

**The Relationship between Extraversion-Introversion on Memory Task
Performance**

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Abstract

The current study examined the relationship between extraversion-introversion on memory task performance, specifically the recall of abstract versus concrete words. It was predicted that extroverts will perform better on this task as a result of the nature and conditions of the task. It was also predicted that participants would be better able to retain and recall concrete words as opposed to abstract words, because they are able to actually visualize the words. Past research is consistent with these predictions. It has been found that introverted individuals have higher cortical arousal levels thus enhancing memory consolidation and storage abilities (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006). They have better memory for the long term. Extroverted individuals have been known to have lower cortical arousal and they tend to have better short term memories (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006). Unfortunately the results obtained from this study did not support the hypotheses put forth by the researchers. This could be a result of several control and methodological issues. If the study was replicated with an improved design more accurate results and potential conclusions could be drawn.

Past research has concluded that there are vast differences in the way that extraverted individuals and introverted individuals function with respect to cognitive performance tasks (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006). It has been predicted that, since introverts have higher arousal levels, they will be able to retain more information and thus demonstrate superior performance on memory tasks (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006). Increased arousal rates have been associated with optimal storage and retrieval mechanisms for introverts (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006). Extraverts are believed to have lower levels of “ascending reticular activating system activity.” It was predicted that extraverts would have better short term memory. There are also differences in how the two personality types respond to situational and human stimuli (Cox-Fuenzalisa, Angie, Holloway, Sohl, 2006).

One study done examined the impact of the personality trait of intro- extraversion on varying levels of cognitive processing, under two distinct conditions. The two conditions were noise and quiet (Belojevic, Slepcevic, Jakovljevic, 2001).

103 medical students participated in the study. They were required to complete the Eysenck Personality Questionnaire, which consisted of 24 questions (Belojevic, Slepcevic, Jakovljevic, 2001). Participants were divided in two groups after the questionnaire was completed, extraverts and introverts (Belojevic, Slepcevic, Jakovljevic, 2001). They were then required to perform “The Mental Arithmetic task.” This test contained 15 questions. There were two versions of the test administered of similar complexity (Belojevic, Slepcevic, Jakovljevic, 2001). There were also two conditions

under which the test was administered, quiet and noise (Belojevic, Slepcevic, Jakovljevic, 2001).

The results of the study suggest that extraverts were less affected by the noise and in fact were able to better focus and achieve optimal outcomes in the noise condition (Belojevic, Slepcevic, Jakovljevic, 2001). It was believed that extraverts performed better in the noise condition, because they have low cortical arousal so they are constantly seeking stimulation in order to achieve success in these tasks (Belojevic, Slepcevic, Jakovljevic, 2001). Introverted individuals were able to perform at the same level as extraverts with respect to speed and accuracy but they were more affected by the noise and this influenced the amount of effort that they had to exert in order to achieve optimal achievement. They had to exert more effort than extraverts in order to achieve the same results. (Belojevic, Slepcevic, Jakovljevic, 2001).

Another study done anticipated that “extraversion is inversely related to cortical arousal.” Extraverts tend to exhibit typically lower levels of cortical arousal than introverts (Fink, Neubauer, 2003). Extraverts will more often search for additional stimulation to enhance arousal levels (Fink, Neubauer, 2003). On the other hand, introverts tend to exhibit higher levels of cortical arousal and thus have no need to seek out further simulation (Fink, Neubauer, 2003). It was predicted that task complexity would change the nature of the relationship between extraversion and the degree of “Event-Related Desynchronization (ERD) in the human EEG (Fink, Neubauer, 2003).

65 participants took part in this study. They were chosen for the study based on scores received on an intelligence test (Fink, Neubauer, 2003). The Triplet Numbers test was utilized in this study. Participants were concurrently exposed to three one-digit numbers on a computer screen and their goal was to decide whether or not the specific digits match a specific pattern (Fink, Neubauer, 2003). They indicated this by pressing yes or no on the computer screen. Participants were exposed to 50 test items. Participants were suited with an electrode cap, before the task commenced. A resting EEG was recorded, after which participants were permitted to start the task. Overall there were five versions of the Triplet Number Test presented, each one increasing in difficulty as the experiment progressed forward (Fink, Neubauer, 2003). EEG and Reaction Times were measured for all conditions and stages of this experiment (Fink, Neubauer, 2003).

