THE EFFECT OF INTELLIGENCE ON SUSCEPTIBILITY TO COGNITIVE ILLUSIONS

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ABSTRACT

Cognitive illusions reveal errors in how individuals perceive, remember, and judge information by showing how the brain uses prior knowledge or mental shortcuts instead of deductive reasoning. These illusions offer a means of investigating processes related to fluid intelligence, the ability to reason and solve new problems independent of prior knowledge. This study examines whether academically high-achieving scholars of the Governor's School of New Jersey Program in the Sciences are less prone to cognitive illusions compared to online participants. The study hypothesized that the scholars are less susceptible to cognitive illusions in comparison to the online participants. Using a 15-task survey, participants were tested on their performance across various cognitive illusions. This survey was administered to 47 scholars and 185 online participants through Qualtrics, with the online participants being recruited through CloudResearch Connect. The data indicated that scholars were less susceptible to the illusions involving perception, attention, and judgment and decision-making. However, scholars were more susceptible to illusions that included memory and self-perception. These findings suggest that susceptibility to cognitive illusions varies depending on mental processes and the task presented. Overall, the data suggests that scholars were less vulnerable to cognitive illusions pertaining to analytical and deliberate reasoning, partially supporting the original hypothesis.

GENERAL INTRODUCTION

Cognition is comprised of multiple complex mental processes: thinking, reasoning, perceiving, imagining, and remembering (Bayne, *et. al.*, 2019). These processes assist in information management in order to better analyze surroundings and develop judgments about them. Cognition is integral to understanding emotions and thus contributes to social and behavioral interactions (Dolan, 2002). However, errors are frequent, and shortcuts are commonly taken.

Cognitive illusions take advantage of the brain's deference to heuristics—mental shortcuts—resulting in misperceptions of reality that tend to follow a systematic pattern in most populations (Pohl, 2022). When faced with cognitive illusions, the brain often erroneously relies on previous knowledge rather than the senses. Even though all cognitive illusions demonstrate errors in human processing, they have different underlying mechanisms that differ depending on the task. To evaluate cognitive illusions systematically, Pohl classified these phenomena into three distinct categories: thinking, judgment, and memory. This organization offers a structured way to compare cognitive illusions, while also demonstrating how varying heuristics can lead to predictable and consistent mistakes (Pohl, 2022).

For thinking illusions, participants commonly fail to apply objective, normative standards when they are solving seemingly simple problems. Alternatively, judgment illusions utilize uncertainty in decision-making to force reliance on heuristics, thus leading to irrational decisions. Memory illusions exploit systematic errors in memory storage, proving they can actively reconstruct the way somebody remembers information. Distinguishing between categories of cognitive illusions is important because it allows for isolated assessments of the different aspects of human general intelligence (Kahneman, 1977).

Human general intelligence—the broad mental capacity to adapt and comprehend sophisticated topics—is divided into fluid intelligence and crystallized intelligence (Colom, *et. al.*, 2010). Fluid intelligence is the capacity to flexibly develop knowledge in new situations regardless of prior experience; it matures around 14 or 15 years old and declines after the age of 22. Conversely, crystallized intelligence applies knowledge and skills gradually accumulated over a lifetime (Cattell, 1963). Cognitive illusions are helpful for testing fluid intelligence because they provoke adaptive thinking and reasoning.

This experiment investigates the effect of intelligence on susceptibility to cognitive illusions by comparing the performance of the Governor's School of New Jersey Program in the Sciences scholars and online participants. The scholars represent the most academically inclined and high-achieving students in New Jersey, thus serving as the ideal experimental group for this study. Therefore, we predict that if intelligent people are presented with cognitive illusions, then they will be less susceptible to false wording, imagery, or logistics.

GENERAL METHODS

Participants

This study included a total of 232 participants, consisting of 47 scholars and 185 online participants. The scholars, aged 16 to 18, represented academically gifted high school students from New Jersey. In contrast, the online participants, aged 18 to 70, stemmed from diverse academic backgrounds and locations. Of the scholars, 45% were female, 53% were male, and 2% were nonbinary. Of the online participants, 35% were female, 65% were male, and less than 1% were transgender. All participants reported proficiency in English.

