

# Individual Differences of Directed Forgetting

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Griselda Alavez  
*University of Central Florida*

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# INDIVIDUAL DIFFERENCES OF DIRECTED FORGETTING

by

GRISELDA ALAVEZ

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major program in Psychology  
in the College of Science  
and in the Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

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Thesis Chair: Dr. Valerie Sims

## **Abstract**

The present study set out to evaluate the relationship between list-method directed forgetting and one's individual differences. Previous research has found personality and emotion as having an influence in how well participants were able to intentionally forget stimuli. Participants were split into a remember group and a forget group of 22 each and tasked to memorize a list of 10 words. They were then given a free recall test and the results for individual differences such as Need for Cognition, Mini-IPIP personality test, and Beck's Depression Inventory were analyzed. Our first hypothesis presumes that participants in the forget group will have impaired recall of words. The second hypothesis predicts that individual differences have an effect with how many words participants recall. Results in this study indicated that while individual measures proved not significant between both groups, overall recall for the first list was lower than recall for the second list. There were also indications of an interaction between amount recalled from lists and whether they were in the remember group or in the forget group. Analyses showed that remember group had a recall mean similar in lists 1 and list 2, while the forget group had a higher recall mean in list 2 and a lower recall mean in the list 1, indicating that directed forgetting had taken place in the forget group.

## **Acknowledgments**

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## **Introduction**

Directed forgetting is a fairly new concept and therefore, does not have a lot of research background because forgetting does not seem like something people would want to do typically, much less be able to do even if we wanted to (Bjork, 1998). Forgetting information is mostly seen as counterproductive but it is also very important to our existence. For example, it would be beneficial to forget an embarrassing event since it would also save us from emotional distress. It also serves the important purpose of decluttering our minds from useless information, permitting us to hold and recall memories that really matter. So far, this field of research is comprised of two types of directed forgetting methods. The first, is the list-method in which participants are given two lists to memorize. They are presented with the first list, following this list, a break in which participants are instructed to forget the first list they just saw. Many studies, such as the one conducted in 2002 by Sahakyan and Kelley at Florida State University, used “just for practice” as the forget instruction between the lists. Afterwards, participants are given the second list and then a free or cued recall test on both lists, even the list they were asked to forget. The second method of directed forgetting is the item-method, participants are shown a word or picture one at a time, each followed with equal probability to get an instruction to remember or forget that item (Quinlan et al, 2010). In this study, we examined list-method directed forgetting. During these forgetting tasks, the participant’s memory was analyzed with a list of different negative and positive valance words and they were instructed to either forget or remember that first list.

Multiple studies suggest that emotion may play a part in someone’s memory and that emotion may interfere with attempts to forget parts of the past that people would like to forget



(Payne & Corrigan, 2007). Banich from the University of Colorado, recreated a study based on a Think/ No-Think paradigm with nonverbal emotional stimuli and found that the paradigm worked and participants were able to recall scenes they were instructed to think about better than scenes they were instructed not to think about. This paradigm worked better with scenes that contained strong emotional content better than scenes with a lack of emotional content (Depue et al, 2006). This study was done with images as a way to fully capture the full emotional impact that emotion has on memory.

There are other researchers that have studied directed forgetting and how it may tie with negative emotions. Joormann and Tran created a study in which they found a correlation participant's ability to recall stimuli that was supposed to be forgotten to how susceptible they are to rumination. They defined rumination as the tendency to respond to negative life events and negative mood states with ruminative thinking which results as emotion dysregulation and a heightened risk for the onset and maintenance of emotional disorders (Joormann & Tran, 2009). Looking for individual differences in regards to rumination and the recalling of material can provide another way of determining how well an individual can intentionally forget something. More than emotion, personality could perhaps have a role in the way one can intentionally forget memories. One study has explored the link between memory and personality traits and found that conscientiousness had a great effect on directed forgetting (Delaney et al, 2015).

## **Literature Review**

### How Forgetting Occurs

How one defines forgetting depends on the person. Some might define it as failing to remember, the neglect to do something, or purposely stop thinking about something and shutting it out. Researchers have found that forgetting is more of a curve, much like what Herman Ebbinghaus (1913) demonstrated in his book. Ebbinghaus is widely known for his experiment on memory and the forgetting curve which theorizes that recall is high immediately after new memories are made and slowly fade over time. Using only himself as the sole subject of his study, he memorized nonsense syllables and graphed his amount of recall over time. His findings demonstrated that he recalled all of the stimuli directly after, but forgot over 40 percent of the stimuli 20 minutes after and about 70 percent over 24 hours. Although many criticize Ebbinghaus for being the only subject in the experiment, the forgetting curve is accurate in the sense that it shows the finding that memories are slowly forgotten if they are not practiced or used.

Research since has focused on how memory decays over time. Ebbinghaus finding of the forgetting curve led to the decay theory by Thorndike in 1914. In his book, *The Psychology of Learning*, Thorndike expressed throughout that memory decays over time if the information stored is not often remembered, making it harder to recall that specific memory later on over time. Thorndike went on to specify ways to facilitate the engraving of memories, leading to his three laws of Readiness, Exercise, and Effect. This decay theory led to the construction of interference theory and its sublevels of proactive and retroactive interference.