The results found the following. Hard conditions were related to stronger ERDs as compared to the less strenuous conditions (Fink, Neubauer, 2003). Complexity of the Triplet Numbers Test was shown to alter the nature of the relationship between extraversion and level of cortical arousal (Fink, Neubauer, 2003). Individuals were shown to possess higher levels of cortical arousal during the more difficult conditions (Fink, Neubauer, 2003). Consistent with Eysenck's original predications, introverts' arousal levels were found to be higher in the harder conditions of the Triplet Numbers Test (Fink, Neubauer, 2003). Differences were found among extroverted and introverted individuals in cortical activation. These differences were especially prevalent in the difficult conditions of the Triplet Numbers Test (Fink, Neubauer, 2003).

In a similar study, researchers were interested in examining the differences between experimentally induced arousal versus physiological arousal (Fink. et al., 2004). They carried this out by measuring cortical stimulation during the performance of various logical reasoning tasks (Fink. et al., 2004). Each condition got progressively harder. There were five conditions in total. It was predicted that the extraversion activation relationship had the potential to change the nature of the relationship between task difficulties (Fink. et al., 2004). This study focused specifically on how cortical arousal affects memory performance.

Participants were required to perform certain memory tasks that required encoding and storage of information at either the working memory level or the short term memory level (Fink. et al., 2004). The first task involved short term memory and the second one involved working or long term memory. It has been suggested that the frontal cortex plays a significant role in several memory tasks (Fink. et al., 2004).

66 participants were selected to take part in this study. Before the commencement of the actual task, participants were required to complete a general intelligence test and a personality inventory (Fink. et al., 2004). " Four experimental tasks were presented during EEG recording, a task involving short term memory function, one involving working memory function, a central executive task and a reaction time task" (Fink. et al., 2004). The last two were not emphasized to a great extent in the research (Fink. et al., 2004).

The results obtained indicated that extraverted and introverted performed similarly in all conditions of this task. There were no significant differences in outcomes (Fink. et al., 2004). There were differences found in the activation of brain regions during performance of these tasks in the two types of individuals (Fink. et al., 2004). In these types of tasks, the area of the brain that is most active is the frontal cortex (Fink. et al., 2004). It can be said that, when performing these types of tasks, introverts and extraverts differ in the way they centre attention and carry out the task (Fink. et al., 2004).

It has been suggested that mental imagery has a strong influence on memory (Marschark, Hunt, 1989). The most substantial piece of evidence for this assumption is the dual coding theory. Human cognition is proposed to be composed of two interrelated processing structures (Marschark, Hunt, 1989). There is a visual compartment as well as a verbal compartment. Each system is responsible for various cognitive functions (Marschark, Hunt, 1989). The interconnections between the two systems enable the two compartments to both process incoming information and store it in memory until later use (Marschark, Hunt, 1989). This theory proposed that information that is coded by both systems is better remembered (Marschark, Hunt, 1989). It was also proposed that information encoded using the visual system would be better retained (Marschark, Hunt, 1989).

The current study examined the relationship between extraversion and introversion on memory task completion, specifically on the recall of concrete and

abstract terms. It was predicted that extroverts will perform better on this task as a result of the nature and conditions of the task. It was also predicted that participants would be better able to remember and recall concrete words as opposed to abstract words, because they are able to actually visualize the words.

Method

Participants

The participants used in the current study were randomly selected. The subject pool included an equal number of males and females. 30 subjects were included in the analysis. Individuals were chosen from various areas around the University of Western Ontario campus. As a result, there was a high probability that most participants were students attending the university. Individual's ages ranged from 18-25.

