THE EFFECTS OF TASTE ON MEMORY

A SCIENTIFIC INVESTIGATION
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Abstract:
Memories can differ quite a lot in quality. Often they can be rather small, undetailed and simple whereas others can be complex and filled with details. Sometimes memories that were otherwise unknown of can re-appear after being provided with a stimulus that relates to the memory. This is called a retrieval cue and often come from one or multiple senses: smell, taste, sound, visuals and feel. Many investigations on the effects of these senses have been carried out but studies of one of these senses are not as prominent – taste. Studies performed suggest that taste has a complex relationship with memories. Most of these investigations suggest that when taste is associated with a negative emotion, areas of the brain related to memory become more active. The brain creates memory through the process of three steps: encoding, storage and retrieval. This investigation studies the effects of taste, not only those associated with negative emotions, on one’s ability to retrieve memories. Thirty people, split into three equal groups of ten, were used in this experiment. One group was the control and wasn’t given a drink, the next was given drinks that they identified as favoured and the last was given drinks that they’d identified as disliked. Participants were given visual material to memorise, presented on a projector in a well-lit classroom, and were given 10 questions on a piece of paper 20 minutes after viewing this material. This enabled me to investigate the effects of taste on long term memory recall and compare/identify the effects of drinks linked with positive emotions and negative emotions. The date collected from this investigation concluded that the effects of taste on memories of facts and information were not beneficial, but rather negative.

Background Information:
Introduction
The part of the brain responsible for keeping memories of taste is called the taste cortex. It is found within the area of the brain called the insular cortex. The area of the brain that is responsible for forming memories is named the hippocampus. Being able to register flavours is the product of two senses, taste and smell. This means that without the participation of smell in taste you would only be able to detect basic taste sensations that are picked up chemically by the tongue: salty, sour, sweet, bitter and umami (a savoury sensation).

Process of Creating Memories
Most psychologists know memory as an information processing procedure that consists of three basic steps: encoding, storage and retrieval. Encoding is the process of changing information from the outside world that is delivered to us through our senses, into information that can be stored in memory. The process of encoding can happen in a few different ways including acoustically (through sound), visually (through forming a mental image), and semantically – to encode information by transforming sounds and visuals into words of meaning. For instance, to memorise someone’s address you may use acoustic encoding by repeating the address to yourself.

The process of storage involves retaining information in memory. Some information is only retained for a matter of seconds while others may last a lifetime.

Memory retrieval describes the process of the brain re-accessing information of previous events that have been encoded into your brain. To do this, the brain imitates its perception of the event by “replaying” the pattern of neural activity produced by the brain as a response to the event as it happened. Memory recall is basically a recollection of elements scattered throughout the brain that are linked by associations and neural networks. The brain doesn’t store memories in confined regions, like books in a library, but instead stores different elements of the memory in different areas of the brain. Therefore, to effectively retrieve a memory, the brain must re-visit the nerve pathways it created when forming the memory. This means that the strength of these pathways have a great impact on how effectively a memory can be recalled. Long-term memory, which is what will be tested in this experiment, is retrieved through association so memories that have more associations will be easier to recall. For instance, a memory of a restaurant will be easier to recall if there are more associations with the way the food tasted or smelled.
Studies on the Effects of Taste on Memory

Not many studies have been done on the effects of taste on memory but from the research that has been conducted it is known to be long lasting and usually bring back memories of emotional things, instead of information such as a phone number.

A study by neurobiologists in the University of Haifa found that taste, when related with a negative feeling, can trigger the hippocampus. The researchers gave a group of mice two new tastes, one that created stomach pains (to imitate a negative event) and one that didn’t. They found that there was no outstanding involvement of the hippocampus when the normal taste was given but there was clear activity when they trialled the taste that caused a negative feeling. An area of the hippocampus, called the CA1 area, became involved a lot more with the latter taste. The CA1 is associated with encoding the concept of space, or where you are. These findings showed how the taste with a negative feeling became associated with memory, the hippocampus. This experiment showed how simply involving taste in a task meant that the brain uses the entire hippocampus to provide a rounded experience, with information such as time and location.