### Interference

According to Wixted, McGeoch's 1932 observation of interference theory further cemented the idea that basically, forgetting is not caused by the passage of time compared to how physical aging is affected by time passing (Wixted, 2004). In 1957, research done by Underwood believed that the reasons for participants forgetting was not because something outside of the lab had interfered, but because of something that had been said or shown to them inside of the lab. Throughout multiple studies, Underwood found that participants forgetfulness over a 24-hour period was affected more by the amount of lists they were tasked to memorize in the experiment. Participants who were asked to memorize one list of nonsense syllable words with no previous list had a 69 percent recall rate after 48 hours. Participants had 25 percent recall rate after 48 hours memorizing 3 previous nonsense syllable lists. Underwood's study demonstrated that forgetting did not occur due to retroactive interference but a proactive one and suggested that the Ebbinghaus curve of forgetting results from interference from materials learned in the laboratory. When the reason for this interference is taken away, we can see that forgetting actually decreases from 75 percent in 24 hours to 25 percent in over 24 hours (Underwood, 1957). These studies led researchers of directed forgetting to theorize that proactive interference plays a role in a participant's memory ability to purposely forget or remember. Not only is proactive interference a possibility, but a lot of times so is retroactive. Directed forgetting mainly focuses on the retroactive interference of the first list that is presented and therefore, most studies focus on this aspect of interference and what its causes are.

### The Source of Directed Forgetting

The invention of the list-method in directed forgetting has been credited to Bjork, LeGrand, and LaBerge back in 1968. They wanted to test if the students would be able to lessen

the proactive interference of the first verbal item if they gave instructions to forget the first item before the presentation of the second item (Bjork et al, 1968). He started his research as way to study memory load and it resulted in a method that many researchers would use for many years. Furthering his research, he came up with a phenomenon called the costs and benefits of directed forgetting. The costs of directed forgetting would be the impaired recall of the items in the first list after the forget cue has been given. The benefits of directed forgetting are those recalled items in the second list that were given after the forget cue (Bjork,1998).

After the settling of the list-method, one of the studies that followed this research was MacLeod's in 1999. In his study, MacLeod comparing the two dominant techniques of directed forgetting: the list-method in which a forget cue is inserted in after the first list and before the second list, and item-method which inserts a remember or forget instruction after each word is shown. He conducted his study with 48 students split into 2 groups of 24 participants for list-method group and 24 in the item-method group. All of the participants were tasked with memorizing 50 words after which two recall and recognition test were given. In the second free recall test, participants were paid 50 cents for each forget word that was recalled, as to ensure that participants were not withholding forget words they actually remembered in the first test. In the end, both methods showed a significant remember and forget difference in the free recall test, but when it came to recognizing items, the item method showed directed forgetting compared to the lack of remember and forget difference from the list method (MacLeod, 1999). Even after being offered compensation for additional forget words, participants were not able to recall any more than they did the first time, assuring that participants are not likely to withhold remembered items. Following the results of this study, it is concluded that the item method has participants

suspending their processing of the stimuli after the instructions appear, and since they don't process the forget words and process the remember words as instructed, participants aren't actually encoding this words enough to forget when they didn't memorize them in the first place (MacLeod, 1999) Regarding the list method, they found that a lot of the required processing to memorize has already occurred in participants by the time they get the instructions to forget halfway through the task, therefore any difference between remembered and forget words are because of restructuring of the encoded material after the forget instruction (MacLeod, 1999). The reason why this study was conducted with the list-method is because item-method seems to rely more on participants failing to encode rather than forget. When participants are given the forget instruction immediately after the word, they have not had enough time to deeply encode the word in a way that it requires forgetting later. The restructuring in the memory and list-method technique has become the subject of further directed forgetting research.

#### Effects on Memory

Researchers have looked at another angle of directed forgetting and studied the effects that different strategies have on memory. In a 2006 study, Benjamin studied how recognition memory is affected by the list-method directed forgetting. With 45 participants, each other them were tested with 80 different words that were in either green or red colors. The participant's memory was then tested with a yes/no recall task that listed all of the words they had seen and asked them to press yes or no if they remembered seeing the word and color, regardless of whether they had been told to forget it (Benjamin, 2006). His test results indicated that a cue to remember the first list led to poor memory for items in the second list, but a cue to forget the previous list eliminated this effect and led to a slight increase in performance across lists

(Benjamin, 2006). This result suggests the removal of retroactive interference under the forget cue, and supports the view that recognition is affected by directed forgetting (Benjamin, 2006).

