

# Effect of colour on recall memory of images



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This experiment was designed to investigate the effect of colour on memory recall. 30 subjects were shown 15 slides. Each slide has one coloured images and one black and white images. After 3 minute-long filler task, the subjects were given two minutes to recall as many images they could remember.

Statistical test was carried out on the data collected using a Wilcoxon Signed-Rank Test and the results showed that the null hypothesis was rejected. To conclude, there was sufficient evidence that coloured image is recalled more than the black and white image. Most subjects could recall more images if they were with coloured than if they were black and white.

### **Experimental hypothesis**

The number of images with colour is recalled significantly greater than black and white images.

### **Null hypothesis**

There is no significant difference between the number of coloured images and gblack and white images recalled.

### **Research and Rationale**

The objective of this experiment was to investigate the effect of colour on memory recall. Memory refers to the ability to reproduce or recount information that was experienced at an earlier time. Memory results from a process of continual recategorization, which, by its nature, must be procedural and involve continual motor activity and repeated rehearsal. Memory processes include the operations performed on the stimulus inputs to convert them into usable memories. Most researchers agree that three processes are of critical importance; encoding, storage and retrieval.

Memory does not comprise a single unitary system, but rather an array of interacting systems, each capable of encoding information storing it, and making it available for retrieval.

The parts of the brain that involved in memory storage are hippocampus and thalamus. They are located inside the cerebral campus, which is one of the three parts of your brain. The hippocampus curls off the end of the cerebral campus.

<http://www.elements4health.com/images/stories/conditions/hippocampus-brain.jpg>

Figure 1 - The brain

A theory that was dismissed as an oversimplification for many years suggested that individual brain cells handle specific concepts. But recent research on epileptics using tiny electrodes implanted in the hippocampal region of the brain actually supports the idea that our brains wire up and fire very specifically for things we see repeatedly.

“ The higher fit people have a bigger hippocampus, and the people that have more tissue in the hippocampus have a better spatial memory,” said Art Kramer, who led the study with Kirk Erickson.

Art Kramer, Kirk Erickson, et al. University of Illinois at Urbana-Champaign

(Cumulative Words count : )

Memory function decreases by 20 to 40 percent with age. There are wide individual differences in aging, some of which are genetic.

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Atkinson and Shiffrin's multi-store model of memory incorporates three separate storage stages; a sensory information store or sensory information register, a short term and a long term store. From Atkinson and Shiffrin theory, humans possess three different kinds of memory: sensory, short-term and long term memory. Sensory memory retains information for duration of less than a few seconds with a high capacity, while short-term (working memory) has a more limited capacity but longer duration which is less than 20 seconds. Long-term memory has a potentially unlimited capacity and long, or permanent, duration. It is so powerful that some information stored can last a lifetime.

#### Figure 2 Multi Store model of memory

Sensory memory also known as immediate memory is for things hold in the memory for such a short amount of time that most people don't even know about it. Most people have visual memory, not to be confused with photographic memory which 5% of young children have.

Photographic memory is very rare in adults. People who have photographic memory can take a picture in their mind and remember exactly what it looked like, or read a book in their mind.

STM (short term memory) is the system the brain uses to remember information that's currently in use. It is believed that when our sense receptors such as eyes, ears, touch and others send nerve messages to our brains, the sensory stimulus forms a very short lived sensory memory. PET (positron emission tomography) and MRI (magnetic resonance image) brain scans have shown that the prefrontal cortex, in the forehead area of the <https://assignbuster.com/effect-of-colour-on-recall-memory-of-images/>

brain seems to be critical for this short term memory. Brain injuries in this region often cause short term memory loss.

[http://www.thomaskoenig.ch/Lester/Files/SPAMs\\_Hippocampus.jpg](http://www.thomaskoenig.ch/Lester/Files/SPAMs_Hippocampus.jpg)

Figure 3 : MRI individual images segmented in hippocampus.

The views of short term store which Atkinson and Shiffrin model summarized assume that it is of limited capacity, and that it performs various control activities including coding, decision and retrieval strategies and especially rehearsal.

In 1974 Baddeley and Hitch proposed a working memory model which replaced the concept of general short term memory with specific, active components. Working memory is essential a range of ways of carrying out different task. It currently comprises three main elements; an attention and a control system together with two slave systems, and one system for dealing with acoustic information and one system for dealing with visual or spatial information. The working memory framework is depicted in Figure 4.