A researcher named John Garcia performed another experiment similar to this. There was an issue with coyotes attacking the sheep of a sheep farmer. Garcia came up with the idea to create a taste aversion. He laced the dead sheep with some lithium chloride, which makes you quite sick. After this, the coyotes did not return to eat the sheep. Taste aversion is often used with house pets to stop them from eating things they’re not supposed to. Owners will cover these objects with a taste that creates a negative feeling, which causes the animal to avoid eating the object. The memory of this taste that had a negative impact is so strong that the animals stop eating the food entirely. This is also an example of the way taste has a long lasting impact on memory.

A study conducted at the University of Northumbria in Newcastle, England involved 75 participants that were split into thirds. The group that was given gum to chew recalled information 35% better than the two other groups, one that imitated the motions of chewing gum without actual gum and a control group that didn’t have any gum. Edward McLaughlin at Cornell University carried out similar research in 2007 reported similar results.

The effect of taste on memory is described in the “Proustian” experience. A famous passage from the book “Remembrance of Things Past” by Marcel Proust describes Proust having a vivid memory from his childhood, 40 years ago, after taking a sip of lemon tea and biting into a Madeleine cookie: "...and as soon as I had recognized the taste of madeleine soaked in her decoction of lime-blossom which my aunt used to give me ... immediately the old grey house upon the street, where her room was, rose up like a stage set ... and with the house the town, from morning to night and in all weathers, the Square where I used to be sent before lunch, the streets along which I used to run errands, the country roads we took when it was fine." It was a memory of coming home from church and eating the same meal at his aunt’s home. Though the actual event occurred many years ago and the memory was otherwise not very significant or known to Proust, the taste became a strong retrieval cue and brought back the memory of an emotional event quite strongly.

Memory of Emotional Events Compared to Neutral Events

Research has been done to prove the idea that memories tend to be more vivid when they are of emotional events, compared to neutral events. These memories, in comparison to those of neutral events, tend to be recalled more often with higher levels of clarity and detail. One theory to explain this is that higher levels of emotion lead to attention narrowing meaning that information more central to causing these high levels of emotion are encoded into the memory, rather than peripheral information. For instance, someone will remember the taste of something that caused a strong negative feeling, such as sickness, in great detail rather than how the people surrounding him or her were dressed.
**My Proposed Investigation**

While research has been done on the relationship between taste and memory not much has been done on the effects of tastes that aren’t necessarily related to a negative experience on memory. Some experiments have been done to test the relationship between taste and memory however this relationship is quite complex so many areas and questions have not been thoroughly investigated.

My scientific experiment would investigate the relationship between taste and memory where variables that could make the experiment invalid, such as vastly different textures that come with the taste, will be isolated as best possible. It will investigate the way taste can stimulate memories within a group of people that are quite similar to ensure results that can be properly averaged and therefore become more accurate.

While it is known that taste is related to memory, it is not known how well it may have the ability to improve memory recall. My experiment also compares the way taste, associated with both positive and negative emotions, can improve memory recall. Experiments have been done on the effects of taste, which create negative feelings, on memory, i.e. in taste aversion. However, not much experimentation has been done on the effects of taste related to positive feeling.

Many experiments have been done to prove that smell has a strong impact on improving memories. Taste is closely related to smell but hasn’t been investigated much, especially in humans. The new areas covered in my experiment would mean more information about the relationship between taste and memory, therefore providing further resources for more complex investigations on the brain and certain areas of it.
**Aim:**
The aim of this experiment is to investigate whether a taste will help someone recall a memory better, compared to one’s ability of recalling memories without significant taste as a retrieval cue. Also, an aim of this experiment is to see whether a taste that the subject likes, which creates positive feelings, is better at triggering memories than if it is disliked, which creates negative feelings.

**Hypothesis:**
That a taste that someone dislikes will help someone remember information more than someone without taste as a retrieval cue or a taste that someone likes as a retrieval cue.