As further research accumulates, results from directed forgetting studies are better understood. In 2003, Sahakyan and Delaney looked into how different strategies of encoding affected the recalling of the second list during list-method directed forgetting. It was hypothesized that shallow and deep encoding strategies could make a difference in the amount costs and benefits that were gained after the directed forgetting task. With a total of 192 participants, a study was created to test half of them in a shallow encoding condition and the other half in a deep encoding condition (Sahakyan & Delaney, 2003). The shallow encoding group was simply told to repeat and include each word in the repetition cycle as they appear on the screen. The deep encoding group was instructed to make up a story that included every word that showed up (Sahakyan & Delaney, 2003). As a result, in both experiments the benefits of directed forgetting were eliminated and only the costs remained, concluding that proactive interference played a big role when participants were assigned a way of encoding memory (Sahakyan & Delaney, 2003). Contextual changes may affect directed forgetting in participants, another study by Sahakyan & Kelley concluded. In this study, participants were asked to change context in which the word lists were memorized. The data results matched what happens when context change is taken into account when doing a directed forgetting study (2002). When reinstating context, they had reduced costs and benefits of the change in context in the group that had its context manipulated (Sahakyan & Kelley, 2002). This proves that the context in which we receive or encoded memories have a say in whether or not we remember it.

### Think/No-think Paradigm

Anderson first published the paper that proposed the Think/No-think paradigm in 2001.

Anderson, like Freud, proposed that one is able to suppress memories and have it affect the amount of information that is recalled. To test his hypothesis, Anderson came up with the go/no-go paradigm and used it to investigate executive control in motor actions with primates and humans in a memory retrieval task (Anderson & Green, 2001). Anderson had participants that were tested on 40 pairs of words that they would later use for recall. Their study consisted of participants receiving a cue from some of the pairs shown. After each cue, participants were instructed to either recall and think about the word associated with the response word or the instructions could be to not think about the response word and therefore, suppress (2001). Regarding the suppression pairs, the subjects were told not to allow the pairs to be remembered and if they accidentally did remember, they would hear a beep that signaled their error (Anderson et al., 2001).

They stated that the goal of the paradigm is to determine if the prevention of awareness of a memory affects its later retrieval. Their study seemed to support that hypothesis as their results showed that final recall of suppressed items was worse compared to baseline items, and impairment increased linearly with suppression practice. On the other hand, recall improved across repetitions for respond items, demonstrating the benefits of retrieving memories on later recall. These diverging patterns show that controlling awareness not only terminated the powerful facilitative effects of retrieval, but also impaired the recall of suppressed items (Anderson et al., 2001). Although their results do imply that there is a process that prevents one's

ability to retain or recall unwanted memories, other processes beyond repression may be a factor as well.

### Individual Differences

#### Personality

In 2015, Delaney, Goldman, King & Nelson-Gray studied how personality might correlate with directed forgetting using the Big Five Inventory scale. They gathered 120 undergraduate students and split them into experimental and control groups. Both groups were given two lists that they were tested on after both lists were presented. Their study found that the remember group recalled both lists about the same while the forget group recalled the list they were told to remember better than the list they were told to forget. When they correlated their results with the BFI, Conscientiousness and Openness showed greater recall of list 2. Neuroticism had little effect of directed forgetting but dysphoric mood did show directed forgetting benefits (Delaney et al., 2015).

#### Rumination

In 2009, Joormann and Tran conducted a list-method directed forgetting study focused on rumination. To investigate this maladaptive response style, their study examined whether rumination is linked to individual differences in the ability to intentionally forget emotional material. They had 20 males and 13 females participate, half of which receive a forget instruction after the first list was presented, and the other half was given a keep remembering instruction after the first list was presented. All participants were told to remember the second list. Each list had a total of 10 positive and 10 negative words, totaling 40 words with both lists. After, a recall test was given and they were asked to recall all words from both lists. Participants were asked to complete the Ruminative Responses Scale and a Center for Epidemiological Studies Depression



Scale, which is a self-report scale designed to measure depression symptoms. Their results showed very little directed forgetting for the high ruminators whether they were under forget or remember instructions. When compared to low ruminators, however, the high ruminators presented high rates of recall for words that were supposed to be forgotten (Joormann et al., 2009). Rumination very well ties in with Need for Cognition. Ruminators mainly focus on past experiences to the point of constantly thinking about them and that is somewhat similar to Need for Cognition. The fact that they both have a high need for that mental stimulation and thinking could be a factor in how well one forgets or remembers when instructed to do so. To better illustrate this, perhaps an individual with a high need for cognition may recall more words but since they are also high in rumination, the remembered would result being negative rather than positive.

Wong et al., investigated high dysphoric and low dysphoric students in her 2007 study with item-method directed forgetting. They had a total of 80 students that were then broken up into two groups of 40; a rumination group and a distraction group. Before the word tasks began, the rumination group was given a series of statements that were self-focused while the distraction group was given statements that were externally focused. Participants were presented with positive, neutral and negative words. Overall, it was hypothesized that participants with high rumination and dysphoric levels would recall a higher rate of negative words despite whether they were told to remember or forget them (Wong et al., 2008). Participants were given the Beck Depression Inventory, Beck Anxiety Inventory, and the Ruminative Responses Scale to measure rumination and dysphoric states.

The results depicted that high dysphoric participants in both the rumination and distraction conditions demonstrated directed forgetting effects and demonstrated better recall of to-be-remembered than to-be-forgotten words, for all positive, neutral, and negative words. Their results did not support the hypothesis that rumination enhances the encoding of negative information in high dysphoric participants (Wong et al., 2008).

