

COGNITIVE ILLUSIONS

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ABSTRACT

Though much research has been done on social contagion and false memory, there is a dearth of such inquiry into the correlation between the aforementioned and personality/group settings. We set out to prove that introverts are more susceptible to false implantation of memory. Experimentation began as students were arranged into six groups of 12 people each; two were made up of all extroverts, two of all introverts, and the other two of an even mix of both types of people. Analysis of our data has shown that no statistically significant difference in memory exists between the two groups of people. We did find, however, that in other comparisons, such as those of homogeneous (all of same personality type) versus the mixed (even spreads of different personality types), the mixed groups did much better on certain portions of the administered memory tests and were much less susceptible to false memory implantation. Many other statistically significant variations occurred and are detailed in our discussion. Our novel research suggests that diverse personality dynamics affect memory implantation and perhaps memory in general.

INTRODUCTION

Memory is an intrinsic and essential element of human life. When we study for an exam, look through an old yearbook, describe dinner the night before to a friend, or even complete everyday tasks such as typing or walking upright, we utilize our ability to form memories. However, as much as we depend on our memory and believe it to be accurate, there are also instances where our memory is faulty. Generally, these lapses are errors of omission, when events have simply been erased from memory. These errors were studied by Ebbinghaus in 1885, who investigated the rate at which one forgets information, the ability to retain information, and the effect of an item's position in a series on recall [1]. Less common, but more interesting, are errors of commission, also called false memory. These occur when an individual remembers something that never happened, such as eyewitnesses giving contradictory testimonies about the same crime. Another example is seen when someone hears a friend's anecdote so often as to believe he was actually there.

As early as 1959, scientists have studied this phenomenon in psychology experiments with the establishment of Deese's paradigm. Subjects were given a list of words related to a key word that itself was never mentioned (i.e. *thread, pin, eye, sewing, prick, point, thimble, haystack* for the key word *needle*). Nevertheless, many of the participants incorrectly remembered it when asked to recall the list [2]. Similarly, experiments were conducted involving eyewitness testimonies where participants looked at slides of a car accident. Although a yield sign was

never seen, its existence was later suggested, and upon recall, many subjects falsely stated that there had been a yield sign at the intersection [3].

Roediger, Meade, and Bergman [4] further studied false memories and added the factor of social influence. In their experiments, a subject and confederate looked at pictures of common household scenes together, and then completed a collaborative recall session where the confederate suggested items that had not been in the scenes. When tested on which items had been in the scene, the subject who had worked with a confederate showed less accuracy on the test than those in the control situation with no suggestions. The Roediger, Meade, and Bergman study indicated that false memories are subject to social influence.

Later experiments investigated the degree to which personality traits affected an individual's susceptibility to false memory. In personality psychology, there is a "Big Five" of personality: social versus reserved, limbic versus calm, organized versus unorganized, accommodating versus egotistical, and non-curious versus inquisitive behaviors. Social/reserved measures how extroverted an individual is, considering characteristics such as how open he is, how much he enjoys attracting attention, how he responds to peers, and so on. Limbic/calm, also known as emotional stability, gauges how a person managing internal and external stress, while organized/unorganized determines how neat he is. An accommodating person will put others before himself, and, in contrast, an egotistical person will usually put himself before others. Finally, an inquisitive individual always seeks to discover, invent, and imagine, while a non-curious individual tends to avoid new ideas and changes [5]. Among these five traits, there is a wide spectrum of possible personalities, all of which may or may not affect how a person reacts to false memories.

The subjects watched a clip of a crime scene and read a description of that scene that included some false information. Additionally, they had to complete a source monitoring task that measured their imagery capability. Their results indicated that high imagers were less able to discern the planted memories from the true ones, [6] indicating that personality differences can contribute to the formation of false memories. Similarly, OJaschinski and Wentura reported that the ability to correctly remember the details of a sequence of events despite fabricated information about it was negatively correlated with an individual's working memory capacity [7]. Even with the original Ward and Loftus experiments, measuring participants' Jungian types indicated that introverted and intuitive subjects are more susceptible to misinformation than extroverted and sensing participants. In other studies that did not directly test the misinformation effect, Yerkes and Dodson investigated differences in extroversion and their link to variations in learning and memory. Categorizing participants using the Eysenck theory of personality, they asserted that introverts had a tendency to learn simple tasks more readily while extroverts had optimal performance when performing complex tasks. In addition to this experimental evidence, physiological evidence for the differences between introverts and extroverts was obtained by Savage who discovered statistically significant differences in the electrocerebral activity between these two groups. [8]

Considering this with the idea of a social contagion from the Roediger, Meade, and Bergman study, we decided to focus on the trait of extroversion and its effect on susceptibility to false memory with a factor of social influence from a confederate. Since extroverts and

introverts react to the people differently, we asked if a variation existed in one's susceptibility to false memories in a group context. To answer this question, we developed an experiment to determine the degree to which extroverts and introverts in a group were influenced by false memories implanted by a confederate. We suspect that the degree of social contagion in a group setting will be greater among introverts than among groups composed of extroverts.