Materials

Participants were required to complete the Eysenck Personality Inventory. They were also required to engage in brief memory task that involved the recall of abstract and concrete words. The Eysenck Personality Inventory is a popular personality measure that has been around for several years. It has been used on multiple occasions to test for personality traits and study the effects and impact of these traits on other variables. Thus, this scale is a reliable and valid measure of personality. The scale was a measure of factorial, construct and concurrent validity.

The memory task that was used in this study was one that required participants to learn first a list of concrete words and then recall them, then learn a list of abstract words and recall those. The words chosen for both lists are commonly used words. Those used in the abstract list are words that received a concrete score of 2 or lower. Those used on the concrete list were ones that obtained a score of 6 or higher on concreteness. The meaningfulness of the words on each list was almost identical.

Procedure

Before participants engaged in the study, they were required to sign a consent form entailing that they agreed to take part in the study. The consent form mentioned possible risks that might be associated with participation in the study. It provided a brief description of what was being studied and the time it would take to complete the experimental testing. Lastly, the consent form provided the professors contact information in case participants had any questions or concerns about the study.

Participants were given the Eysenck Personality Inventory to complete. This inventory had 57 questions and participants were required to answer yes or no to the questions based on personal opinion.

Participants were then required to complete a memory task. The task involved the recall of abstract and concrete words. Participants were first given the concrete list of words. This list had 15 words and participants were given 5 minutes to absorb the words after they were read aloud and then to record them on a piece of paper. The abstract list

had 15 words as well and the list was read aloud by the researcher. Participants were again given 5 minutes to learn the words and then record them. The study took 20 minutes to complete.

After the tasks were completed, participants received a debriefing form. This form further discussed what was being examined in the study. It provided participants with the hypotheses of the current study. The debriefing form provided a reference for participants so they are able to learn more about the prior research on the subject. Lastly, the form included contact information if participants had any questions or concerns they needed cleared up.