**Equipment:**
- 30 people of the same age and gender
- image made up of various elements for the subjects to remember
- 10 x 2 60mL sample of each subject in group A’s favourite drink
- 10 x 2 60mL sample of each subject in group B’s least favourite drink
- 40 x cups for drink (2 for each subject)
- 30 x paper with 10 questions about material given
- 30 x pencils
- 1 x projector
- 1 x laptop
- 1 x stop watch

**Method:**
1. Ask 30 people for consent in participating in this experiment, making them completely aware of all the procedures
2. Split the 30 people up into 3 groups of 10
3. The first group of 10 will be group A. Ask each person what their favourite drink is and note it down
4. The next group of 10 will be group B. Ask each person what their least favourite drink is and note it down
5. Pour 60mL of these drinks into the cups labelling them with the subject’s name and the group they’re in. Each subject should have two cups filled with their assigned drink
6. The last group of 10 will be group C. Present the image to this group on the projector and leave it on for 1 minute
7. Take the image away once the minute is up
8. Play a video for these participants to watch for 20 minutes on the projector
9. Hand each person the piece of paper with the 10 questions on the material they were asked to remember
10. Add this data to a table, marking each question based on the given guidelines. Make sure this information is in the right section of the table - that it outlines what group they’re in and which subject they are (e.g. subject 1, subject 2 etc.)
11. Give each subject in group A their favourite drink and show them the image on the projector. Leave the image on for 1 minute and ask them to drink their drink as they look at it
12. Repeat step 7 and 8 with this group of 10
13. Give the subject the second 60mL cup with the same liquid that they drank when first shown the image
14. Repeat step 9 and 10 with this group
15. Give each subject in group B their least favourite drink and show them the image on the projector. Leave the image on for 1 minute and ask them to drink their drink as they look at it
16. Repeat step 7 and 8 with this group of 10
17. Give the subject the second 60mL cup with the same liquid that they drank when first shown the image
18. Repeat step 9 and 10 with this group.
19. Compare the results from each group with the other groups and discuss the results and any trends.

**Variables:**
*Controlled:* image that each subject had to memorise, time given with the image/without it, method of presenting images/video, age of the subjects, gender of the subjects, video played for 20 minutes, questions asked, how the answers were marked and the experiment environment (classroom)
*Independent:* the drink they’re given (liked, disliked or none)
*Dependent:* the test results
*Control:* the group that is not given a drink

**Risk Assessment:**
1. The subjects may have an allergic reaction to the drinks given to them.
   - Subjects will each be asked to sign a consent form that details the drink they will be given.
   - Furthermore, subjects will be specifically asked whether they are allergic to the drink they will be given.
2. The drinks that the subjects will have to consume may be expired.
   - When purchasing the drinks I will ensure the best before date is well before my planned experiment day.
   - The material will be of an appropriate size, will not be of a very low quality and will not contain colours that may be difficult to view (e.g. light grey text on a white background).
3. Eye strain, from poor lighting, or back/neck pain, from poor posture, may develop when subjects are asked to study the material.
   - Subjects will be seated in comfortable chairs at a table to prevent possible back/neck pain.
   - The room in which the experiments will be carried out will be well light via natural lighting and artificial lighting.
Diagram of Equipment Used for Drinks

- Coke
- Fanta

Cups for drinks given to participants

Measuring spoons to measure out 60mL

Diagram of Setup Used to Display Image and Video

- Projector
- Sufficient classroom lighting

Image for participants to memorise

(Not pictured) all participants at desks 3-5m away
Questions Given to Participants 20 Minutes After Being Shown Image

QUESTIONS

1. Describe the images that the batteries were in between.

2. How many batteries were there?

3. How many numbers and letters, made of dog bone shaped biscuits, were there in the image? What were these numbers/letters?

4. What colour was the suitcase and what was the colour and pattern of the cap on top of it?

5. Name the word in the bottom left corner of the image. What were the colours of each letter? (e.g. “A” was purple)

6. Were any of these shapes in the image? If so, circle it; otherwise write “none”.

7. To which number on the clock, that the man was holding, was the long arm pointing and hands pointing to?

8. How many brimmed hats were there? What colours were they?

9. How many donuts were there? What toppings did they have?

10. What is the name of the fruit pictured in the bottom row?
**Marking Guideline:**

Question 1: apples (1 point), burger (1 point) – total: 2 points

Question 2: four (1 point) – total: 1 point

Question 3: four (1 point), 2 (1 point), 4 (1 point), 6 (1 point), Y (1 point) – total: 5 points

Question 4: blue suitcase (1 point), pink cap (1 point), polka dot cap (1 point) – total: 3 points

Question 5: oil (1 point), O = pink (1 point), I = pink (1 point), L = green (1 point) – total: 4 points

Question 6: number 4 (1 point) – total: 1 point

Question 7: 12 (1 point) – total: 1 point

Question 8: four (1 point), green (1 point), yellow (1 point), blue (1 point), red (1 point) – total: 5 points