METHODS

Participants

The students who attended the 2006 New Jersey Governor's School of Sciences at Drew University were the participants in the Psychology Team Project, excluding the 13 of us who ran the experiment. Of these other 72 students, 37 were female, 35 were male, and ranged in age from 16 to 18 years old as all participants were rising seniors in high school. The SLOAN Personality Test, which categorized people as introvert or extrovert, was used to split the participants into six groups of twelve. Two of the groups were composed of all introverts, two of all extroverts, and two were mixed.

Materials

Card Trick: The trick consisted of the magician cutting to specific cards. First, he put half the cards face up into the rest of the downward facing deck. Next, he cut the deck three times and revealed the first seven. The cuts and revelation were repeated two more times. The fourth time, he cut the deck twice to show a king. At this point, he pretended to have made an error.

However, this was shortly proven to be part of the trick, as when he rubbed the king over the other three cards, they were revealed to be the other kings. Finally, he spread the deck on the table. All the cards were face up, with the exception of the four sevens.

SLOAN Personality Test [9]: This test was a 25 question personality test which categorized the participants in terms of five different personality traits: Extroversion (Social/Reserved), Emotional Stability (Limbic/Calm), Orderliness (Organized/Unorganized), Accommodation (Accommodating/Egotistical), and Intellect (Noncurious/Inquisitive) [citation]. All questions required the participants to rank themselves from 1 to 7 based on topics related to these five personality traits (see appendix).

Confederates: Two counselors working at the Governor's School of Sciences were asked to be confederates for the experiment to implant false memories.

Memory Implantation Test (MIT): This test consisted of thirteen questions. Eleven of the questions were used for data while the last two questions were used to throw the participants off by strengthening the impression that the test was designed to uncover how they believed the trick was accomplished. Of the eleven meaningful questions in the test, three were based on the information implanted falsely by the confederate, three were based on the true information mentioned by the confederate, and five were not mentioned at all. This questionnaire provided us with the bulk of the data for the experiment.

Reasoning Tests 1 and 2: These were used mainly to create a time gap between the meaningful parts of the experiment and to obscure our exact purpose. One was the Linda the bankteller conjunction fallacy problem created by Tversky & Kahneman [10] and the other was the Cheap necklace problem [11] (see appendix).

Design:

All of the participants completed the personality test, which was then scored separately for the five different traits. After these were double-checked, they were individually entered into a spreadsheet. The ranges, means, and standard deviations of all five traits were calculated and assessed. Researchers decided to use the score that distinguished between reserved and social personalities in order to construct groups in the study because the scores of this trait had a large range and standard deviation as well as an even spread. The groups were made by switching students until the average scores in the two extrovert groups and of the extroverts in the control groups were almost equal. Similarly, the averages of the scores of the two introvert groups and the introverts in the control groups were almost the same. Once this was decided, the primary focus of the experiment was to find out which type, reserved or social, was more likely to create false memory after being influenced by a confederate. In addition, by separating the participants into like-minded and mixed groups, we were able to study the social dynamics of similar personalities versus diverse personalities.

Procedure:

We distributed the SLOAN Personality Test to each participant a week before the actual experiment took place. After these were returned, they were scored and the six groups were made. Once the groups were compiled, they were scheduled to see the magic trick and take the subsequent memory test. Two were scheduled for Monday July 31st, two for Tuesday the next day, and two for Wednesday the day after. Before the groups came to see the magic trick and take the test, the research team talked to the confederates, Alex Kohl and Kirsten Ruch, in order to tell them about the purpose of the experiment and their part in the experiment. They were provided with a rough script about what to mention in the discussion and told to prepare for the actual event. Each confederate was scheduled to lead an introvert, extrovert, and mixed group and was asked to repeat their “performance” in each group as consistently as possible. When students arrived for the meeting, they were first asked to sign a waiver allowing us to videotape the session and use their results from the MIT as part of our experiment. Each group was led to another room, where they witnessed the same magic trick performed by Alex Young, a member of the research team. This trick was a stimulus for later discussion and the memory questionnaire pertaining to the trick. After the trick, which took approximately five minutes, the participants were taken back to the original room and given two minutes to work on the first filler test. The purpose of adding a time delay between the trick and discussion was to allow their memories of the trick to fade and possibly make them more susceptible to the confederate’s misdirection. They were not aware of the purpose of this test. Following the filler test, the groups were given eight minutes to discuss the trick, with the purported reason of attempting to discover how it was performed. The confederate assumed the role of moderator in the group and led the discussion. At different points in this discussion, the confederate mentioned three true items about the trick, which appeared on the MIT administered afterwards. He or she also implanted three false pieces of information about the trick. After the discussion ended, participants were given five minutes to complete the second filler task, and were likewise not informed of its purpose. Finally, the participants were given five minutes to complete the thirteen question memory questionnaire. At the end of the session, participants were asked not to discuss the events of the experiment with anyone until after all the groups were tested to ensure our experiment would remain uncontaminated.

