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Influences of the working memory

How do depression, anxiety and stress affect working memory?

Harrison Notkin
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40 participants were chosen at random from students who attend Huron University College. Each participant was given three separate tests. The first test the participants were administered was the depression, anxiety, and stress scale (DASS). The second test the participants were given was the morningness-eveningness questionnaire (MEQ). The final test they were given was an oral memory test that dealt with strings of numbers and repeating them back to the administrator. The present study was conducted to see if depression, anxiety, or stress would directly affect a persons’ working memory and whether or not the time of day a person took the study would affect their working memory. The results indicated that there was a significant main effect for the DASS, $F(1,20) = 9.96$, $p < .05$, partial $\eta^2 = 0.22$

The study of short-term memory began to boom in the mid 20th century when the modal model of the mind was proposed, an outline still used when someone speaks about the mind today. (Gray, 1994) This model splits memory into three different groupings; sensory, short-term, and long-term. (Gray, 1994) The present study focuses solely on short-term memory. Short-term memory, also referred to as working memory, is the workplace of the mind and the memory category that is most often used. (Gray, 1994) A person’s working memory represents the present environment, a very small space where a person can consciously store that can store only a few different items. (Gray, 1994) The current study tested the span of a persons’ short-term memory. Span is a term that quantifies the amount of storage someone has in their short-term memory with numbers, letters, and sometimes short stories. (Gray, 1994) When measured in
Influences of the working memory

terms of digit span, the span of short-term memory for most people is seven digits long; this is the reason that telephone numbers without area codes are seven digits long. (Gray, 1994) One of the first studies of a person’s span of short-term memory was conducted by Hermann Ebbinghas, a nineteenth century German who found that he could read a list of nonsense syllables and repeat it back successfully after one reading if the list had fewer than seven syllables. (Gray, 1994)

Depression and anxiety are two different disorders that are typically paired together in the same person. (Gray, 1994) Depression and anxiety are disorders that can cause intrusive memories and cause the recovery of repressed memories. (Huntjens, Verwoerd, & Wessel, 2009) There are however two major distinctions that can be made between depression and anxiety. The first is that anxiety is more likely to be accompanied by physiological arousal and paranoia. (Gray, 1994) Secondly depression is more likely to accompany a loss of all pleasure and a general feeling of hopelessness. (Gray, 1994) According to the DSM-IV for depression to be diagnosed symptoms must either be extreme or prolonged and can not be attributed to one specific life event. (Gray, 1994) Neurotic anxiety is another disorder that can be problematic and occurs when the Id and Superego get into conflict. (Chaplin & Phares, 1997) During this the ego sets up various defense mechanisms that can further the problem. Repression is a common defense mechanism that pushes the issue back into the unconscious, so the person will not have to deal with it at all. Displacement is a defense mechanism that can be dangerous to those around an anxious person as they can displace their urges onto another target and become aggressive. (Chaplin & Phares, 1997) An anxious person can also employ many other defense mechanism including projection, rationalization,
Influences of the working memory

regression and sublimation which can all turn into dangerous or just poor situations for
the anxious person or those around them. (Chaplin & Phares, 1997)

Men and Woman differ greatly when it comes to depression, anxiety, and stress
because of a few societal and mental reasons. (Gray, 1994) Woman in North America
are more likely than men to live in poverty, experience discrimination, to have been
sexually or physically abused in childhood or by a spouse, all of which contributes to
depression, anxiety, and stress. (Gray, 1994) Many psychologists argue that the role of a
woman or housewife in our society is more isolated than the role of the average male;
such isolation can lead to anxiety and depression. (Gray, 1994) This is mainly due to the
fact that a woman’s role has higher demands with low rewards that are perfect factors to
cause stress, anxiety and depression in a persons’ life. (Gray, 1994)