Question 9: two (1 point), green (1 point), yellow (1 point), blue (1 point), red (1 point) – total: 5 points

Question 10: banana (1 point) – total: 1 point

**TOTAL: 26 points**
**Table 2**: quiz score averages

<table>
<thead>
<tr>
<th>Group</th>
<th>Score Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>11</td>
</tr>
<tr>
<td>Like</td>
<td>9.9</td>
</tr>
<tr>
<td>Dislike</td>
<td>10.7</td>
</tr>
</tbody>
</table>

**Table 3**: average scores per question

<table>
<thead>
<tr>
<th>Group</th>
<th>q.1 (/2)</th>
<th>q.2 (/1)</th>
<th>q.3 (/5)</th>
<th>q.4 (/3)</th>
<th>q.5 (/4)</th>
<th>q.6 (/1)</th>
<th>q.7 (/1)</th>
<th>q.8 (/5)</th>
<th>q.9 (/3)</th>
<th>q.10 (/1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>0.1</td>
<td>3.8</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>3.1</td>
<td>1.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Like</td>
<td>0.4</td>
<td>0.3</td>
<td>2.5</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>2.6</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Dislike</td>
<td>0.4</td>
<td>0.6</td>
<td>2.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>3.4</td>
<td>1.6</td>
<td>0.5</td>
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</tr>
</tbody>
</table>

**Table 3**: average percentage of marks received per question

<table>
<thead>
<tr>
<th>Group</th>
<th>q.1 (/2)</th>
<th>q.2 (/1)</th>
<th>q.3 (/5)</th>
<th>q.4 (/3)</th>
<th>q.5 (/4)</th>
<th>q.6 (/1)</th>
<th>q.7 (/1)</th>
<th>q.8 (/5)</th>
<th>q.9 (/3)</th>
<th>q.10 (/1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0%</td>
<td>10%</td>
<td>76%</td>
<td>16.7%</td>
<td>10%</td>
<td>30%</td>
<td>30%</td>
<td>62%</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>Like</td>
<td>20%</td>
<td>30%</td>
<td>50%</td>
<td>30%</td>
<td>17.5%</td>
<td>40%</td>
<td>30%</td>
<td>52%</td>
<td>43.3%</td>
<td>50%</td>
</tr>
<tr>
<td>Dislike</td>
<td>20%</td>
<td>60%</td>
<td>50%</td>
<td>16.7%</td>
<td>12.5%</td>
<td>40%</td>
<td>30%</td>
<td>72%</td>
<td>53.3%</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Table 4**: total score range

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<th>Group</th>
<th>Score Range</th>
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</thead>
<tbody>
<tr>
<td>Control</td>
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</tr>
<tr>
<td>Like</td>
<td>15</td>
</tr>
<tr>
<td>Dislike</td>
<td>12</td>
</tr>
</tbody>
</table>

**Graph 1**: Overall Percentage of Correct Answers

**Graph 2**: Overall Score Average Per Question
Graph 3: Overall Percentage Accuracy Per Question

Average Percentage Accuracy Per Question

<table>
<thead>
<tr>
<th>Question</th>
<th>Control</th>
<th>Like</th>
<th>Dislike</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td></td>
<td></td>
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<td>2</td>
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<td></td>
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<td>9</td>
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<td></td>
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<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Discussion:**

The data collected from this experiment disproved my hypothesis, that a taste that someone dislikes will help them remember more. On average, the control group answered 42% of the questions correctly, the group that received drinks they liked answered 38% of the questions correctly and the group that received drinks they disliked answered 41% of the questions correctly. The average total score (table 2) for the control group was 11.9 for the group that were given drinks they liked and 10.7 for the groups given drinks they disliked. This meant that the control group performed the best while the group given drinks they disliked came in a close second and the group given drinks they liked came in third with a significant gap from the other two groups.