RESULTS

The average scores of the SLOAN Personality Test are shown in Table 1:

Table 1
Averages SLOAN Scores for Participants

Measured Traits	Mean	Standard Dev	Range	Average Type
Extroversion	19.0	6.1	28	(S)ocial
Emotional Stability	19.0	6.6	30	(C)alm
Orderliness	16.5	5.6	24	(O)rganized
Accommodation	19.6	4.9	22	(X) None
Intellectual Curiosity	18.2	4.6	24	(I)nquisitive

In the SLOAN Personality Test, subjects are scored through a variety of questions for five categories, with possible scores for each category ranging from five to thirty-five. The middle score, indicating no distinct personality type, is an X and corresponds with the score of twenty. Higher or lower scores are given specific labels, such as S for “social”, L for “limbic”, or U for “unorganized”, depending on the category scored. These labels are then combined to create a five-letter summary of the subject’s personality. The word SLOAN, after which the test is named, is a good example of this. The overall “average” personality type for a Governor’s School student would be SCOXI. [Table 1] However, this data is not absolute, as the standard deviation for the traits is quite high. For example, only 68% of the subjects are within 6.1 points of the mean extroversion score of 19.0, and a total of 30 out of the 67 of the subjects measured were not the social type. This applies to the other traits as well.

The primary dependent measure of interest was performance on the Memory Implantation Test (MIT). Questions were either about details not mentioned by the confederate (not mentioned), details correctly discussed by the confederate (correct), or details incorrectly mentioned by the confederate (misleading). For each subject we computed the percent correct for these three item types. In addition, we computed for each subject the percentage of times they falsely reported the implanted details (false memories). Finally, we computed for each person whether they had at least 1 false memory or not. Overall, the subjects got an average of 88% correct of the items never mentioned by the confederate. This was slightly more than the 80% correct average for items correctly mentioned by the confederate. In contrast, only 56% of the items mislead by the confederate were answered correctly. Twenty-eight percent of these items were incorrectly answered with the misleading information (the remaining 16% were answered with random incorrect responses). In fact, 64% of all subjects had at least one wrong answer corresponding with an implanted memory on the MIT. Finally, each subject was asked to rank the effectiveness of the magic trick on a scale of 1-5, the average rating was 4.36.

On the Linda the bank teller filler task, 42% of the participants correctly ranked the joint probability option last. Published normative data on this task reports that less than 15% of participants correctly answer the “Linda” reasoning test. Nine percent of the participants correctly solved the Chain problem. There was no correlation between correctly solving one task and correctly solving the other.

The first comparison of interest was the effects of being tested in groups of people with similar personality versus groups of mixed personality types. Four of our groups were composed of people of the same personality type (two of extroverts, two of introverts) and two of our groups were equally divided between extroverts and introverts. Figure 1 presents the comparison of these two groups on the four dependent measures of interest. While these two groups did not differ on memory for not mentioned and correctly mentioned items, mixed groups were statistically more likely to correctly answer the questions in which they were misled by the confederate [$F(1,65) = 7.4, p = .008$], and consequently, mixed groups were less likely to give the implanted information [$F(1,65) = 5.4, p=.02$]