A study that was conducted in the Republic of Korea wanted to determine if
depression had any significant relation to a persons’ morning/day activity (morningness)
or evening/night activity (eveningness). (Cho, Cho, Kim, Kim, Lee, & Lee, 2010)
People who have been diagnosed with depression have usually been reported to be an
eveningness type person. (Cho et al., 2010) Furthermore there has also been a
correlation in the non-clinical world that associated depression with an eveningness type
person. (Cho et al., 2010) It is also a well known fact that morningness-eveningness is
greatly affected by age; the older one gets, the more likely they are a morningness type
person. (Cho et al., 2010) Once the study was conducted they found a significant effect
between a persons MEQ score and depression. (Cho et al., 2010)
Another study conducted in Italy wanted to determine how depression in patients was affecting their sleeping. (Calati, Cruz-Fuentes, Gaspar-Barba, Natale, Ronchi, Serretti, Ontiveros-Uribe, 2009) The patients in the study were divided up into three different groups depending on their MEQ score; they were eveningness, neither, and morningness. (Calati, et al., 2009) The major criticism found with the study was that they had a very small sample size that may have caused their finding to be biased. (Calati, et al., 2009) Nevertheless, the study was intriguing as it found that the older patients tended to be the morningness type while the eveningness type group tended to be more depressed. (Calati, et al., 2009) The eveningness patients showed many depressive symptoms such as suicidal thoughts, impaired work and activities due to depressive thoughts and paranoia; they were also generally more anxious than the morningness type patients. (Calati, et al., 2009) The study concluded that there is definitely significance between a patients’ depressive episodes and being an eveningness type patient. (Calati, et al., 2009)

The hypothesis for the present study will be that those who score higher on the depression, anxiety, and stress (DASS) as well as score higher on the MEQ (morningness person) will do worse on working memory tests than those who score less on the DASS and the MEQ.

Method

Participants

The participants in the current study were forty persons that were individually selected by the administrator of the study. The administrator of the study found all of the participants inside the Huron University College Library. The administrator made sure
Influences of the working memory

that the participants all attended Huron University College and that they were all full
time students with final exams to be allowed to participate in the study. The study
consisted of a total of 20 male and 20 female participants. All the participants that took
part in the study were between the ages of 19 and 23 years of age, with an average age
of 20 years old. Closer to the end of the data collection the administrator had to discard
some data as an even number of participants was needed for each of the independent
variables. In total no more than 5 participants’ data was not used.

Measure

In this study three separate tests were used to measure a few different abilities
and emotions. The first test that was administered to the participants was the DASS. The
DASS is a depression, anxiety, stress scale. There are a total of 42 questions that are
rated on a scale from zero to three. Zero meaning that the question does not apply to me
at all while three would mean that it applies to me most of the time. Currently the
reliability and validity of the test is unknown. The second test that was used is the MEQ,
which stands for morningness - eveningness questionnaire. This questionnaire contained
a total of 19 questions that were mostly rated on a four-point scale with the exception of
a few individual questions. Again the current reliability and validity of the test is
unknown. Go to Appendix C to find links to the DASS and the MEQ test used. Finally
the last test that was used was a memory test. This test is used by psychological
educational workers to determine ones’ capabilities in their working memory. This test
is quite reliable as well as consistent. This is due to the fact that numbers are used
instead of words making the test universal to the majority of the world. The face validity
of the three measures gives the impression that all three are both valid and reliable.
Influences of the working memory

Procedure

Once a participant was found to complete the study, they were given a booklet. The booklet was always filled out in the Huron University College Library and all the booklets were completed between the times of 3pm and 5pm to ensure that the MEQ could be further analyzed if at all significant. The study was done over a three-day period to avoid any possible errors or inconsistencies in the time of day the study was taken. Each booklet that was handed out to a participant was checked twice before and once immediately before the participant took part in the study. This was done to ensure that there would be no missing or extra pages that would cause inconsistency between the participants. Each participant was given a letter informing the participants why this study was being conducted without giving any vital information away. The first page of the booklet was a consent form that explained the voluntary nature of the study and that at any moment, if the participant wished to; they could drop out of the study. As well, the participant was required to sign and date the consent form in order to continue. The participant was then given the booklet, which immediately introduced the first test to be completed. Below the instructions on the first page and on the second page of the booklet was the first questionnaire. On the third page of the questionnaire were the instructions for the MEQ as well as the first few questions. The fourth and fifth pages of the questionnaire were the rest of the questions that comprise the MEQ. After the final question on the MEQ was completed, each participant was given clear instructions to hand their booklet back to the administrator and that they were about to complete a memory test. On the final page of the booklet was the memory test which can be found in Appendix B. Each participant was clearly asked to repeat the numbers in order back
Influences of the working memory to the administrator that were being spoken audibly. There were 18 random strings of numbers that started out at only two numbers and gradually went up to a total of 11 numbers in one string. All the strings of numbers were made randomly in a random number generator using the program Excel. Each participant was given the same 18 strings of numbers to avoid any inconsistencies or errors. After this final task each participant was given a debriefing session informing the participant what the study was about. All the booklets and consent forms used in the study are attached separately to this report.