### Emotion

Emotionally valent stimuli have been the subject of a large quantity of studies pertaining to directed forgetting. Studies such as Nowicka et al, demonstrated with an fMRI test that if one has the intention to forget and then actually forgets negative images, one gets a series of activations ranging from the posterior to the anterior parts of the right hemisphere brain, but with neutral stimuli, only one cluster of in the right lingual gyrus was activated (Nowicka et al., 2010). Their study gave strong evidence that emotion is strongly tied to whether one may be able to intentionally forget material. This is because since emotion affects our memories on a neural level, the more negative and strongly valent the material is, the much easier it is to recall, regardless of a forget instruction.

Additionally, in 2000, Power et al performed a study investigating the relationship between emotionally valent stimuli and depression. In the first experiment, they studied 110 participants without depression and 35 with depression. Results showed that both sets of participants displayed directed forgetting, with participants without depression recalling more positive valent items while participants with depression recalled an even amount of negative and positive items. In a third experiment, Power et al had participants with clinical depression and anxiety, and a group of “healthy” participants. It was concluded that participants with depression

showed increased retrieval for to be forgotten negative words but this effect was not present in the other two groups (Power et al, 2000). Power also stated that this directed forgetting task could potentially be used to study the links between cognition and emotion in clinical populations. This could greatly affect therapy for patients and relieve some stress from having negative memories.

In 2008, Minnema and Knowlton speculated that arousal was more effective in recalling material than negative emotionally valent material. Three hundred participants were set up into 10 groups of 30 and studied sets of lists with positive, neutral, and negative words. Their study found that negative valent stimuli also prevailed in the participant's memory and the effect successfully correlated with the negative emotion as assessed by PANAS, hence supporting the idea that directed forgetting depends on cognitive control that are interrupted by a negative emotion (Minnema & Knowlton, 2008). Continued research has shown that negative stimuli is still prevalently remembered across studies where mood is involved. These studies highlight the importance of directed forgetting to be studied along with natural forgetting. It is a phenomenon that could potentially change the way trauma patients receive therapy for their recollections of harmful memories.

## **Research Objective**

The goal of this study is to expand on the findings of past research and explore the effects individual differences have on directed forgetting when participants are presented with emotional stimuli. Participant results from the memory task will be analyzed to examine how well they can willingly forget certain stimuli when compared to individual differences measures. These measures included scores from the Mini-IPIP scale that tests whether certain results are obtained because of the participant's personality. Conscientiousness could be associated with more forgetting because people would be more likely to make an effort to forget; Agreeableness could influence their willingness to go along with an experimenter's instruction to forget; Neuroticism can cause some to be suspicious and less likely to comply (Delaney, 2015). The Beck's Depression Inventory will be included to investigate for a relationship that shows increased recall of negative stimuli if one is prone to depression. A Need for Cognition Scale is also included to examine if increased recall of overall stimuli is related to how much they enjoy mental stimulation. Finally, a demographics survey will be conducted to find any other correlations between individual differences and recall. Our first hypothesis presumes that participants in the forget group will have impaired recall of words. The second hypothesis predicts that individual differences have an effect with how many words participants recall. This study uses a between-subject design to analyze differences between the control and treatment group.

## **Method**

### Participants

Participants were college students from the University of Central Florida. They were able to sign up for the study through the UCF SONA system. This study had a total of 46 participants ranging from the age of 18 through 35. Participants were also awarded 1 credit on SONA.

### Stimuli

Participants were tested on stimuli taken from the Affective Norms for English Words (ANEW) database. The stimuli consisted of two sets of lists, each list containing 10 negative and positive words that the participants in the control group were instructed to remember and participants in the treatment group instructed to forget. The ANEW program (Bradley & Lang, 1999) was provided to the University of Central Florida by the Center for Emotion and Attention (CSEA) at the University of Florida. The entirety of the 20 words were chosen based on their valance as stated in the ANEW database. Negative emotion words have been rated with a lower valance while emotionally positive words have a higher valance. Word length was also account for since word length is a factor during recall, and words were kept at a minimum 6 letter count and a maximum of 8 letter count. Two charts containing the word lists in the order in which they were presented, are located in the appendix, containing the words, valance, standard deviation, the number of the word in which it is located in the database, and letter count. After having completed the memory tasks, both groups of participants were given a Need for Cognition survey, a mini-IPIP survey, the Beck's Depression Inventory scale, and a demographics survey on Qualtrics.