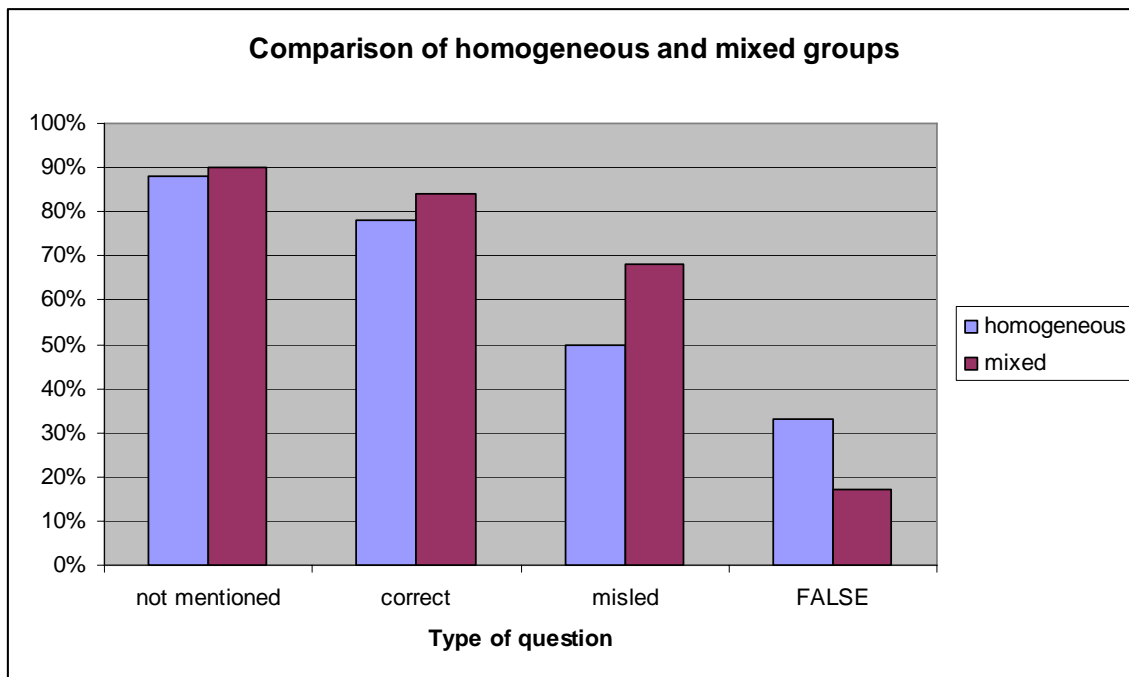


Figure 1: First 3 sets of bars indicate the percent of correct responses; the last set indicates the percentage of misleading questions that were answered with the false memories implanted by the confederate.

In addition to comparisons based on group type, we compared performance based on personality type. Comparing extroverts to introverts, there were few differences in these four measures (Appendix I).

Comparisons based on other personality dimensions, however, did reveal statistically reliable differences. Inquisitive versus non-curious types did not differ on memory for not mentioned and correctly mentioned items, inquisitive types had a much higher score on implanted false questions than non-curious types – 66% versus 46% respectively. These data have been shown to be extremely statistically significant, $p < .01$. Consequently, non-curious people were more likely to give the implanted false answer than inquisitive people, $p = .08$ [Figure 2]. Curiously enough, non-curious people found the trick (on a scale from 1 to 5) statistically significantly more entertaining than inquisitive people (4.24 versus 4.47, respectively; $p = .03$).

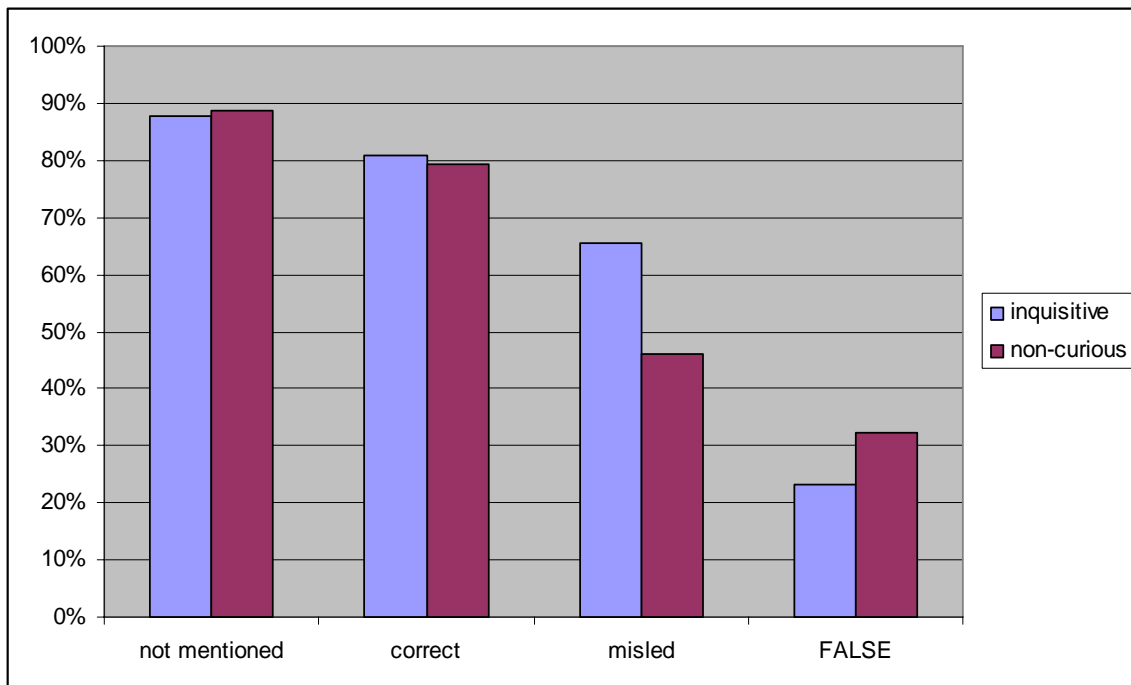


Figure 2: First 3 sets of bars indicate the percent of correct responses; the last set indicates the percentage of misleading questions that were answered with the false memories implanted by the confederate.

Organized subjects had a much higher proportion of wrong answers due to memory implantation than unorganized subjects, with proportions of 76% and 50%, respectively – again, t-tests have demonstrated that these data are statistically significant ($p = .02$).

Furthermore, accommodating personality types had a much higher proportion of subjects that remembered false memories compared to egocentric personality types, 76% versus 53%, respectively ($p = .05$).