Materials

The survey used in this study was created and administered through the program Qualtrics (Qualtrics 2025), and all participants consented to the survey before completing. Online participants were recruited through the platform CloudResearch Connect (CloudResearch 2026) and compensated $1 upon completion. The survey itself included various cognitive illusions described below. To minimize response bias, the survey was masked as a personality test using filler questions taken from the Eysenck Personality Questionnaire. All participants provided their own electronic device and headphones or earphones to take this survey.

Procedure

Scholars were administered the survey in a controlled environment on Saturday, July 18, 2026 at 3 p.m. ET. Each small cohort was proctored by at least one student researcher and one

counselor. Most scholars completed the survey on a laptop; however, those without access utilized tablets or phones. This did not alter response or viewing format.

Scholars were instructed to remain silent throughout the testing period and refrain from interacting with peers in order to reduce confounding variables. The Qualtrics system randomly assigned different test versions to participants, using slight variations of the same questions. Online participants completed the survey off-site and without direct supervision, which is consistent with typical online data collection protocols.

MAIN TASKS

Kiki/Bouba Effect

Introduction

The kiki/bouba effect, first developed by Kohler in 1929, is an example of the association of the nonsensical names of shapes with different physical attributes through the iconicity of words (Ćwiek, *et. al.*, 2022). This phenomenon occurs through crossmodal correspondence, where individuals make connections across modalities, specifically between sound and shape. This compels individuals to associate the word "kiki" with a sharp shape and "bouba" with a rounded shape, a connection often made without deliberate consideration (Peiffer-Smadja and Cohen, 2018).

Methods

For this task two images were featured: one with a spiky shape and the other with a rounded shape (Appendix III). The prompt instructed participants to select an order in which the names would be assigned to the two shapes. The two options, "kiki on the left, bouba on the right" and "bouba on the left, kiki on the right," were presented in randomized order. Data was collected to determine the percentage of participants that had matched "kiki" with the sharp shape, "bouba" with the rounded shape.

Results

According to the data, 98% of scholars and 66% of online participants named the spiky shape "kiki" and the rounded shape "bouba." A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=19.14, p<0.001).

Priming of an Ambiguous Figure

Introduction

The priming of ambiguous figures task focuses on the intersection between bottom-up and top-down processing. Bottom-up processing is used to interpret new data solely based on the new data given, whereas top-down processing is based on prior knowledge and experience for interpretation of the given data. Ambiguous figures have various interpretations, allowing psychologists to study how perception is impacted by previous experience or context. Previous research on priming—conducted by Goolkasian and Woodberry—provides information on showing one possible interpretation, the prime, before showing the ambiguous figure

(Goolkasian and Woodberry, 2010). This prime consistently influences how individuals perceive the figure, showing that perception is not just based on processing new information individually, but also prior experiences and expectations.

Methods

In this task, participants were shown an elephant and macaw, then one of three priming images: a donkey, seal, or snake (Appendix IV). The image of the snake served as a control. Participants were asked if the three animals that they saw were potential pets by selecting "yes," "no," or "maybe." They were then shown an ambiguous picture that could be interpreted as either a donkey or a seal, and were asked to quickly identify what animal they perceived. (Appendix IV).

Results

Participants' responses were categorized based on their identification of the ambiguous figure as "donkey," "seal," or "other." The percentages of participants who selected the interpretation that was consistent with the prime that they viewed were calculated and compared across the three priming images to determine if priming truly impacted perception. The results showed that scholars with the donkey prime saw a donkey and seal in equal proportion of 47%, while 84% of online participants saw a donkey and only 1% saw a seal. For the snake prime, 50% of scholars saw a donkey and 38% saw a seal, compared to 77% seeing a donkey and 9% seeing a seal for the online participants. For the seal prime, 50% of scholars saw a donkey and 31% saw a seal, while 74% of online participants saw a donkey and 11% saw a seal. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=32.00, p<0.001).

McGurk Effect

Introduction

The McGurk effect, which was first discovered by McGurk and MacDonald, demonstrates how multisensory integration influences speech perception (Tiippana, 2014). Cognitive processing often relies on multiple sensory inputs for identification, so conflicting auditory and visual cues can alter the perceived sound (Schneider and Shriffrin, 1977). Since the pathways between the two senses are linked, it causes a misconception in the analysis of the information, causing the viewer to hear something that is not being said.