Visuo-spatial Store

Phonological Store

Central Executive

Figure 4 :

At a neuronal level, changes connected with LTM seem to be permanent, with formation of new synapses and protein synthesis, in contrast to STM, where changes are only functional.

Concentration is the key to memorization. To recall an image, people will use their sensory perceptions to the fullest. The making of the image involves both imagination and intellect.

Color impacts the brain because it can greatly affect our physiology, since it influences anxiety, pulse, blood flow and arousal. One of the reasons why color makes an impact on the senses is due to memory. Memory of colors turned out to be surprising, a recent study showed. The functions of the left brain and the right brain are also crucial to color and the brain.

A recent study examined differences in peoples' recall of words and memory for colors. Results show that people recall color to a higher degree. And when people were asked to recall objects versus color, color memory was significantly greater. Even when people attempted to remember words or objects, color had the greatest affect on recall.

“ For most humans, the left side is tied to language and the right more to visual perception, imagery, and emotion,” the Spirituality and Western Psychology article said.

It is crucial to examine how visual information (namely color) is processed. It is equally important to understand theories of color vision. The mechanics of neuroanatomical data, coupled with color vision theories, help to provide an

understanding of how the brain perceives color and how color perception interacts with memory processes.

The Young-Helmholtz trichromatic theory states that the retina has three types of color receptors, each differentially sensitive to red, green and blue. Each receptor may be stimulated at any wavelength but maximally responds to the wavelength to which it is most sensitive.

“ It is probably the expressive qualities (primarily of color but also of shape) that spontaneously affect the passively receiving mind, whereas the tectonic structure of pattern (characteristic of shape, but found also in color) engages the actively organizing mind.”

Source: Arnheim, Rudolf, Art and Visual Perception, University of California Press, Berkely, 1974, p. 336

The result from this investigation could benefit the process of teaching and learning. Lecturers and tutors could prepare slideshows and handouts with coloured images especially for the important content of the lesson. This can facilitate better retention. Students can also practice using coloured diagrams and highlighters in their notes. This can help them in memorizing the facts. The textbooks also should emphasize the usage of coloured diagrams in the content of the book.

## **Planning**

Several trial experiments were conducted to modify the investigational procedure.

Trial 1 : Images versus Words

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This trial was carried out to investigate whether images or words should be used as object of recall. To conduct these trials, a sample of four subjects aged 19-20 was taken. The subjects were given a list of 15 slides with images that were each projected for five seconds, after which they were required to do a 3-minute filler task, comprising of simple mathematical problems. They were given a minute to write a list of as many images as they could recall. After that the process was repeated using a new list of slides of words.

Table 1 : The Results of the First Trial Experiment

Subject

The Number of

Images Recalled

1

10

2

11

3

9

4

10



Trial results show that the subjects recalled more images than the words. It might be thought that images are more memorable than words because images access superior sensory or physical encoding, rather than because of enhanced semantic or conceptual encoding. Hence I decided to use images as to yield ideal results in the actual experiment.

(Cumulative Words count : )

Trial 2 : Duration of Filler Task

This trial experiment was done to determine a suitable duration for the filler task. Three subjects were shown slides of coloured images. They were required to do a filler task of simple mathematical problems for one minute, after which they were required to recall the images remembered in one minute. The experiment was repeated with new sets of images and filler tasks of duration 2, 3 and 4 minutes.

Time taken for Filler Task

The Number of Images Recalled

Subject 1

Subject 2

1

12

11

2

10

10

3

11

10

4

9

9

This purpose of this experiment was to distract the subjects temporarily before list down the images they remembered. The median was relatively constant up to 3 minutes and decreased when the duration was increased to 4 minutes. The duration 3 minutes was chosen as it seemed long enough to prevent the subjects from rehearsing the last few pieces of information they have just received. Simple mathematical problem were chosen as filler task.

## **Experimental Method**

A random sample of 30 subjects aged 19-20 was selected from the register of A-Level students in my college using a random number generator.

Subjects were provided with a sheet of paper containing a filler task and a blank recall sheet. The filler task consisted of simple mathematical problems.

Using a projector, the subjects were shown 15 slides of images, where each

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slide has one coloured images and one black and white image. Each slide was shown for 5 seconds. Next the subjects were asked to perform the 3-minutes filler task. After that they were given 2 minute to recall the images they remembered. A Wilcoxon signed-ranks test was used to compare the median of the number images recalled between coloured images and black and white images at 5% confidence level.