Significant differences were also found between personality types in performance on the reasoning tests. The group which performed best on the Linda task was the reserved personality type, followed closely by the organized and limbic personalities [Figure 3]. Other discrepancies were seen with the “Chain” reasoning test. Three percent of Limbic personalities got the correct

answer, meaning that calm participants obtained the correct answer 15% of the time (the total being 18%), while all other personality types were split between 6% and 12%. [Table 2]

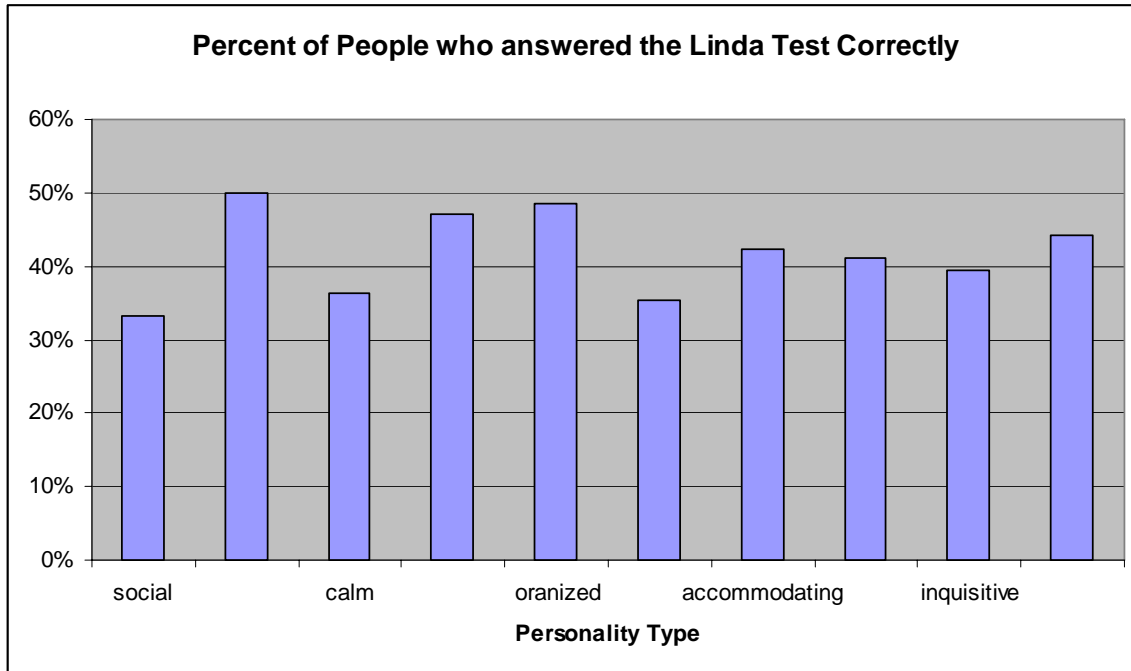


Figure 3: Personality traits are organized by groups of two, so the first two bars show the percent of participants who correctly ranked the three possible choices in order of probability split by Social/Reserved characteristics. The other 4 sets of bars follow the same pattern.

Table 2

Percent of Participants who Correctly Answered the Chain Problem by Personality Type
 Note that the each set of two characteristics forms a complete set of participants, and therefore a person may be Social and Calm, etc.

Personality Type	“Chain” Test Score (Percent Correct)
Social	6%
Reserved	12%
Calm	3%
Limbic	15%
Organized	12%
Unstructured	6%
Accommodating	12%
Egocentric	6%
Inquisitive	6%
Non-Curious	12%

DISCUSSION

The original purpose and intent of our experiment was to test the differences in susceptibility to false memory by means of a confederate between people with differing levels of extroversion. Our experiment was successful on many counts, using a previously untested and novel procedure we were able to successfully implant false memories in our subjects. The results of our experiment contradict our original hypothesis; our results indicate that a subject's level of extroversion did not significantly affect his or her susceptibility to false memory by means of a confederate. In addition to learning this, our experiment returned unforeseen results that showed that while homogeneous groups of introverts and extroverts demonstrated near-identical abilities in resisting false memories, heterogeneous groups demonstrated a vastly better ability to resist the implantation of false memories. Furthermore, our experiment also revealed other interesting trends regarding susceptibility to false memory with other different aspects of the Big Five personality traits.

Given that our experimental hypothesis was based on previous experimentation by Loftus and Ward that examined memory and susceptibility to false memory as a function of different Jungian personality types, it is noteworthy that our experiment was unable to duplicate the results of their experiment. Different procedures could have led to the differences in the results; that our experiment returned similar levels of subjects that answered test questions with implanted information suggest that our results are a viable comparison to Loftus and Ward's experiments.

Implications

Upon examining the results, it was immediately evident that our experimental hypothesis was inconsistent with our data. The results suggested that groups that were heterogeneous in composition were more resistant to false implantation than the two sets of homogeneous groups. This is evidenced by the percent of questions correctly answered by heterogeneous groups and by the fact that they responded less often with implanted information. What this data suggests is that in groups where the level of extroversion is varied, individuals are able to better resist social contagion and subsequently recall information more accurately than groups of introverts or extroverts. This poses an especially difficult problem in interpreting the data because it also suggests that there is something within the group dynamic of the mixed control groups that does not exist in the introverted or extroverted groups. Somehow the ability of the mixed group exceeds the ability of its individual parts.