Methods

For this task, participants were shown two different videos of a man saying "ba" (Appendix V). One group of participants viewed the lip movements for the sound "ba," while the other group viewed the lip movements for "fa." However, the audio for the word "ba" was still played in both videos. The participants were then asked to report what word the man was saying.

Results

The data collected displays 100% of scholar participants answered correctly to the "ba" lip movement video. For scholars who viewed the "fa" lip movements, 42% correctly answered "ba," 50% answered "fa" or "va," and 8% answered a separate response. The online participants had greater variation in their responses. When presented with the "ba" lip movement video, 37%

correctly answered “ba,” 45% answered “pa,” 1% answered “fa,” and 8% answered with other various responses. When presented with the “fa” lip movement video, 62% answered a variation of “fa,” 6% answered “ba,” 13% answered “pa,” and 19% answered with other various responses. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=51.53, p<0.001).

Change Blindness Effect

Introduction

Change blindness is a phenomenon where observers have difficulty noticing subtle changes in large visual scenes. The effect was first studied by Levin and Simons in 1997, and multiple experiments have since been conducted to validate this phenomenon (Simons and Levin, 1997). Change blindness is thought to be a byproduct of how the brain generates a continuous view of the world. When shifting focus, the brain does not process the differences in order to avoid generating extraneous information that could devalue necessary information (McConkie and Zola, 2010).

Methods

In this task, participants were shown a video of two women talking over a meal, where details like the color of the plates or the presence of a scarf changed between scenes (Appendix VI). About half of the participants were warned ahead of time about “editing mistakes.” After the video, participants were given an unrelated question on which women they sympathize with. Then, they were asked what unusual details they noticed about the video, if any.

Results

0% of unwarned scholars or online participants detected any unusual changes In the warned scholar group, 22% of participants noticed editing mistakes, with an average of 1.2 mistakes noticed. Of the online warned participants, 5% noticed editing mistakes as well, with an average of 1.5 mistakes noticed. A chi-square test of independence revealed marginal significance between the response distributions of scholars and online participants (χ^2=3.77, p=0.052).

Penny Identification Effect

Introduction

The penny identification phenomenon originated from a 1979 study by Nickerson and Adams, who showed that people overwhelmingly fail to remember specific visual features of everyday objects like pennies (Nickerson and Adams, 1979). The human brain cannot functionally recall every minor detail of an everyday object; instead, it trains itself more for recognition than comprehensive recollection. As a result, when asked to draw or identify an object based on specific features, participants failed to accurately sort through mixtures of correct and incorrect information.

Methods

In this study, participants were provided with images of one correct penny and 11 incorrect pennies arranged side by side, each with corresponding letters (Appendix VII).

Participants were then asked to identify the correct penny solely based on their recollection of a penny's appearance.

Results

Of the scholars, 43% correctly identified the real penny, while only 30% of the online participants answered correctly. A chi-square test of independence revealed no significant difference in response distributions between scholars and online participants (χ^2=2.59, p=0.107).

Moses Illusion

Introduction

The Moses illusion is a cognitive illusion in which individuals consistently fail to notice a factual error in a question or statement, even when the error should have been readily apparent (Erickson and Mattson, 1981). In the original study by Erickson and Mattson, individuals were presented with a question asking, "How many animals of each kind did Moses take on the ark?" Participants would often answer "two," failing to notice the semantic distortion (Erickson and Mattson, 1981; Bottoms, *et. al.*, 2010). Typically, participants did not notice the inconsistency, especially when the incorrect word was semantically related to the correct word. Participants relied on rapid processing, suggesting that language processing was often driven by overall meaning rather than precise details (Speckmann and Unkelbach, 2021).

Methods

Participants were told that they were in a "lightning round" and instructed to answer the following questions as quickly as possible in a free response format. To familiarize participants with the format, two common knowledge questions were presented. Then, participants were asked one of two questions (Appendix VIII). Percentages of participants who responded "Santa" or "circle" for either question were categorized as having fallen for the illusion or not while any nonsensical responses were classified as "other."

