to everything, and the normal one still tasted bitter even though there was no food colouring in it. So it could simply be that C was tired. It could also be because he asked what was in the drinks, and we couldn't give it to him, so he stopped liking it.

Finally, all that talk about emotions (see green, orange,...), but emotions could be completely irrelevant here. Some scientists say about colours and taste that it largely depends on experience with different colours.

Still, considering that a lot of what the article about emotions says lines up at least partially with the results, I think it’s at least a factor.

**CONCLUSION**

My hypothesis was that the colour would affect whether people will want to drink it, but not whether they like it or not so the ratings would be about the same. I base that on the fact that once it’s in their mouth, it won’t matter what colour it is. I can safely declare that this hypothesis is partially false. Colour affects both whether people would want to drink the drink (the selection) **and** their rating for it.

If I had to redo this experiment, I would look up the least appetising colours, to potentially give a better contrast between seeing and not seeing the drinks and therefore a more accurate result. Additionally, I’d perform it on more subjects (impossible this year due to COVID-19) and I’d gather their thoughts about the drink along with their rating to better analyse why they picked the drinks and rated them the way they did.

**SOURCES**

Pflugfelder, Bob. "Science Fair Ideas." 2020-01-05. <https://sciencebob.com/science-fair-ideas/ideas> (Late January 2021)

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99designs. “How color affects emotions and behaviours.” 30 June, 2020. <https://99designs.ca/blog/tips/how-color-impacts-emotions-and-behaviors/> (21 February 2021)

Jon Kapecki. Answer to “How does colour affect the taste of food?”. 3 November, 2019. <https://www.quora.com/How-does-colour-affect-the-taste-of-food/answer/Jon-Kapecki> (23 February 2021)

**ACKNOWLEDGEMENTS**

Thanks to my mom and dad for helping me with this a lot, and thank you to my brother, sister, and dad for participating in the experiment. Liam Courtney was also the one who suggested the colours that I am using.

**TODO (raw)**

* Learn whether if they don't like it is it psychological or is there actually something in the food colouring that makes it taste different - DONE