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Ink Colors as Additional Stimuli in Digit Span Test: A Theoretical Approach

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Abstract: Part of the people around us have been proven to own synesthesia, a fascinating ability to experience two or more kinds of sensual feeling when only stimulated by one kind of sense organ. The author as synesthetes will detect some unique color when seeing every single figure. This article will discuss whether this connection between color and figure can help common people get a better memory of numeric strings. The participant will be asked to do some basic arithmetic drills which are written in figures with different colors. Then the digit span test will be operated in three different forms. That is the numeric string whose figures are all in black for the first; a one-to-one correspondence between colors and numbers for the second. This one-to-one correspondence should be in the same regulation as the arithmetic drill. The third one would be those colorful figures with a different congruent relationship to that in the arithmetic drills. The result will be recorded to show will the extra color signal influence the memory.

Keywords: Synesthesia, Memory Span, Digit Span Test

1. Introduction

After taking the arithmetic drills written in colorful figures, the participants will get a basic suggestion of the connection between the figure and the specific color. So they will keep this connection in the next experiment. As long as the quantity of participants is large enough, the shift in the average length of numeric string between different groups will be a proper reflection of the memory enhancement or memory deterioration [1]. The final result will be used to prove or find out the extra color information's influence on short-term memory.

There are more than fifty scientifically documented types of synesthesia, which run in families and are common in many creative women [2, 3]. Most people see associative perception as evidence of creative exuberance. By the same token, the effective use of synesthesia is seen as one of the psychological interventions to enhance short-term memory and concentration.

Part of the people around us has been proven to own synesthesia, a fascinating ability to experience two or more kinds of sensual feeling when only stimulated by one kind of sense organ. The author as synesthetes will detect some unique color when seeing every single figure. This article will discuss whether this connection between color and figure can help common people get a better memory of numeric strings. The participant will be asked to do some basic arithmetic drills which are written in figures with different colors. Then the digit span test will be operated in three different forms. That is the numeric string whose figures are all in black for the first; a one-to-one correspondence between

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2. Literature Review

This field can be described as a combination and reconstruction of many basic theories [4]. Synesthesia is characterized by the paradoxical perception in which stimulation in one sensory modality automatically, individually, and systematically elicits a conscious perception either in an additional sensory modality or in a different aspect of the same modality. Although many hypotheses are going up well, like grapheme-color synesthesia has been proved to be true, the fundamental neural mechanism remains unknown. This topic can't be described as a very famous and popular one hence the related experiments and articles aren't that many. But, when we focus on some previous achievements, there are still many problems and deficiencies to be solved and handled. Most research is focused on the phenomenon itself but not why it should be like this, also those people who have the synesthesia experience are given too much attention that quite a few of the tests are designed for them to show the difference between them and common people. The current situation is that the research focuses have not been moved to the general case or many of their findings may have nothing to do with our daily life or the formation of a rigorous theoretical system [1]. But on the other side, the basic work to discover this unknown land has been done well [4]. Just like the grapheme-color synesthesia had been proved to be true and many tests have been adopted into the work. In a word, the many previous results are valuable for the following research and are waiting to be put into corresponding with other proved results and hypotheses. Also, many it has been proved that synesthesia may recruit mechanisms of normal cross-modal perception, albeit in an exaggerated form [5, 6]. If synesthesia can show an overdeveloped capacity in cross-modal processing that we all possess, synesthesia-like behavior should also be expressed in the general population rather than being unique to a few individuals.

Even though the general data was in line with the forecast, we can still not ignore that facilitation was not observed in both the cued-recall and the associative recognition tests. The author didn't take the visual searching strategies into the conclusion which can have an obvious effect on facilitation. Also, the significant difference between the neutral and incongruent conditions on the recognition tests occurred may due to increased accuracy in the neutral condition but not due to the degraded learning efficacy with incongruent ink colors.