Results

Out of the scholars given the circle question, 54% answered with "circle," whereas 36% of online participants answered "circle." Out of the scholars given the Santa question, 100% answered with "Santa," whereas with the online participants, 51% answered with "Santa." A chi-square test of independence was conducted to evaluate the relationship between participant group and response category. For the circle question, results showed a significant association between the group and response (χ^2 =33.63, $p < 0.001$). For the Santa question, a significant association was also observed (χ^2 =26.07, $p < 0.001$).

DRM False Memory Paradigm

Introduction

The Deese-Roediger-McDermott (DRM) paradigm is a procedure used in laboratory settings to study false memories in people, including self-made or illusion-based memories that never actually occurred (Arndt, 2010). When presented with a list of 15 words with a common theme, there is one word, the critical lure, that is not presented in the list but is expected to be mistakenly remembered. This suggests the brain might form memory based on thematics and not

specifics.

Methods

This DRM paradigm was conducted by using a standardized semantic word list, featuring 15 words that are strongly associated with the target word, doctor (Appendix IX). To discourage deep analysis of the list, the words were displayed in descending order of associative strength at a rapid pace. Immediately following the list, participants answered a brief side question to clear short-term memory or working memory and were then asked to recite every word they could remember from the list.

Results

A total of 232 participants completed the study. However, only a total of 216 results were counted due to nonsensical answers. Performance differed between the two groups: the scholars correctly recalled an average of 41% of the 15 presented words, whereas online participants correctly recalled an average of 28%. False recall of the critical lure, "doctor," also differed between groups. Among the scholars, 45% falsely recalled "doctor." In comparison, 34% of online participants recalled the critical lure. A chi-square test of independence revealed no significant difference in response distributions between scholars and online participants (χ^2=3.48, p=0.324).

Conjunction Fallacy

Introduction

The conjunction fallacy, discovered in 1983 by Tversky and Kahneman, is a cognitive bias where humans are more likely to pick an illogical option as more likely to occur than a single option (Tversky and Kahneman, 1983). This is because a conjunction of two events is less probable to occur than either event on its own. The representativeness heuristic, a reason for this phenomena, is when an instance and category can be described with the same characteristics, and therefore are deemed as similar and picked as more probable (Gavanski and Roskos-Ewoldsen, 1991). Another reason, the availability heuristic, is slightly similar to the representative heuristic, however, it describes how people tend to find things or events more probable based on how easily examples come to mind (Tversky and Kahneman, 1973).

Methods

Participants were asked the "Linda Problem," which required them to rank the likelihood of Linda having two different traits or both traits from most likely to least likely (Appendix X). Participants were expected to rank the conjunction statement second, even though the conjunction should statistically be ranked last.

Results

In this study, 9% of scholars ranked the conjunction as least likely and 76% ranked the conjunction as second most likely. One scholar's answers were omitted because there was no response. On the other hand, 27% of online participants ranked the conjunction as least likely and 54% ranked the conjunction as second most likely. The scholars did much worse in this regard than the online participants. A chi-square test of independence confirmed a significant

difference in response distributions between scholars and online participants (χ^2=20.520, p<0.001).

Coin Toss Illusion

Introduction

The coin toss illusion illustrates the representativeness heuristic principle through a misconception of chance. First tested by Tversky and Kahneman in 1972, the representativeness heuristic describes a mental shortcut that individuals make to form quick judgments. Essentially, a given situation is compared to a preexisting stereotype, which allows one to rapidly organize and understand new ideas. However, this can often lead to cognitive biases (Cherry, 2026). In the coin toss illusion, people expect small sequences of coin flips to exactly mirror long-term probabilities where heads and tails are equally likely, resulting in incorrect statistical judgments.

Methods

Participants were shown the outcome of six coin flips and selected the most likely resulting sequence—one in which there was a randomized mix of heads and tails, or another in which there were six straight heads (Appendix XI). After being directed to type out a response, participants were expected to enter the option with a randomized mix of heads and tails, though the correct answer was that they were equally as likely.

Results

Of the scholars, 47% correctly identified that both sequences were equally as likely, whereas only 4% of the online participants answered the question correctly. Furthermore, 53% of the scholars incorrectly selected the randomized mix of heads and tails, whereas 75% of the online participants selected this option. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=63.52, p<0.001).