Results

A 2 X 2 between-subjects ANOVA was conducted with memory as the dependent variable and DAS (depression/anxiety/stress) and MEQ (morning person/evening person) as the independent variables. The results indicated that there was a significant main effect for the DAS, F(1,20) = 9.96, p < .05, partial $\eta^2 = 0.22$, with those who scored low on the DAS (M = 6.5, SD = 1.32) scoring significantly higher on the memory test than those who scored higher on the DAS (M = 5.33, SD = 1.07). There was no significant main effect for the MEQ, F (1, 20) = 3.29, p < .05, partial $\eta^2 = 0.08$, with those who scored low on the MEQ (M = 6.25, SD = 1.29) having very similar values to those who scored high on the MEQ (M = 5.58, SD = 1.3) There was also no significance when comparing the DAS to the MEQ. Overall the participants who had a higher score on the DAS had scored lower on the memory test than in any of the other conditions. Attached to this report is an ANOVA summary table that can be found in Appendix A. Figure 1 shows a summary graph for the mean score on the memory test.
Influences of the working memory

There are two solid lines, one representing a low score on the MEQ, while the other represents a high score on the MEQ.
Figure 1. Summary Graph. The solid lines represent the mean score on the memory test for a low and high MEQ score, labeled respectively.

Mean Score on Memory Test

DASS Score

Low MEQ Score

High MEQ Score

Influences of the working memory
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Discussion

The hypothesis that was tested in the current study was that those who score higher on depression, anxiety, and stress (DASS) as well as score higher on the MEQ (morningness person) will do worse on working memory tests than those who score less on the DASS and MEQ. The statistical analysis of the current study that was conducted at Huron University College shows that there was a strong significance between the DASS and a person's abilities that were shown on the memory test. The data was obtained using a survey method that was given to participants who attended Huron University College. Some of the findings in the current study have shown a similar result to similar studies while other findings in the present study have not.

Although the study showed us a significant and strong correlation we must properly analyze what could be improved as well as discuss the major flaws within the study that could have caused there to be inconsistencies. To begin with our study at Huron University College involved only 40 participants, while all the other studies employed many more. As we have seen in other studies as well as past research, gender and age do play a large role when it comes to the DASS and MEQ. In the present study gender was not taken into account and that may have caused a bias in the study and inconsistencies. Men and Woman differ greatly when it comes to depression, anxiety, and stress due to a number of societal and mental reasons. (Gray, 1994) Woman in North America are more likely than men to live in poverty, experience discrimination, to have been sexually or physically abused in childhood or by a spouse, all of which contributes to depression, anxiety, and stress.(Gray, 1994) These reasons may have caused a larger number of women to score higher on the DASS than men. Another reason that women
Influences of the working memory

could have scored higher on the DASS may be that a woman’s role has higher demands with low rewards, perfect factors to cause stress, anxiety and depression in a person’s life. (Gray, 1994) If this is the case then the results will most likely have a feminine bias to it.

There were two studies that were quite similar to the present study. The first was a study that was conducted in the Republic of Korea that wanted to determine if depression had any significant relation to a person’s morning/day activity (moringness) or evening/night activity (eveningness). (Cho et al., 2010) What they found was that people who have been diagnosed with depression have usually been reported to be an eveningness type person. (Cho et al., 2010) Furthermore there has also been a correlation in the non-clinical world that associated depression with an eveningness type person. (Cho et al., 2010) The current study had an average age of participants of 20 years old and it is also a well known fact that morningness-eveningness is greatly affected by age, as the older one gets, the more likely they are a morningness type person. (Cho et al., 2010) In the current study there was no significant main effect between the MEQ and the memory test or even the DASS. This could have been due to the fact that the present study was conducted on a specific age group that research suggests is more likely to be evening type people (Cho et al., 2010); evening type people aren’t as likely to have a high score on the DASS. (Gray, 1994) The Republic of Korea study found a significant effect between a person’s MEQ score and depression. (Cho et al., 2010)

Another study conducted in Italy wanted to determine how depression in patients was affecting their sleeping. (Calati, Cruz-Fuentes, Gaspar-Barba, Natale, Ronchi,
Influences of the working memory

Serretti, Ontiveros-Uribe, 2009) The patients in the study were divided up into three different groups depending on their MEQ score. (Calati, et al., 2009) The present study divided the participants into two separate groups low (eveningness) and high (morningness). This was done because too many of the participants would have been marked as neither and it would have been too time-consuming to find individuals who were at the extremes of the MEQ. Unfortunately this probably caused a bias in the study that may have skewed the results and may well be one of the many reasons as to why the MEQ and memory test did not have a significant main effect.