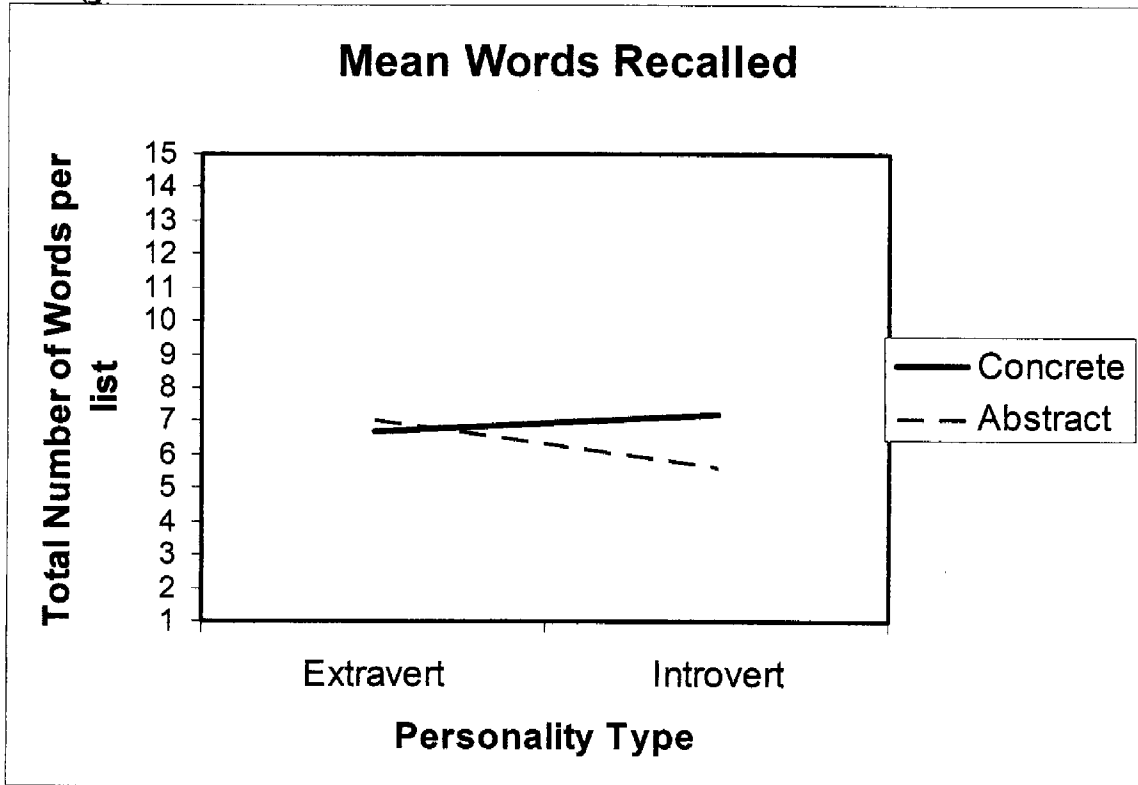
Results

A median split was performed to determine the cut off for scores of extroverts versus introverts. An individual scoring below 12.5 was considered to be introverted in nature. An individual scoring above 12.5, that individual was considered to be extraverted in nature.

A MANOVA was performed to determine if extraversion was related to two composite variables, recall of concrete versus abstract words. Significant results were not obtained ($F(1, 28) = 0.48$, n.s) for concrete words nor ($F(1, 28) = 3.61$, n.s) for abstract words. Results also indicated that extraverted individuals did not significantly recall more concrete or abstract words than introverts. The mean number of concrete words recalled by extroverts was 6.67/15, and the mean for extrovert's recall of abstract words

was 7.00/15. The mean number of concrete words recalled by introverts was 7.20/ 15 and the mean number of abstract words recalled was 5.67. A graph of the means is displayed in Figure 1.

Fig. 1



Discussion

The results obtained from the current study did not support the hypothesis brought forth by the researcher nor did it support current research in this field. There were no significant findings. No main effects were found and there was no interaction.

The second hypothesis, predicting that concrete words would be better remembered than abstract words, was also not supported. This was surprising as, the majority of research predicted that this should be the case. Concrete words should have been better remembered and more of them should have been recalled. It is not known why this effect did not occur in the present study. It could be a result of certain sampling and control issues.

There are a few sampling issues that should be mentioned. First, the sample size was small, consisting of only 30 participants. Thus, it was not representative of the larger population. There was not sufficient data collected in order to draw firm conclusions about the hypotheses predicted in the current study.

There was also certain control issues associated with this study. First, participants were administered the questionnaire and the memory task in the University Community Centre. The atmosphere inside the centre was chaotic. Thus, individuals might not have been able to focus their attention to the task at hand. Thus, results may have been inaccurate.

A second control issue concerned experimenter bias. Participants may have answered questionnaires in a way they think the experimenter wanted them to be answered in order for the researcher's hypothesis to be supported.

A third control issue was that of preoccupation. Participants were randomly selected during various points of the day from the University Community centre. Most of them were found while consuming a meal. It was possible that the participants answered the questionnaires and completed the task quickly and haphazardly in order to go back to what they were engaging in before they were disrupted. It was also possible that participants' were focused on other matters, for example, on an upcoming test or assignment. Thus their full effort and attention was not directed to the task. This could have also led to inaccurate results.

Finally, participants could have completed the Eysenck Personality Inventory according to how they want others to perceive them, even if they are aware that no one will know the identity behind the questionnaires that are collected. It is possible that they perceive themselves a certain way and want others to perceive them in that light, so inaccurate results could have arisen.

With respect to reliability and validity, the measurements utilized in the current study prove to be valid and reliable ones. The Eysenck Personality Inventory has demonstrated factorial validity as well as construct and concurrent validity. The words generated for the abstract and concrete lists were derived from the Journal of

Experimental Psychology Monograph Supplement – concreteness, Imagery, and Meaningfulness Values for 925 Nouns. The concrete list of words was comprised of 15 words. All had an F value of A. Their concreteness scores were all 6 or greater. The average score for meaningfulness for the concrete words was 6.60. The abstract list of words was comprised of 15 words as well, with an F value of A. Their concreteness scores were 2 or lower. The average score for meaningfulness for this list was 5.70. .