There are several potential reasons why the mixed groups could have tested better than the introverted or extroverted groups. The experiment itself does little to explain why the control groups test best, so one is left to speculate on potential explanations. It is possible that the personality test issued did not test as accurately for extroversion as we had intended. The result would be that while our controls were designed to have equal numbers of introverts and extroverts and test their ability to resist social contagion as a group, they would be weighted

towards “true” introversion or extroversion while appearing to be equally spread. This seems to be the least likely possibility given the high levels of correlation between the SLOAN personality test’s ability to test for extroversion and the Myers-Briggs test’s ability to test for the same trait. The Myers-Briggs test is considered a standard in the sphere of psychology and because there is a strong relation between the Myers-Briggs test and the SLOAN test in analyzing extroversion it is unlikely that the data is a result of a problem in the original personality test.

More likely perhaps than the data being a result of the flawed personality test is the possibility that being in a group of mixed introverts and extroverts contributes to better group discussion and recall. There is also the possibility that the mixed setting could have increased the level of “positive” (true) social contagion between subjects. One explanation for this would be that the subjects within the control groups were most comfortable and better equipped socially to handle a group that was mixed between introverts and extroverts than were the homogeneous groups. To wit: it seems unlikely that in the social experiences of most subjects they would socialize actively with groups of people that were solely extroverted or introverted. Instead, it seems more likely that the subjects would have experience in social settings with groups of people with greatly varying levels of extroversion. It is possible that this greater experience in these kinds of social settings could lead to a greater level of comfort during the discussion session. This greater level of comfort could translate into a greater willingness among all individuals to participate and contribute to the discussion, creating what would be better and more accurate discussion with the addition of more input. Beyond this, there is also the potential that with a continuum of levels of extroversion, subjects are more comfortable and willing to listen to what other subjects have to say and thus depend less on the confederate for their information, yielding a greater resistance to false memories implanted via social contagion.

While the question of susceptibility to false memory as a function of level of extroversion was the primary question for our experiment, much of our experiment’s data extends beyond this sphere of interest. Though it was not contained within the original scope of the experiment, much of the data is statistically significant and suggests many other correlations between memory or reasoning ability and different personality traits. Within the same sector of personality, level of extroversion, additional testing during the experiment found differences in the cognitive abilities of the three groups (introverts, extroverts, and mixed) based on the two reasoning tests that were given during the same experimental session as the memory exam. The first of these tested the susceptibility of the subjects to heuristics in a logic problem. Heuristics are used in problem-solving to make obstacles less time and thought-consuming while usually allowing the individual to obtain a satisfactory answer. In our experiment, we tested the tendency within each of the different groups to use heuristics to obfuscate essential information in a logical problem. What we found is that there were statistical differences between the three different groups in their ability to correctly answer the problem. The introverted groups solved the problem correctly 42% of the time as compared to 29% of the time in the extroverted groups. Once again, however, the mixed groups performed best in the experiment, correctly solving the test at a rate of 57% of the time.

Again, speculation as to why this might be the case is difficult. Working independently of the control, one could draw the conclusion that because the introverted groups tested better on the heuristics test that they were less susceptible to its effects. It is impossible though, to align

this conclusion with the results obtained from the control groups of mixed introverts and extroverts. If it were true that individuals from one group or the other resisted heuristic analysis better than the other, then the control group would presumably return an average between the rates of the introverts and extroverts. Once again then, what these data imply is that there is something to the mixed group dynamic that affects the individuals even when they are being tested on an individual level without group interaction preceding the test. Returning to the original proposal for what is special about the group dynamic, it again seems possible that the comfort level created by the mixed social setting could contribute to better test-taking skills. Still, it should be mentioned that the test results of all three of these group types is abnormal. On average, most groups correctly complete the test less than 15% of the time. So, despite the fact that there are differences in the three group types for this test, all scores should be considered high. This is to be expected, to some degree, given that all of the subjects tested, as has been previously mentioned, were Governor's School students selected for their ability to think scientifically.

A second type of reasoning test revealed slightly different results. This test examined the ability of the subjects to think logically and quickly in a tightly controlled period of time. In this test the results varied between the three groups. In this test the introverted groups tested the best of the three groups, answering the question correctly 17% of the time. In contrast, extroverts answered the question correctly only 4% of the time while the mixed control groups answered the question correctly at a rate of 10%. Furthermore, results were amplified when the data were limited to the extreme half of each group, namely the most polar halves. These results are more exaggerated, with the extreme extroverts correctly solving the problem none of the time while the extreme introverts correctly solved the problem 18% of the time. This collective data suggests that introverts may have a stronger ability to solve logic-intensive problems under imposing time constraints. Seeing that introverts test better in this respect is not altogether surprising. In the context of an independent logic-intensive problem, one would expect that introverts would perform better independently under duress than extroverts who are more accustomed to working with others in groups to solve problems.