## **Risk Assessment**

The subjects were informed prior to the experiment that the data would be used in a scientific investigation. The subjects were told that subjects' details used in this experiment were kept anonymous for confidentiality reasons. Also, subjects were told not to disclose any information regarding the test to anyone who had not taken it. The time for each slide to be shown was not rapid which is shown five seconds, and was neither flickering nor flashing. In any case, the subjects were informed about the procedure of the experiment and for those who felt they were at risk were asked to withdraw. Otherwise, the experimental procedure is ranked low-risk.

(Cumulative Words count : )

## **Results**

Number of Images Recalled

Black and White Images

Coloured-images

0

0

0

1

0

0

2

0

0

3

0

0

4

0

0

5

0

0

6

3

0

7

2

5

8

9

7

9

9

7

10

4

3

11

2

3

12

1

2

13

0

2

14

0

1

15

0

0

Total

30

30

(Cumulative Words count : )

Figure 3 : Comparison between the numbers of images recalled between coloured-images and black and white images.

(Cumulative Words count : )

## Statistical Analysis

A Wilcoxon Signed-Ranks test was used to analyze the data for each type of slideshow. This statistical test was chosen as the data is skewed and does not show a normal distribution.

Subject

Grayscale Images, X

Coloured Images, Y

$D = (Y - X)$

Absolute D

Rank of Absolute

Signed Rank

1

11

13

2

2

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19.5

19.5

2

6

7

1

1

7

7

3

10

9

-1

1

7

-7

4



6

9

3

3

27

27

5

8

7

-1

1

7

-7

6

9

8

-1

1

7

-7

7

9

11

2

2

19.5

19.5

8

10

12

2

2

19.5

19.5

9

7

9

2

2

19.5

19.5

10

9

9

0

0

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—

11

8

10

2

2

19.5

19.5

12

10

9

-1

1

7

-7

13

8

9

1

1

7

7

14

8

8

0

0

—

—

15

9

10

1

1

7

7

16

9

7

-2

2

19.5

-19.5

17

8

10

2

2

19.5

19.5

18

11

13

2

2

19.5

19.5

19

9

8

-1

1

7

-7

20

6

8

2

2

19.5

19.5

21

9

12

3

3

27

27

22

9

8

-1

1

7

-7

23

7

8

1

1

7



7

24

8

9

1

1

7

7

25

8

7

-1

1

7

-7

26

12

14

2

2

19.5

19.5

27

10

8

-2

2

19.5

-19.5

28

8

11

3

3

27

27

29

8

7

-1

1

7

-7

30

9

11

2

2

19.5

19.5

The sum of Rank of Absolute,  $W+$  is 406 and the sum of Signed Rank,  $W-$  is 88.  $W-$  is lower than  $W+$ , hence the test statistic,  $T$  is 88.

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(Cumulative Words count : )

From Wilcoxon Signed-Rank table, the critical value at 5% significance level (one-tailed test) is 152. Test statistic which is 88 is lower than the critical value of 152, hence the null hypothesis is rejected and the experimental hypothesis is accepted. Subjects recalled more coloured images than black and white images.

## **Data Analysis**

The Wilcoxon signed-rank test demonstrated that memory recall is better when coloured images are used rather than grayscale images. At  $\hat{1}\pm = 0.05$ , the value of the test statistic is 144.5 which is lower than the critical value which is 152. This shows that the probability of the number of coloured images recalled being significantly greater is more than 95% if the experiment was to be repeated on the same population. And the probability that the result occurred by coincidence is less than 5%. This supports the experimental hypothesis that the number of images recalled is greater when coloured images are used compared to grayscale images.

70% of the subjects recalled more coloured images than black and white images. The data shows that more subjects could recall 12, 13 or 14 coloured images where less subject recall 12 and 13 grayscale images. No subject could recall 14 grayscale images. This proves that colour do have effect in the results.

Coloured images are generally more attention-grabbing than grayscale ones. Color is an important function that signals and helps facilitate perceptual organization. The study of what colors will maximize memorization skills is <https://assignbuster.com/effect-of-colour-on-recall-memory-of-images/>

important for many reasons. Also, finding the colors that best stimulate memorization could increase study skills in students, especially those with learning disabilities. Naor (2001) found that color knowledge interacts with object representation in many levels, depending upon the access level that is triggered by the stimulus. Therefore, using colors in signs and signals that are more familiar to people would increase the effectiveness of the devices.

If a picture is worth a thousand words, a picture with natural colors may be worth a million, memory-wise. Psychologists have documented that “living color” does more than appeal to the senses. It also boosts memory for scenes in the natural world.