Hospital Births Fallacy

Introduction

The hospital births fallacy is driven by the representative heuristic, a bias where people judge the likelihood of an event occurring based on how close the event matches to their expectations instead of actual statistical reasoning (Mayiwar, *et. al.*, 2025). This bias was first introduced by Tversky and Kahneman in 1972, and the hospital births fallacy became one of the most well-known demonstrations of it (Mayiwar, *et. al.*, 2025).

Methods

Participants were presented with two hospitals: a larger one with approximately 45 babies born each day and a smaller one with approximately 15 babies born each day. Participants were told that most days, about 50% of babies born are boys. For a period of one year, each hospital had recorded the days in which more that 60% of the babies born were boys. The participants were then asked which hospital they think recorded more such days, or if the amount of days recorded were about the same (Appendix XII).

Results

Of the scholars, 60% had picked the smaller hospital, 36% picked that they were about the same, and 4% had picked the larger hospital. Of the online participants, 22% picked the smaller hospital, 27% picked that they were about the same, and 51% picked the larger hospital. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=38.36, p<0.001).

Anchoring and Adjustment Heuristic

Introduction

Anchoring is a cognitive bias where people focus too heavily on the first numerical number encountered, referred to as the "anchor," when making numerical estimates. Final estimates skew in the direction of the anchor even when the initial value is irrelevant, indicative of inadequate adjustment from the original value. Analyzed first by Tversky and Kahneman in 1974, the effect has since been emulated in pricing and criminal sentencing, amongst others (Holm *et. al.,* 2025; Tversky and Kahneman, 1974).

Methods

Participants were randomly assigned to a low or high anchor condition for two questions, one on the age of Gandhi and the other on the temperature of Tanzania (Appendix XII). All participants then provided their estimates. After collecting all of the responses, they were sorted by anchor condition and then standardized.

Results

Many responses were excluded because they were incoherent or identified outliers. For the Gandhi question, the mean estimate for scholars for the low anchor was 66, while the online participants averaged 67. For the high anchor, the scholars estimated 84 years, while the online participants predicted 88 years. For the Tanzania temperature question, the scholars given the low anchor (51°F) estimated a mean temperature of 68.19°F, while the online participants averaged 63.14°F. For the high anchor (106°F), scholars estimated a mean of 85.46°F, while the online participants predicted 89.86°F. A two-sample t-test was conducted, analyzing the differences between the scholars' and online participants' responses, and there was no significant difference found for both the Gandhi sample (t=0.97, p>0.05) and the Tanzania sample (t=1.11, p>0.05).

Decoy Effect

Introduction

The decoy effect, originally studied by researcher Joel Huber in 1980, is presented as a question with three options, with the choices most commonly being soda sizes (Ungvarsky, 2021). The small soda serves as the competitor since it is the cheapest, the target is the most expensive large soda, and the decoy is the slightly expensive and medium soda. This effect works when a decoy makes the person more likely to select the target and is fueled by a human tendency to overanalyze and assume that the target is the superior option when extra, unnecessary information is given. Morality is a central concern due to the use of this ploy in marketing, which can be used to make people choose a more expensive option subconsciously,

even if they normally would have selected the cheaper option if they had only two options originally (Stoffel, *et. al.*, 2019).

Methods

For this specific task, we utilized the common question mentioned previously using soda sizes. Participants randomly received either a control image with only a small and large soda, or another image with a small, medium, and large soda. However, the question was the same: "If you were purchasing your favorite drink at the movie theater, which size would you choose?" The target choice was the large since it has a closer price range to the medium, making the medium the "inferior" decoy. The competitor is the small soda, as it was the cheaper option.

Results

Of the scholars, 78% chose the small, while 22% chose the large when given two soda options. Compared to the group given three soda options, there was no extraordinary change, as 75% chose the small, 4% chose the medium, and 21% chose the large. Within the online participants, 43% chose the small while 57% chose the large when given two options. There was a large shift when three sodas were given as an option, though, as in the experimental group 27% chose the small, 47% chose the medium, and 26% chose the large. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants (χ^2=38.51, p<0.001).