This data almost had a converse result to my hypothesis. Both groups that were given drinks didn’t perform as well in the questions as the group that wasn’t given anything to drink. I discussed this with some of the participants of these groups and a few of them said that the requirement to finish their drink acted as a sort of distraction to them as they were looking at the image. This result was quite unexpected to me as, based on my research, senses such as taste are strong retrieval cues. However, this may only be with emotional events instead of memory of facts and information such as tested in this experiment. This may also be because the sense, to become an effective retrieval cue, needed to have strong links to the meaning of the actual information. In this experiment, the only link between the information being memorised and the taste was that they were presented at the same time. The taste itself was not very significantly related specifically to any aspects of the image. It would’ve been tasted numerous times previously and therefore linked to many other memories, not just the information presented. I also didn’t consider the distraction that could be created from the drink. Instead of focusing on the image and memorising as many elements as possible participants could be distracted by their opinion of the drink or recent emotional events related to the drink that re-appeared after tasting the drink.

The difference in performance between the groups given drinks they liked compared to the group given drinks the disliked was not very significant per question, except for in questions 2, 4 and 8 where one group performed more than 10% better than the other. Both results followed similar trends when compared to the control group. This tells us that the emotion created by the drink has no effect on ones ability to recall information. The type of emotion created and used as a retrieval cue does not strongly impact a person’s ability to recall better/more memories. However, this does tell us that a taste stimulus does have an impact on a person’s ability to recall information, regardless of the type of emotion that it creates. Most previous experiments that tested the effects of tastes associated with negative emotions, such as at the University of Haifa, found that there was a definite effect from taste and this is supported by the data from my experiment.

Also, from the data gathered I found that those given drinks that they liked performed noticeably worse than the group given drinks they disliked and more so with the control group. This could be because the drinks served as a distraction to participants. But, the disliked drink also became a retrieval cue, as it was unfamiliar to the subject (most participants in this group stated that they didn’t often drink the drink), and created more emotions than the drink that was liked. The drinks given to the “like” group served solely as a distraction and didn’t create very strong retrieval cues as the drink was familiar and didn’t trigger any strong emotions.

A trend I found was that the groups given drinks performed worse than the control group where they had to answer questions on multiple elements of the image (for instance, question 3 which asked them to identify four different number/letters). 50% of the control group managed to identify all 4 characters correctly while only 30% in the group given disliked drinks and 30% the group given liked drinks could identify all characters correctly. Most participants in these groups were unable to identify all of the numbers/letters but could identify a few. This was then further reflected in question 9 where participants were asked to identify the flavour and topping of pictured donuts and the amount. Most participants in groups that were given drinks could only identify one or two of the required elements correctly (e.g. only the topping, not flavour or amount).
However, with questions that only targeted one or two elements (for instance, question 2 which asked them about the amount of batteries, that were part of one photo, in the overall image) these groups surpassed or equated the performance of the control group. This trend becomes a little inconsistent in questions 10, 5 and 4. Question 10 only required the identification of one element, the name of a fruit pictured, but groups given taste stimuli performed worse than the control group. Questions 5 and 4 required the identification of multiple elements (colour/pattern in q.4 and three different colours linked to letters in q.5) but both groups given drinks performed slightly better than the control group. These inconsistencies were disregarded though since the difference in performances between groups were only minor signifying that other variables may of effected participants abilities to recall memory, rather than the drink they were given or not given. While this trend is not perfectly consistent or very outstanding, it shows that drinks may be able to help your memory recall non-complex memories that don’t contain very much detail (e.g. patterns/textures of multiple objects). Taste can act as a stimulus for memory but not of things that contain multiple elements, layers and details.

A common error made by participants which I found quite interesting was that quite a few participants identified the two chocolate donuts questioned about in question 10 as having pink icing when they were chocolate. This may have been since there were strawberry donuts in the 20 minute video played between the image being shown and the questions being asked. There wasn’t a substantive difference in the amount of people that made this error between groups. This signified that the addition of taste stimulus doesn’t help memory errors such as this but the reason that this error was common is unclear. Also, quite a few participants identified the colour blue (as in the suitcase and hats) as brown and the colour pink (as in the cap on the suitcase) as red. The reason for this error was a little unclear but could indicate that people have tend to lose information on colours quite quickly in visual memory. The easy retention loss of details of colour can mean that people may mistake colours for somewhat similar colours to make up for the information in the memory lost.

A difficulty I encountered during this experiment was ensuring all variables stayed controlled throughout the experiment. When shown the image many participants called things out creating distractions or highlighting certain elements of the material, which may of then affected a participant’s ability to recall information later on. Fortunately, this was noticed in trial experiments so that when I moved on to the final experiments I was able to remind the participants before showing them the material to remain quiet. Another variable that was difficult for me to control was the changes in environments between the different days of experiments. For instance, the size of the groups I was experimenting on was larger for some experiments and significantly smaller for others. Also, the time of day was different which introduced many variables that affected the experiment.