Several special experiments included in the article have been drilled [7]. But except for the people in the control group, that gifted grill took up all the places in the testing group to be compared on her own. So it is hard to tell whether people who can experience synesthetic have a better memory of relevant figures due to the corresponding color or that just simply because the girl's memory is better than the standard value [8]. The average length of the final result in the digit span test of experiment A (the corresponding regulation is the same as the arithmetic drill) will be longer than that in the control group. Even though the result of that experiment is true and can tell us about the amazing ability of those synesthetic people to use two sensual pieces of information to enhance and help the memory system, the limitation is still a problem since most of us do not have this gift. Besides, the size of the sample is not large enough to make sure the accuracy of the result, and the participants can only stand for the situation in one certain district since 7 students in the local university are invited to this experiment as volunteers. The article is not able to tell a general fact for all the age periods due to the short and limited participants' age span. To sum up, the experiments included in the article are too incomprehensive to give reliable proof of what the author would like to convey. Even though the author's hypothesis has been proved to be a general fact, the field that it contains remains small. Their

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researches are all based on a synesthesia experienced girl but not the common people just like us. From this point of view, they are more recording an interesting fact rather than trying to find out the myth behind the phenomenon.

As for Misae Ishikawa and Dinkar Sharma's article, the authors only focus on the factors of binary and octal responding but not on the general aspect to do the overall experiment [7]. When it comes to the selection of the participants, the limitations and the requirement were not so strict and reasonable [9]. The lack of necessary prepositive tests leads to many new undetectable problems [10]. Take the experience of the participants, for example, the training level of every individual participant hasn't been controlled so their learning ability and previous cognition towards binary and octal areas. A well-trained figure user with a level above average standard can perform better and get familiar with many test steps at a relatively rapid speed [1]. As long as this situation exists, the result of the data will experience a shift compared with the actual value. What's more some of the steps in the experiment have been drilled many times which may give chance for the participants to get a better understanding of what they will facing, so the reaction time and the accuracy of their performance will be greatly influenced by an unreliable level. Will this kind of synesthesia be good for the memory of some related target? Can this kind of extra information of color be used to enhance the memory of certain figures for common people? The article above didn’t go back to the normal cases to get a further study for the fundamental problem.

3. Proposed Methods

There will be a prepositive test for all the participants before the main experiment. All of them will be shown different figures and colors to make sure the participants are free of synesthesia [1].

An arithmetic drill with many basic equations written in colorful figures will be shown to all the participants. Every single figure will correspond to a unique color. In this step, participants are expected to form the unique but shallow cognition of relevance between colors and figures according to the regulation we set in the arithmetic. Then the participants will be divided evenly into three groups for the next stage. Two groups are experiment groups while the rest of them will play the role of the control group. All of them will be asked to take the digit span test with some necessary modifications. For the control group, they will take the original digit span test without any change to get the data as the standard value. The colors of the figures will be different but obey the one-to-one regulation in the arithmetic drill in the test of experiment group A. The color of figures in the digit span test for experiment group B will be completely random. The result will be collected and treated to the average data individually. All the data will be gathered and treated together to find out the shift of the result between the groups to prove or disprove the hypothesis.

4. Expected Results and Discussions

Under the condition that all the participants did not show the obvious gift to tell the correspondence between colors and figures in the prepositive test [1].

The average length of the final result in the digit span test of experiment A (the corresponding regulation between colors and figures is the same as the arithmetic drill) will be longer than that in the control group.

The average length of the final result in the digit span test of experiment B (the color of the figures is completely random) will be shorter than that in the control group.

If the experiment result is the same as we expected, my hypothesis can be partly proved that the extra corresponding color information will enhance the memory of the relevant figures [2]. Some radical problems are remaining in the studies which are carried out before. One of the most influential points is the selection of the participants in the control group. They just recruited people who declared

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they can't tell the correspondence between two sensual aspects but there was no prepositive had been used to exclude those potential synesthesia people. It's no doubt that a quite essential step for the whole study but we are not able to find out a specific useful method to screening the participants because these weak corresponds for many people is hard to be a detective or cause a shift on some essential value but will do a difference when we operate this kind of experiments. This still needs to be improved.