## **Procedure**

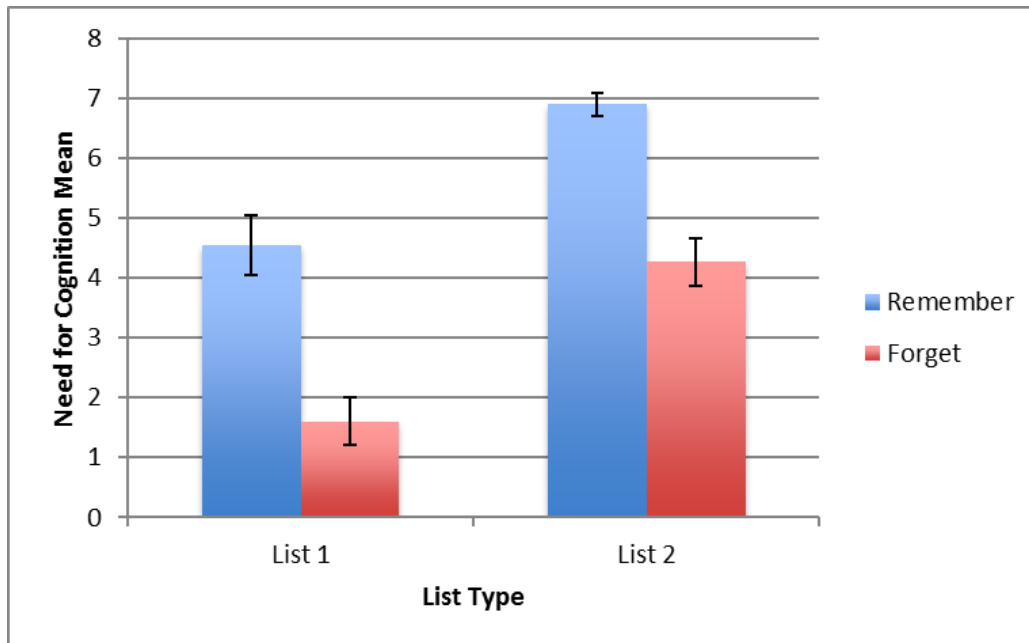
This study used a between-subjects design, therefore half of the participants were randomly assigned into the treatment group while the other half were randomly assigned into the control group. Participants were seated at a computer in a private lab room where they were given a consent form as well as instructions to memorize the words shown. They were told they will be performing a memory task with a lists of words and to try their best to memorize them because they will be asked to recall them immediately afterwards. In the treatment group, the PowerPoint program was used to display the list of 5 negative and 5 positive words. These 10 words were black in color located in the center of the screen with a plain white background. The word list lasted on the screen 5 seconds for each word, 50 seconds total for the list. Immediately after, instructions appeared after instructing participants to forget the first list, as it was only practice. These instructions lasted on the screen for 10 seconds. A second list of different 5 positive and 5 negative words were then displayed for 50 seconds in the middle of the screen. Instructions to remember this second list appeared on the screen and lasted for 10 seconds. Participants were then asked to recall both lists, including the one they were instructed to forget, with no time limit. The control group went through the same process and were asked to memorize the same lists of words, but were given a remember instruction after the first list, asking them to remember the first lists as well as the second list they were about to see. A free recall test with no time limit was given at the end for the control group. Once the word task was completed, participants were asked to complete a series of surveys on Qualtrics. These surveys included the Need for Cognition survey that measures the extent to which they enjoy mental stimulation, the Beck's Depression Inventory that will report their depressive tendencies, and the mini-IPIP personality scale to measure their Openness to Experience, Conscientiousness,

Extraversion, Agreeableness, and Neuroticism. Finally, a demographics survey was given to look for other significant personal differences. Participants had a total of 1 hour to complete this study and were given a debriefing statement about the true nature of this study.

## Results

### Need for Cognition

After processing results and excluding 2 participants, we had a total of 44 participants whose data was used for this study. Both the forget group and the remember group had a total of 22 participants each. To test for individual differences, a median split was done on the data for Need for Cognition(NFC) with a low score being up to 57, and a high score being 59+. The results of this study was completed using a 2x2x2 mixed Analysis of Variance (ANOVA), between group and NFC and within list variables. The inputs were as follows: 2(remember and forget group) x 2(NFC high/low) x 2(1<sup>st</sup> or 2<sup>nd</sup> list). Results for NFC were not significant at  $F(1, 40) = 3.75$   $p = 0.06$  and can be seen below in Figure 1.



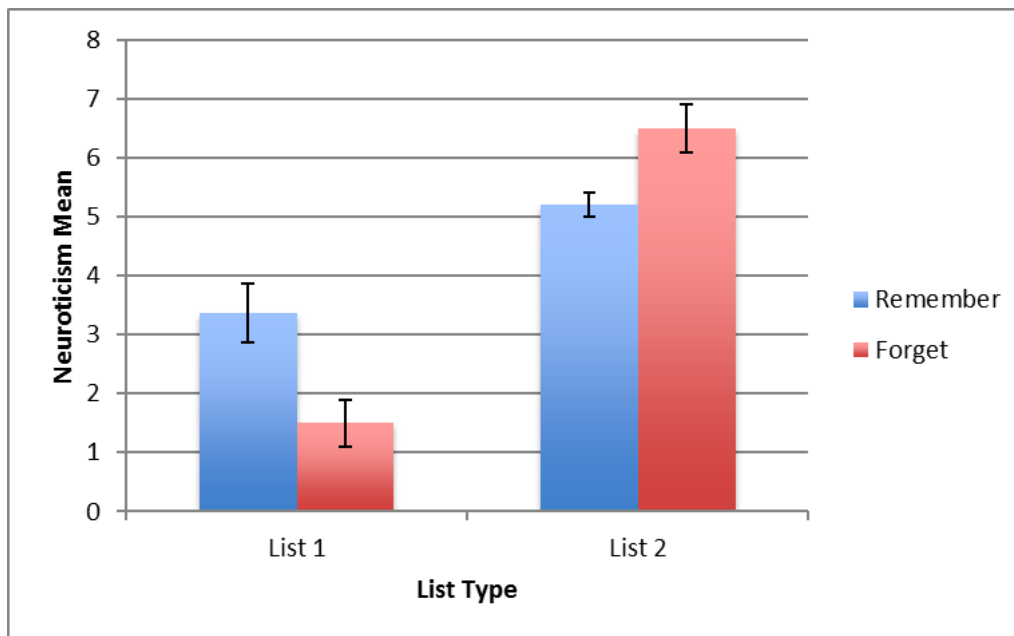
**Figure 1: Need for Cognition mean was not a significant effect for list and groups.**