Another difficulty I faced in this experiment was ensuring that the emotions, both positive and negative, created by the drinks were of a similar level between each participant. This was quite hard to maintain as I had a limited pool of people to choose from and the information provided to me by each participant was not necessarily reliable. To best overcome this, I allowed extra time to thoroughly question each person in the pool of people I could select from and utilised a scale to help me identify the level and type of emotion each drink created. Then, from this information, I selected people that did not range largely in the type and level of emotion created from the taste. Another difficulty I encountered was controlling as many variables with the taste so that the participants were given an isolated taste instead of distractions that could be a variable to affect my results (such as texture of food) and make them unreliable. To ensure this I made sure to only use drinks as these don’t have the variable of texture and tried to limit the variety of drinks given. In this experiment, I only used Fanta and Coke – two very similar drinks of a similar texture. When asking the people in my class to participate in my experiment I asked them on their opinion specifically on these two drinks then only chose that fit my criteria well.
Improvements that could’ve been made to my experiment included controlling variables more closely. For instance, the drinks provided to my participants could have been of the same sort to ensure that the taste of the drinks didn’t create an effect on the results of my experiment. I also could’ve ensured that the images used in the visual material presented to my participants were equally challenging so that when questioned about the image, the answers given would not be too greatly impacted by the varying difficulty of the image. Also, the questions given to the participants could be of a more equal difficulty but varied more in the areas of visual memory. For instance, some questions could question participants on their memory of letters, symbols and numbers while others questioned them on details of objects. The ability to pick from a larger pool of people and gather more participants would help to make the experiment more reliable. Also, controlling the activity of participants a few hours before the experiment could help to make results more accurate as their activity during this time may affect their ability to recall information. Providing subjects each with their own image, playing the 20 minute video for each participant separately and isolating them from one another could help to provide more accurate results as the distractions created by others would be removed. Since the distance of the image and therefore clarity would be controlled by utilising this method, the results would become more reliable and accurate.

An area that I could further investigate is the effect taste has on memories of emotional events, such as the one described in the “Proustian” experience. My experiment investigated the effect of taste when linked to a rather unemotional memory. Research carried out previously that identified taste as being a strong retrieval cue was done on episodic memories. The images displayed to the participants did not, in the majority of cases, have a strong, emotional link to their drink. Taste is not shown to greatly improve semantic memory (memory of facts such as capital cities, names of foods etc.) both in my experiment and in previously carried out experiments. Rather, taste may have an impact on episodic memories, similar to the one recalled by Marcel Proust. Episodic memories are memories of an event, for instance remembering what you ate for lunch at a café. The effects of taste when linked to emotional memories, such as episodic ones described by Marcel Proust, have not been investigated very much and could be an area that holds interesting information. This area has the potential to create interesting results based on the information taken from the “Proustian” experience.

The information gathered from my investigation can be used to support more investigations in the area of tastes relationship to memory. This area is rather large so different types of memory can be investigated, such as episodic memories as detailed above or short-term memory. My experiments suggest that taste does create an impact on one’s ability to recall information as the two groups given taste stimuli performed significantly worse, in most questions, than the control group. The investigation I carried out also suggested that taste might only have an impact on recalling information of non-complex things when used as a retrieval cue. Investigations can be further carried out to validate and gather more information on the effects of taste on memory of complex information based on this information.

The results I found are reliable as I controlled as many variables as possible. I also trialled my method various times to find any steps that could be better carried out to improve reliability of my experiment. For instance, through trialling my method I found that the most effective way to question participants on the visual material was with set questions rather than asking them to list all that they could remember. My experiment was carried out 30 different times which increased the reliability of my experiment. However, the investigation could’ve been more reliable if more participants were used as trends in data would become clearer. Collecting more data by carrying out the experiment more times would help me become more certain of my conclusion as I would be more certain that trends and relationships that appeared were not based on outliers.
**Conclusion:**
Taste does not have a profound positive impact on memory of facts and information and instead can worsen one’s ability to recall complex information and details. Also, the type of emotion created as a retrieval cue for a memory does not vary someone’s ability to recall information from a memory.

**Bibliography:**


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