Because our group used a SLOAN personality test that assessed for Big Five personality traits, we also observed interesting correlations between false memory and specific traits. Compared to organized subjects, unstructured subjects were less likely to be fooled by false implantations. It is possible that organized people overanalyze and raise doubts in their minds while unstructured people are more likely to act on intuition; in the case of false memory, acting on intuition is more related to innate memory rather than implanted. Additionally, we found that inquisitive people resisted false memory more than non-curious people. This observation could be explained by the fact that non-curious people are more inclined to believe others, and inquisitive people are more disbelieving and tend to question others. Therefore, non-curious subjects could have trusted in the confederates more whole-heartedly than inquisitive subjects.

Qualifications

Although the results of this project are accurate within the context of our test subjects, NJGSS scholars, they might not be applicable to society as a whole. One factor that impedes the generalization of our results is the quality of our subjects. The scholars are the best and brightest that New Jersey has to offer. This exceptional group of teenagers is likely to perform better on

tests of reasoning and memory than would the average person. Another possible source of error arises from the results of the SLOAN test. Particular traits assessed by the SLOAN test were overrepresented among test subjects. For example, there were a disproportionate number of subjects that fell into the category of being organized as opposed to unstructured. Preferably of course, one would want experimental subjects to be evenly divided across all characteristics. Disproportionate spreads for personality traits like this one could have played an underlying role in affecting our results. For instance, if organization were correlated to resistance to false memory, then our experimental data for introversion and extroversion could be altered by the less-noticed correlation that existed between organization and susceptibility to false memory.

A key indicator that our group will probably perform differently than others is the heuristic test that we administered to our subjects. Generally, only about 15% of the population correctly answers a heuristics-based question about Linda the bank teller/feminist. Within our test group, an uncharacteristically high 40% answered correctly. While it is difficult to compare the results of Governor's School students' performance on the chain test to average subjects because of different time and pressure constraints within testing conditions, it is safe to assume that Governor's School students perform better within the constraints than would the average person. Simply given the fact that students are chosen to attend Governor's School based on their ability to think and reason well, it seems almost certain that these students would solve the chain problem at an exceptionally high level, just as they do with the heuristics question.

Inaccuracies

Studies on the human mind, personality, and group dynamics have an inherent plethora of variables. Initiating our study produced several possible inaccuracies. Personality tests in general rarely measure the full extent of the tester's personality. The SLOAN personality test, which determines a person's sociability, tenseness, organization, flexibility, and curiosity, contained a few ambiguous questions. For example, the differentiation between *invent* or *build* is more confusing than constructive, and *charitable* or *challenger* actually forced subjects to skip the question entirely. Furthermore, one cannot rely on the subjects to be fully capable of assessing their personalities. For instance, different situations may elicit a talkative side from even the most reticent and a messy side from the most organized. Therefore, arranging and classifying our subjects based on one personality test may have caused incomplete and thus imprecise.

During the actual test, there were a number of variables that could have influenced results. The trick may have been slightly altered in different trials of the experiment. Also, the group members proctoring the exams may have administered the tests slightly differently. Certain subjects did not show up, which altered the group dynamics of discussion, leaning groups slightly towards introversion or extroversion. The actual discussion had many inherent variables because the discussion itself cannot be controlled in an absolute way. The group dynamics meant that the confederates had to insert the implants at variable times, which creates a different impact and imprint on the subject's minds. Also, those with exceptionally precise memory may totally overturn the confederate, reducing the impact of the implants. However, in the scope of the entire experiment these niggling possibilities appear relatively minor. We maintain that this experiment is viable and is accurate to the greatest extent of our ability.