Means resulted in list 1 x forget group x NFC  $M = 1.59$ ,  $SD = 1.76$ , mean for list 1 x remember group x NFC  $M = 4.54$ ,  $SD = 2.66$ . Mean for list 2 x forget group x NFC were  $M = 4.27$ ,  $SD = 2.20$ . Mean for list 2 x remember group x NFC  $M = 6.90$ ,  $SD = 2.04$ .



### Neuroticism

For Neuroticism it was decided to do a median split with a low score of up to 10 and a high score of 11 or more. We also did a 2x2x2 mixed ANOVA between groups and within list variable for Neuroticism. Our inputs were 2(remember and forget group) x 2(Neuroticism high/low) x 2(1st or 2nd list). Results for Neuroticism were not significant at  $F(1,40) = .407$ ,  $p = .527$ . This is displayed in Figure 2 below.



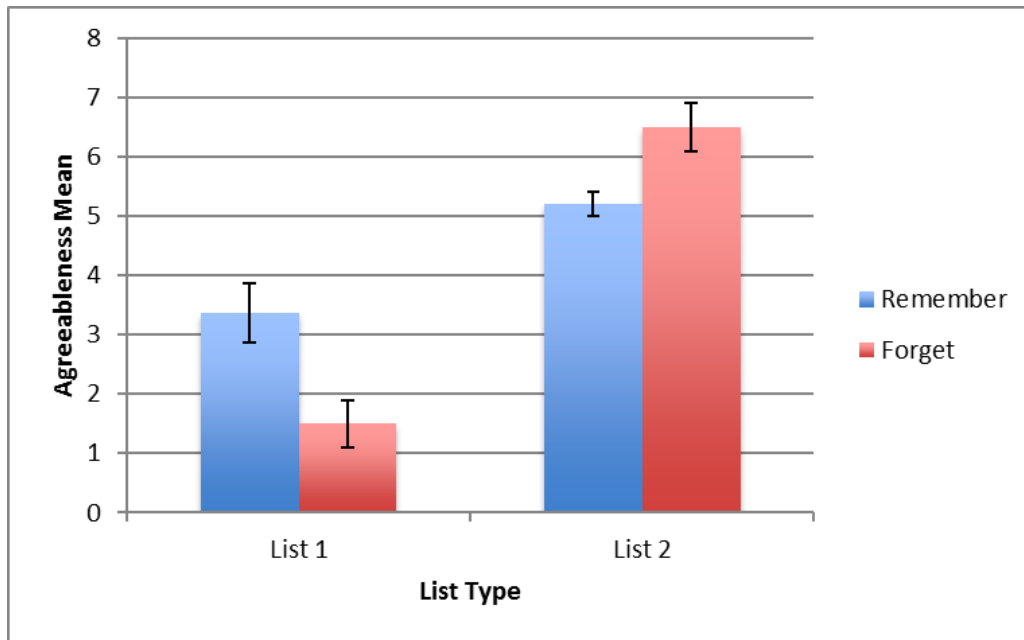
**Figure 2: Neuroticism did not have a significant effect for lists and groups.**

Mean used for graphing were list 1 x forget group x Agreeableness  $M = 1.50$ , mean for list 1 x remember group x Agreeableness  $M = 3.37$ , mean for list 2 x forget group x Agreeableness  $M = 6.5$ , and mean for list 2 x remember group x Agreeableness  $M = 5.2$ .

### Agreeableness

For Agreeableness we also did a median split with a low score of up to 57 and a high score of 59 or greater. A 2x2x2 mixed ANOVA was conducted between groups and within list

variables to test for Agreeableness. Our inputs were the same as previously stated with 2(remember and forget group) x 2(Agreeableness high/low) x 2(1st or 2nd list). Agreeableness results being not significant at  $F(1, 40) = .407, p = .527$ . This can be seen in Figure 3 below.