By hanging an extra “tag” of data on visual scenes, color helps us to process and store images more efficiently than colorless (black and white) scenes, and as a result to remember them better, too.

“Color and form are elementary stimulus encoding dimensions that have effects on the representation of visual stimuli at early processing stages. Little is known, however, about their effects on visual long-term memory. In three experiments we investigated whether color is part of the memory representation, whether color and form are bound in the memory representation, and the effect of color context on memory performance. Experimental results suggest that color is part of the memory representation and that color and form can be represented separately in memory and accessed independently.

We suggest that the binding of color and form is a deliberate strategic act that requires focal attention, not a natural consequence of processing visual

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stimuli. We compare our results with the predictions of two computational memory models regarding feature binding. The effect of color context was not straightforward; however, results are consistent with the encoding specificity principle.”

The result of this study could have a great significance on education in the classroom and work settings as it shows that colour is an effective way to stimulate the brain hence memory. Hence it is recommended that lecturers and tutors to use coloured images in learning process for a more efficient learning.

## **Evaluation**

A large sample of 40 subjects was taken to minimize error. The age of subjects was controlled as memory could vary with age. Older people might forget things easily compared to younger people, hence will give an unreliable result. Recently, researchers have observed mental activity by measuring brain waves using the electroencephalogram (EEG). When the body's general metabolism slows, as occurs in aging, so do the brain waves. The subjects were chosen randomly, both male and female were involved in this experiment.

The subjects were told to get enough sleep and rest since people cannot concentrate with a tired mind. Sleep will recharge your mind and body. Moreover, the experiment was carried out in the morning, the time when the brain works the best. It appears that memory could differ at throughout the day.

Also, the experiment was carried out in a close room to provide a quiet environment so that no distraction could affect the results. This is to ensure sure that there are no distractions in the vicinity. Loud music and noise can hamper concentration as well as memorization. Retention is an important part of memory, and successful retention depends a lot on concentration. The more we concentrate on an image or incident, the better chance it has of staying in our long-term memory. Thus, it is quite safe to say that the efficiency of memory depends a lot on our level of concentration.

In addition, the images chosen from the slideshow are relatively common to all subjects. This will reduce the probability that the subjects did not know what the images shown. The subjects are allowed to write down any words as long as it describing the images shown.

Everyone will have different way in memorizing things they see. Hence it is impossible to control how the subjects memorizing the images they see. Some may choose to use visual link method by which forming a mental image of items to be remembered in a way that links them together. Another method of remembering is keyword method by associate a concrete word with an abstract word and generates an image to represent it.

When the experiment is carried out in a close room, the distance of the subjects from the slide is different. Hence it might affect the results. This experiment could be improved if each subjects could be show the slides on individual computer or laptop.

One of the limitation in this investigation is that the group of subject may not be representative of the true population of general college-aged student. The <https://assignbuster.com/effect-of-colour-on-recall-memory-of-images/>

reason are the limited availability of subjects and also because only one college involved in this investigation. The experiment could be improved by having a larger sample of subjects from other colleges. This can give a more reliable result since the sample size is more large.

Further research

## **Discussion of Sources**

Source is a website run by ..... which is a well-established organization hence the information presented on its website should be correct.

Wikipedia ..... is a multilingual free content web-based encyclopedia which is continually updated and improved. This lead to an upward trend of quality, hence the information is reliable.

Source 3 is a published text book so the information it contains is factual unless it has become out-dated.

Source..... are scientific journals on field of memory. The journals are written by

## **Conclusion**

My hypothesis is that the colored images will be remembered better than those in grayscale. The results indicate that this hypothesis should be accepted. For all subjects, colored images were remembered better than those printed in black.

(Cumulative Words count : )



## **Bibliography**

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### Internet resources

[http://www.srikumar.com/personality-development/memory\\_techniques.](http://www.srikumar.com/personality-development/memory_techniques.htm)

htm

<http://www.brainskills.co.uk/HowMemoryWorks.html>

## **Appendix**

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tulips\_2.jpg

<https://assignbuster.com/effect-of-colour-on-recall-memory-of-images/>

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## Appendix 2

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<http://www.porhomme.com/wp-content/uploads/2009/03/ss-2009-eyewear-eyeglasses-spectacles-3-470x300.jpg>C: Documents and SettingsuserMy DocumentsDownloadsFree\_HP\_Pavilion\_DV6\_2114sa\_Laptop\_deals.jpg

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