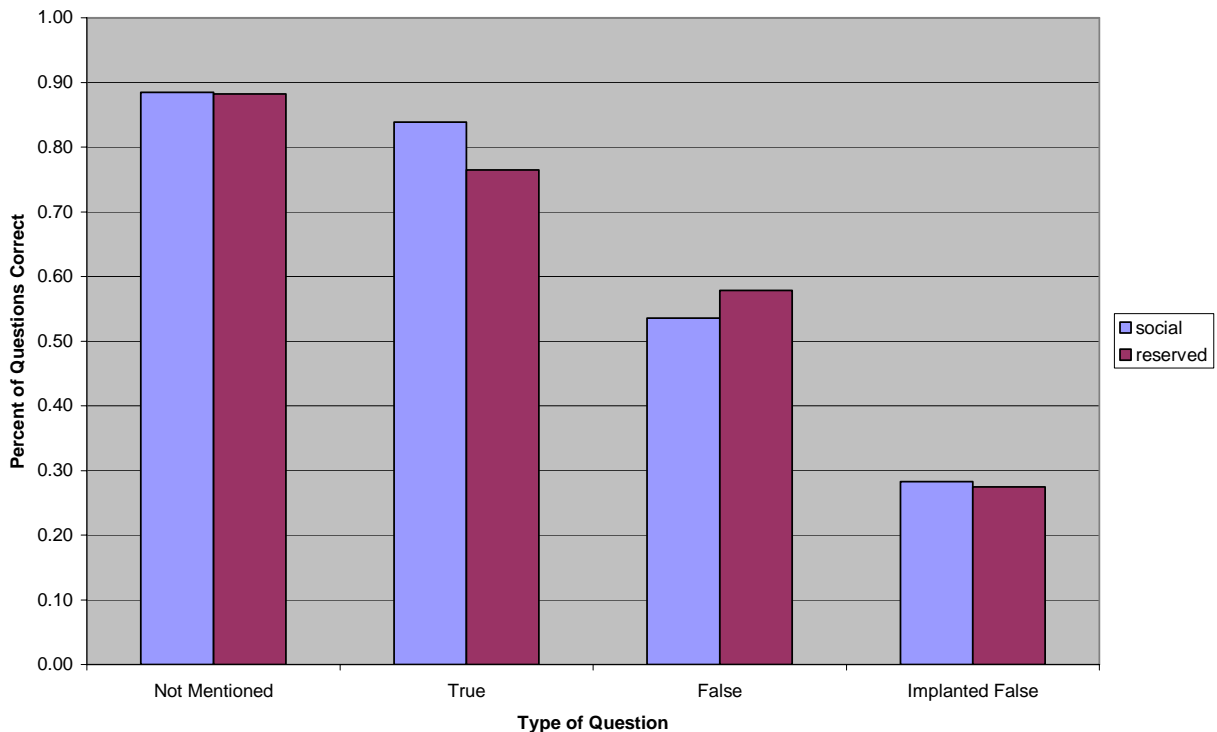
Conclusion

Although the differences in social contagion within groups of extroverts and introverts are small, we have found that diversity within a group is salutary to decision-making and successfully affirmed that social contagion, both positive and negative, does exist. Even though the results from this experiment do not necessarily have direct practical applications they suggest some interesting behavioral patterns. For example, it is disconcerting that false information is more easily planted within single-sided groups. While there are few direct applications for the knowledge that false information is best exposed within mixed groups, this information does suggest that future research should be done to test the effects of diversity in extroversion. Our experiment has shown that mixed groups of extroverts and introverts work together best in resisting false memory, but future research needs to be done to determine whether or not the benefits of working in these mixed groups extends beyond the field of memory. Do people accomplish more in the workplace if they are in groupings of mixed introverts and extroverts? Much has been made in the past of sports teams' chemistry. Are there correlations in "chemistry," performance, and the distribution of extroverts and introverts? Does the homogeneity of groups have an effect on social interactions? It is our hope that further knowledge on the impact of diverse personalities on social dynamics will benefit society.

APPENDICES

Appendix I

Memory Survey Results of Social and Reserved Personalities



Appendix II

Please read the following description and answer the question below.

Linda is 31 years old, single, outspoken and very bright. At university she studied philosophy. As a student she was deeply concerned with issues of discrimination and social justice and also participated in anti-war demonstrations.

Now rank each of the following three statements from most to least likely. For the most likely statement, enter 1, for the more likely of the remaining two statements enter 2 and for the least likely statement enter 3.

___ Linda is a bank teller

___ Linda is active in the feminist movement

___ Linda is active in the feminist movement and is a bank teller

Appendix III

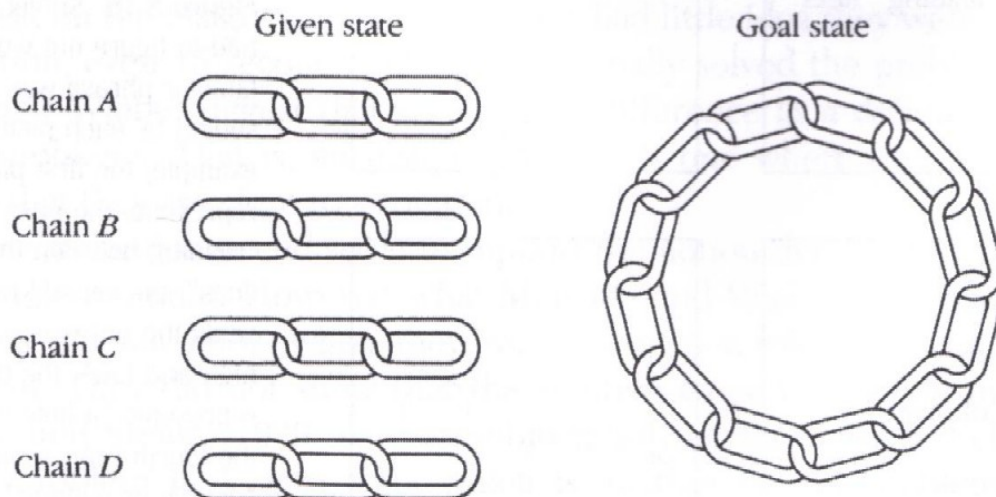


Figure 8.15 The cheap-necklace problem. (Figure 4.5 from W. A. Wickelgren, *How to solve problems*. W. H. Freeman and Company. Copyright © 1974.)

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