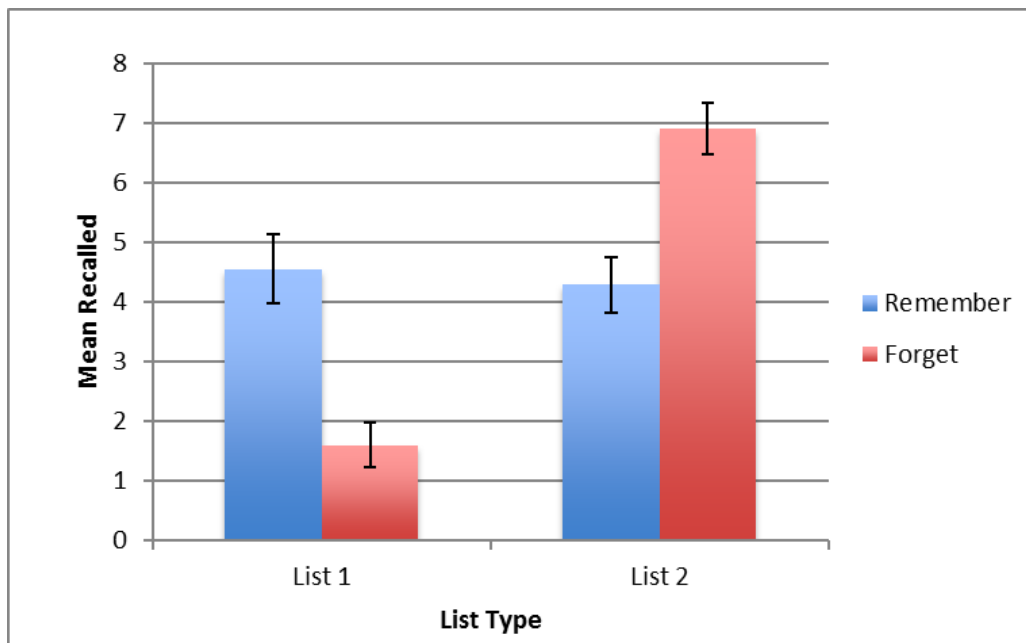
**Figure 3: Agreeableness was not significant for list type and group.**

Means for agreeableness did not differ from neuroticism, therefore we used for list 1 x forget group x Agreeableness  $M = 1.50$ , mean for list 1 x remember group x Agreeableness  $M = 3.37$ , mean for list 2 x forget group x Agreeableness  $M = 6.5$ , and mean for list 2 x remember group x Agreeableness  $M = 5.2$ .

#### List Significance

Although there was no relationship between Need for Cognition, Agreeableness, Neuroticism and the list recalled, the analysis did yield a main effect for list at  $F(1, 40) = 19.06, p < .001$ . This led to the mean for list 1 ( $M = 3.15$ ) being lower than the mean for list 2 ( $M = 5.51$ ) resulting in overall recall being higher for list 2 than for list 1. There was also a significance

between list and group interaction  $F(1, 40) = 31.44, p < .001$ . For the remember group, means for list 1 and list 2 were similar ( $M=4.55, SD= 2.66$ ) and ( $M= 4.28, SD= 2.20$ ). In the forget group however, list 2 ( $M= 6.90, SD= 2.05$ ) was higher than list 1 ( $M= 1.60, SD= 1.76$ ). These effects are shown in Figure 1 below.



**Figure 4: Remember group mean stayed about the same, Forget group mean is much higher.**

This graph shows how directed forgetting actually occurred as intended in the forget group. The remember group recalled just about the same amount of words for both lists. This results matches to results often found in the directed forgetting literature. This may be in part because the remember group was instructed to focus on both lists of words, making participants more likely to encode the two lists as one entity instead of two.

## Discussion

Although all of our individual differences resulted not significant, directed forgetting was still observed in the forget group. In the remember group, there was a small effect size of  $d = .11$ , with the forget group however, there was a large effect size of  $d = 2.77$ , meaning that the forget instruction had significantly affect the participant's memory. This impairment of recall of the list 1 and improved recall in list 2 of the forget group, may be attributed to the interruption in the way stimuli is being encoded in the participant's memory at the time. Sahakyan and Delaney (2003) illustrated this concept by proposing that the benefits (recalled items) when directed forgetting happens are actually because participants begin to use a different encoding strategy to encode list 2. It is very well plausible that participant's in the forget group may have interrupted their encoding after being instructed to forget the list 1 and began encoding list 2 a different way, resulting in more costs for list 1.

This is could also be explained by context change. Past research has shown that context can be used as cue for memory retrieval and that is what Sahakyan and Kelley (2002) studied internal context change and found that forgetting occurred because of the change in mental context that these participants were instructed to focus in. Sahakyan's study also found that directed forgetting could also take place when the forget instruction was replaced with an instruction to mentally change context when learning list 2. It is reasonable to conclude that directed forgetting has occurred as intended in the forget group and since individual difference measurements were inconclusive, perhaps participant's encoding or context strategies had an effect in recall.

Our results could also be explained with the 7 plus or minus 2 theory of short term memory. Our lists contained a total of 10 words each so it was very feasible for participants to hold almost an entire list in their short term memory throughout the memory task which lasted roughly about two minutes. Perhaps a longer list of 15 or more words may help avoid the possibility that participants recall more words because they can store more items in their short term memory.