The study could have been improved in several ways. First, a larger sample would have provided more accurate and representative data that could be applied to real life instances. Also, the study could have been more controlled if all participants had taken part at the same time and in the same location and if the researcher had read out the two lists of words after the questionnaires were completed. This would have accounted for any focus and concentration issues as well as any issues concerning nature list reading. All participants would have been exposed to the same conditions. Thus, the study would have generated more accurate results.

There are several future implications for the current study. The study could be replicated by altering several aspects of the current one. First, one could examine if personality has an influence on memory recall with respect to other cognitive factors. One could administer the Eysenck Inventory and then have participants complete recall exercise, this time examining the effects of primacy and recency effects. One could also see how personality influences short term versus working memory. Participants could be asked to recall a list that is read to them immediately after the completion of the

questionnaire and then test them a day later or a few days later to see what has been maintained and stored permanently in memory. Lastly, one could examine how personality factors influence memory consolidation. Individuals could be asked to learn a list of words and then tested at varying time periods to determine whether extraverts or introverts are more efficient at consolidation.

Other studies could be extended from the current study. One could investigate the influence of personality on other cognitive or motivational areas of behavior. One could examine how personality influences the test taking behavior. One could see if there is a difference in the encoding, maintenance and retrieval of stored information for extraverts versus introverts. This could be carried out by having students complete the Eysenck questionnaire and then inquiring about methods of study and examining grade outcomes.

As a result of the structure and methodology of the current study, results were not as predicted or expected. However, if the study was improved and replicated, it is possible that the original hypotheses could have been supported.

References

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Appendices

Consent Form

A study is being done to examine the relationship between extroversion and introversion on performance in memory tasks. There are no known risks in this study. If at any time you feel uncomfortable or no longer want to take part in the study you are free to withdraw your participation at any time. The estimated time to complete the questionnaires is 30 minutes. Further information concerning the project may be obtained from the course instructor, Dr. M. Cole at Huron University College. He may be reached at (519) 438-7224 extension 223

(1) I _____ agree to participate in this
(Print name clearly)

research project conducted by a student in an course in Learning and Motivation.

- (2) I have read and understand the description of the nature and purpose of this research project. Any questions have been answered to my satisfaction.
- (3) I understand that my participation in this study is voluntary and that I may choose not to answer any questions and to terminate my participation at any time. I understand that such withdrawal will have no adverse consequences of any sort.
- (4) I understand that every effort will be made to maintain the confidentiality of the data now and in the future.
- (5) I understand that individual results will not be made available.
- (6) Participation in this study may not be counted for credit in the Psychology 022 subject pool

Signature

Date

Eysenck Personality Inventory

- | | | |
|---|-----|----|
| 1. Do you often long for excitement? | Yes | No |
| 2. Do you often need understanding friends to cheer you up | Yes | No |
| 3. Are you usually carefree? | Yes | No |
| 4. So you find it very hard for take no for an answer? | Yes | No |
| 5. Do you stop and think things over before doing anything? | Yes | No |
| 6. If you say you will do something do you always keep your promise,
no matter how inconvenient it might be to do so? | Yes | No |
| 7. Does your mood often go up and down? | Yes | No |
| 8. Do you generally do and say things quickly without stopping to think | Yes | No |
| 9. Do you every feel "just miserable for no good reason?" | Yes | No |
| 10. Would you do almost anything for a dare? | Yes | No |
| 11. Do you suddenly feel shy when you want to talk to an attractive
stranger? | Yes | No |
| 12. Once in a while do you lose your temper and get angry | Yes | No |
| 13. Do you often do things on the spur of the moment? | Yes | No |
| 14. Do you often worry about things you should not have done or said? | Yes | No |
| 15. Generally do you prefer reading to meeting people? | Yes | No |
| 16. Are your feelings easily hurt? | Yes | No |
| 17. Do you like going out a lot? | Yes | No |
| 18. Do you occasionally have thoughts and ideas that you would not like
people to know about? | Yes | No |
| 19. Are you something bubbling over with energy and sometimes very
sluggish? | Yes | No |
| 20. Do you prefer to have a few but special friends | Yes | No |
| 21. Do you daydream a lot? | Yes | No |
| 22. When people shout at you, do you shout back? | Yes | No |
| 23. Are you often troubled about feelings of guilt? | Yes | No |
| 24. Are all your habits good and desirable ones? | Yes | No |
| 25. Can you usually let yourself go and enjoy yourself a lot at a lively
party? | Yes | No |
| 26. Would you call yourself tense or "highly-strung"? | Yes | No |
| 27. Do other people think you as being very lively? | Yes | No |
| 28. After you have done something important, do you often come away
feeling you could have done better? | Yes | No |
| 29. Are you mostly quiet when you are with other people | Yes | No |
| 30. Do you sometimes gossip? | Yes | No |
| 31. Do ideas run through your head so that you cannot sleep? | Yes | No |
| 32. If there is something you want to know about, would you rather
look it up in a book than talk to someone about it? | Yes | No |
| 33. Do you get palpitations of thumping in your heart? | Yes | No |
| 34. Do you like the kind of work that you need to pay close attention to? | Yes | No |
| 35. Do you get attacks of shaking or trembling? | Yes | No |