During the study there were a few participants who became distracted, despite the best efforts of the administrator to eliminate all distractions. This was problematic for some of the participants as they were doing the memory test with distractions. This caused many of them to lose concentration and to receive a lower score on the memory test. To eliminate this problem and inconsistency in the future, the administrator should bring the participant to an isolated room and ask if the participant is ready to continue before stating each string of numbers.

The study conducted by (Huntjens, Verwoerd, & Wessel, 2009) involved a population of the same generation and similar geographic area that was used in the present study. This means that (Huntjens, Verwoerd, & Wessel, 2009) and the present study have participants that have similar personalities and goals than if the study was completed a few decades ago. It is also very reasonable to assume that the participants in our study all attended Huron University College as they were asked prior to the study; As Huron University College is a small liberal arts school and therefore would suggest that the students would have similar personalities and goals. The current study used
Influences of the working memory

participants ranging in age from 19 – 23 years of age, while the study conducted by
Huntjens, Verwoerd, & Wessel were ranging between 17-25 years of age. This is a very
small difference but is noted as it includes a wider age group. Another consideration that
should be made is the population sample. The population sample of the study is not a
proper representation of the general population. If this study was to be replicated in the
future, it should be administered online to get a larger population, more results, and
possibly less distractions and errors. One problem with a larger online study is that you
have to trust that the participants are all answering truthfully. There is no way to know
for certain so there would likely be some error in this regard but overall a larger study
can represent a larger population.

The present study was really about a persons’ span of short-term memory, a term
that quantifies the amount of storage someone has in their short-term memory with
numbers, letters, and sometimes short stories. (Gray, 1994) The span of short-term
memory for most people in terms of numbers is seven digits long, which is why
telephone numbers without area codes are seven digits long.(Gray, 1994) One of the first
studies ever conducted on a persons’ span of short-term memory was conducted by
Hermann Ebbinghas, a nineteenth century German who found that he could read a list of
nonsense syllables and could repeat it back successfully after one reading if the list had
fewer than seven syllables. (Gray, 1994) Once the administrator had informed the
participants of the current study the majority would immediately begin to concentrate
and could repeat the numbers in the memory test faster and more accurately as they all
now had a goal to beat. In future studies the administrator should enlighten each
participant about some background information that they find interesting. This will
Influences of the working memory cause the participant to be better focused on the study and would eliminate many errors and inconsistencies.

The methodology of the study that was conducted at Huron University College was well planned. The administrator of the study chose the study's participants individually. The participants of the study were all supposed to complete the booklet by themselves in a quiet area. The administrator of the study noted that five of the participants were speaking to each other and laughing about their answers during the actual completion of the booklet. This may have influenced some of the participants to change or alter their answers based on what the other had written. Since this had happened the data for those participants was not used in this study. Also although the Huron University College library is typically a quiet place, there were many distractions, as people still do talk and make noise. This could have affected the study as a majority of the booklets were filled out under these conditions. As stated earlier in the discussion to eliminate this problem and inconsistency in the future, the administrator should bring the participant to an isolated room and ask if the participant is ready to continue before stating each string of numbers.

Another variable that could have affected the statistical analysis is basic human error. The administrator of the study instructed each participant in the study what was to be expected of them, as well as what was written in the booklet. This may have changed the answers of some participants as this may have influenced them. The instructions may not have been explained properly and the participants state that they understand even though they may not have. This may have also caused some error and uncertainty in the
Influences of the working memory

study. To try and eliminate this error in the future the administrator should do their best to ensure every participant understands what task they need to complete.

In conclusion, I believe that if the above recommendations to change the study were invoked, we would see a greater significance that would further validate the study. Statistical analysis of the data showed that there is a main effect between a participants score on the DASS and the score received on the memory test. This study showed that people who are more depressed, anxious, and stressed than the average person are more likely to have a worse working memory.
References


### ANOVA Summary Table

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<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>Partial η²</th>
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<td>0.084</td>
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<td>1.387</td>
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Appendix B

Memory Test

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Appendix C

Links to tests used in the current study

1. MEQ – http://ubcsad.bc-alter.net/MEQ.pdf as of April 12, 2010
2. DASS - http://www2.psy.unsw.edu.au/groups/dass/ as of April 12, 2010