What these results mean for the future is that there is a strong possibility that if this theory is consistent and reliable, this may affect the clinical therapy population. Such an example would be Bipolar Personality Disorder which makes one focus on the negative over the positive, especially during an episode. A study tested directed forgetting and individuals with BPD and without BPD and showed them positive, neutral, and borderline words. The study resulted in that participants with BPD in the forget group recalled more borderline words that they were instructed to forget as opposed to neutral or positive words (Korfine & Hooley, 2000). In the end, directed forgetting could become a way to either possibly identify if one is susceptible to a disorder or become a way of treating it.

Although in this study we didn't find any significant effects for our individual differences (Need for Cognition, Neuroticism, and Agreeableness), we wonder what would have happened if we had? Since Need for Cognition results nearly significant, we would have been able to say that participants who were able to retain and recall more words are people are high in Need for Cognition. This means that if one tends to enjoy more mental stimulation and challenges themselves to constantly work on solving problems that requires a lot of thinking, then it would

make sense to have a higher memory capacity and be able to retain more words than other participants who didn't have a score such as high.

If neuroticism had been significant, we would have perhaps been able to imply that since neuroticism affects one's memory, directed forgetting could have factors in which this could be used to help people who are high in neuroticism and help shape their therapy to them. If agreeableness had been significant, we would have concluded that being agreeable and be willing to do as instructed could help facilitate whether one remembers or not. Previously stated, another study found that participants who were high in openness did better recall in list 2 and participants with dysphoric mood showed directed forgetting (Delaney et al, 2012). This is important because if it is found that directed forgetting is affected by personality, it could change the way dysphoric or trauma patients are treated.

One limitation in this study would definitely be the sample size. We had a total of 44 participants and perhaps individual differences variables would have presented something of significance if we had a greater sample. It is also suggested for future studies that different measures of individual differences be applied, possibly encoding and context measurements. Further research could also use word stimuli with a high negative and high positive valance to analyze for correlations between the type of word recalled and the forget group. It could be very useful to match the results of past studies and find that the forget group recalled more negative words since they tend to be more salient than positive words.

All in all, forgetting memories has always been viewed as a negative aspect when in reality, it is a very important function. It is necessary to forget certain memories to prevent

overloading our memory with useless information. The questions of how can we forget memories, what is involved in that process, and if we can do it intentionally, could change the way we study memory in the future. Links between personality, dysphoria, and encoding could be studied further so a more concrete theory and causes of directed forgetting may be established.

**APPENDIX A: IRB APPROVAL LETTER**





University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
www.research.ucf.edu/compliance/irb.html

### Approval of Human Research

From: UCF Institutional Review Board #1  
FWA00000351, IRB00001138

To: Valerie K. Sims and Co-PI: Griselda Alavez

Date: November 03, 2016

Dear Researcher:

On 11/03/2016 the IRB approved the following human participant research until 11/02/2017 inclusive:

Type of Review: UCF Initial Review Submission Form  
Expedited Review

Project Title: Individual Differences of Directed Forgetting

Investigator: Valerie K. Sims

IRB Number: SBE-16-12569

Funding Agency:  
Grant Title:

Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 11/02/2017, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

*Kamille Chap*

Signature applied by Kamille Chaparro on 11/05/2016 03:12:03 PM EDT

IRB Coordinator Page 2 of 2

## **APPENDIX B: STIMULI**

Word List 1	Valence	Standard Deviation	Word Number	Letter Count
Awkward	3.20	1.79	#1130	7
Loving	8.28	0.88	#1804	6
Disaster	1.73	1.13	#121	8
Talent	7.56	1.25	#427	6
Menace	2.88	1.64	#275	6
Render	4.50	1.33	#2077	6
Behave	5.50	2.05	#1166	6
Funeral	1.39	0.87	#178	7
Vehicle	6.27	2.34	#473	7
Champion	8.44	0.90	#67	8

Word List 2	Valence	Standard Deviation	Word Number	Letter Count
Detach	3.19	1.57	#1418	6
Romantic	8.32	1	#364	8
Failure	1.70	1.07	#156	7
Excite	7.60	1.29	#1513	6
Blister	2.88	1.75	#661	7
Cattle	5.50	1.74	#1260	6
Policy	4.50	1.55	#1992	6
Murderer	1.53	0.96	#289	8
Voyage	6.25	1.191	#1028	6
Laughter	8.45	1.08	#251	8

## **APPENDIX C: DEMOGRAPHICS**

Q1 Select your gender

- Male
- Female

Q2 How old are you?

Q3 Class standing?

- Freshman
- Sophomore
- Junior
- Senior
- Super senior

Q4 What is your major?

Q5 What is your ethnicity?

- White
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Hispanic
- Other

Q6 Do you engage in memory exercises?

- Yes
- No

Q7 Please select yes

- Yes
- No

Q8 Is English your first language?

- Yes
- No

Q9 Are you an introvert?

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q10 Are you an extrovert?

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q11 Do you believe it is possible to voluntarily forget memories?

- Extremely believable
- Somewhat believable
- Neither believable nor unbelievable
- Somewhat unbelievable
- Extremely unbelievable



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