The article of Daniel Smilek et al discusses the better performance of women who can experience synesthesia when remembering the figures. Several special experiments included in the article have been drilled. But except for the people in the control group, that gifted grill took up all the places in the testing group to be compared on her own. So it is hard to tell whether people who can experience synesthetic have a better memory of relevant figures due to the corresponding color or that just simply because the girl's memory is better than the standard value [7]. The average length of the final result in the digit span test of experiment A (the corresponding regulation is the same as the arithmetic drill) will be longer than that in the control group. Even though the result of that experiment is true and can tell us about the amazing ability of those synesthetic people to use two sensual pieces of information to enhance and help the memory system, the limitation is still a problem since most of us do not have this gift. In another word, the author didn't find out the fundamental reason for the memory enhancement. That's why all the participants in my experiment are common. It is worth trying to make the experiment result can be more universal and reliable.

A few digit span test disruptive factors should be also mentioned here. Chinese literati created a rhetorical technique that links the senses of sight, hearing, smell, taste, and touch. It is also known as synaesthesia. It is very useful in creating the mood of ancient poems. A typical example is a famous line in Song Qi's "Spring in the Jade House": "Spring is in the branches of red apricots". Wang Guowei, a famous scholar of the Qing Dynasty, praised it in his "Words of the World" for its "full expression of the realm of spring with the use of the word 'haunting'".

Facing the same aesthetic object, different aesthetic feelings appear. This not only shows that the "general feeling" is the mutual transfer of external sensory organs but also can explain that the external feeling is determined by the internal aesthetic psychological induction. Another example is the line "The morning bell is wet outside the clouds" in Du Fu's "Kui Zhou Raining Wetness Can't Be Made on the Shore", which says that because of the cloudy and wet weather, the sound of the bell transmitted to the clouds is not only less crisp and loud but also has some moist (visual) or wet (tactile) sensations. The sound of the bell is originally a recourse to hear, because Du Fu in the specific weather in the wet environment to feel, the sound of the bell from hearing to visual and even tactile, which writes a unique feeling for the sound of the bell, to avoid generalization.

The "sense of communication" also has the shape of the sound of the sensory transformation. For example, two lines from Tang Xianzu's "The Peony Pavilion" read, "The sound of swallows is as clear as shears, and the song of the nicking warbler is as round as a slinky." The words "swallow's voice" and "warbler's song" are both used in the sense of hearing, while "shear" is an object and "circle" is used in the sense of shape. How can the word "swallow" be like "shears" and the word "warbler" be "circles"? It turns out that people can derive the association of sharpness and lightness from the shape of "shear" and the inspiration of purity from the form of a "circle". It can be seen that the art of "sense of communication" can only be completed in the sense of transformation. If the reader can't make an association, the reader can't communicate with sense A and sense B. The purpose of conversion can't be completed, and the beauty of a "sense of communication" can't be experienced.

5. Conclusion

The "sense of communication" and the color to write the sound, such as the Qing Dynasty poet Yan Suicheng's "Mancheng Road" in the "wind with the willow turn sound are green, wheat by the dust

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deception color easy yellow. "Sound" is auditory, and "green" is visual, but how can "sound" turn green? Because of the wind in the willow, the sound, of willow silk fluttering, like a green curtain spread, from this green bush sound also seems to be dyed green. "Green" here, not only tinted color beauty, and at the same time as light and pleasant sound of the synonym. In the current secondary school language textbooks, there is no shortage of examples of "generic feeling".

There are two examples in "Moonlight on the Lotus Pond". The first example is to describe the fragrance of the lotus: "The breeze sent wisps of fragrance through the pond as if it were the faint singing of a distant tall building." This line compares the fragrance, which is obtained through the sense of smell, to the sound of singing, which is obtained through the sense of hearing. It is a fascinating and exquisite scene that adds infinite rhythm to the enchanting realm. The second part is used to describe the lotus pond under the moon: "The moonlight in the pond was not uniform; but the light and shadow had a harmonious melody, like the famous song played on the van shapely ling." This line cleverly compares the combination of light and shadow, light and dark, to harmonious music, transforming visual images into auditory ones, and expressing the harmonious beauty of the lotus pond under the moon just right, with a faint joyfulness that overflows into words. This suggests that the sensation and the co-functions are far beyond the color and stimulus. Whether this connection between color and figure can help is one thing, there are other ways to enhance common people get a better memory of numeric strings as well.

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