- | | | |
|--|-----|----|
| 36. Would you always declare everything at the customs, even if you knew that you never be found out? | Yes | No |
| 37. Do you hate being with a crowd who plays jokes on one another? | Yes | No |
| 38. Are you an irritable person? | Yes | No |
| 39. Do you like doing things in which you have to act quickly? | Yes | No |
| 40. Do you worry about awful things that might happen? | Yes | No |
| 41. Are you slow and unhurried in the way you move? | Yes | No |
| 42. Have you ever been late for an appointment or work? | Yes | No |
| 43. Do you have many nightmares? | Yes | No |
| 44. Do you like talking to people so much that you would never miss a chance of talking to a stranger? | Yes | No |
| 45. Are you troubled by aches and pains? | Yes | No |
| 46. Would you be very unhappy if you could not see lots of people most of the time? | Yes | No |
| 47. Would you call yourself a nervous person? | Yes | No |
| 48. Of all people you know are there some whom you definitely do not like? | Yes | No |
| 49. Would you say your were fairly self confident? | Yes | No |
| 50. Are you easily hurt when people find fault with you or your work? | Yes | No |
| 51. Do you find it hard to really enjoy yourself at a lively party? | Yes | No |
| 52. Are you troubled with feelings of inferiority? | Yes | No |
| 53. Can you easily get some life into a rather dull party? | Yes | No |
| 54. Do you sometimes talk about things you know nothing about? | Yes | No |
| 55. Do you worry about your health? | Yes | No |
| 56. Do you like playing pranks on others? | Yes | No |
| 57. Do you suffer from sleeplessness? | Yes | No |

Memory Task

Concrete words

1. Artist
2. automobile
3. author
4. bottle
5. bowl
6. cabin
7. dust
8. engine
9. factory
10. hotel
11. library
12. magazine
13. palace
14. slave
15. temple

Abstract Words

1. anger
2. attitude
3. confidence
4. freedom
5. glory
6. happiness
7. moral
8. necessity
9. passion
10. pride
11. shame
12. theory
13. virtue
14. advice
15. devil
- 16.

Debriefing Form

The following study that you just took part in examines the relationship between extraversion and introversion and its influence on overall memory task performance. It has been hypothesized that introverts will be more competent in completion the completion of memory tasks as a result of their higher arousal levels which in turn affects their storage capacities. It was also predicted that more concrete words would be recalled than abstract words. This hypothesis is consistent with past research in the field (Cox-Fuenzalida, Angie, Holloway, Sohl, 2006) (Hadwin, Brogan, Stevenson, 2005). Your participation has benefited by providing information to further our understanding of the relationship between sex, extroversion and introversion on memory task performance. If you have any questions or concerns regarding the study please feel free to contact Dr. M. Cole, at Huron University College. He may be reached at (519) 438-7224 extension 233.