Intuitive Physics Illusion

Introduction

Naive physics refers to intuitive, experience-focused beliefs pertaining to the physical world that go against Newtonian mechanics (McCloskey and Felch, 1983). A prominent example across studies is the "straight-down belief," where people estimate that an object released from a moving entity will fall straight down instead of continuing with the horizontal velocity of the carrier (Hecht and Bertamini, 2000).

Methods

Participants were given a diagram of an airplane travelling horizontally at a constant altitude and speed, with a ball released from a marked point beneath it. Five trajectories were shown, ranging from a straight-down path (the naive, incorrect response) to a parabolic path retaining forward velocity (the physically correct response), with intermediate options reflecting partial correction (Appendix XV). Participants selected the letter matching their predicted path.

Results

The distribution of the responses was substantially different between the scholars and the online samples for the five answer choices. Most significantly, the rate of scholars selecting D, the correct answer, is more than double that of the online sample: 55% compared to 22%. Out of the scholars, accuracy differed based on their favorite type of science. Physics-track scholars answered correctly 81.2% of the time, compared to 42.9% for biology-track and 40.0% for chemistry-track scholars. The most common choice for the online sample was C, selected by 28% of them, while 2% of the scholars selected C. A chi-square test of independence confirmed a significant difference in response distributions between scholars and online participants

(χ^2=66.94, p<0.001).

Illusory Superiority Effect

Introduction

Illusory superiority is the phenomenon in which people believe they are better than they actually are at certain tasks or abilities. These kinds of judgments are statistically impossible because if everyone were to be raised above average, then the average would shift. This phenomenon only occurs as a form of boosting self-esteem and confidence (Tappin and McKay, 2016). It is also known as the Lake Wobegon Effect and was first demonstrated by Svenson in 1980 to show that most drivers see themselves as better drivers than they actually are (Kruger, 1999).

Methods

Participants were asked to rate their skill level on 14 academically or behaviorally-based abilities compared to their peers. A rating of 1 indicated being very unskilled, while a rating of 5 indicated being very skilled (Appendix XVI). For the scholars, the prompt made it clear that "peers" constituted other Governor's School attendees.

Results

The average rating for the scholars was 3.86 with the average rating for the online participants was 3.43. Except for one question pertaining to creative ability, scholars rated themselves higher above the average than the online participants did.

Forer Effect

Introduction

Discovered in 1948, the Forer effect describes how people tend to believe that a broad, very generic description is believably accurate for themselves (Ungvarsky, 2021). This phenomenon is a form of confirmation bias, as participants focused on the true aspects and ignored the untrue aspects of the description in order to believe that their assessment was personalized. Moreover, participants may have trusted what they have perceived as a reliable personality assessment more because it came from a figure who is more knowledgeable about psychology (Ungvarsky, 2021).

Methods

After answering all of the experimental questions, participants were presented with a page followed by a randomly generated personality type and its description (Appendix XVII). They were then asked to rate their personality description from "0-poor" to "5-excellent". Following that was a question for participants to freely answer what they thought the survey was about. This was done to eliminate possibly biased results from participants who recognized the tasks.

Results

On average, scholars rated the assessment 4.2 while online participants rated the assessment 3.7. Moreover, between the personality types, there were overall some slight

variations in average rating. QTR was rated as 3.48 while QYR was rated 4.04; however, these differences are considered part of a result of random variation rather than the sequence or lettering. An independent sample t-test confirmed a significant difference between scholars and online participants (t=22.49, p<0.001).

DISCUSSION

The purpose of this study was to determine the extent to which high-achieving scholars were susceptible to cognitive illusions in comparison to online participants. Some of the skills evaluated were perception, attention, memory, and judgment, but they all focused on using given information to misdirect the viewer. The illusions studied involve fluid intelligence, as they utilize new information to overwhelm processing and cause a lapse in decision-making. Overall, we found that across all these different cognitive illusions, scholars' susceptibility varied depending on the task, demonstrating the effects of fluid intelligence as well as crystallized intelligence.

Perception/Attention

The illusions pertaining to perception and attention included the priming of an ambiguous figure, McGurk, and change blindness effects. Scholars were more susceptible to the priming effect than the online participants, but performed better in the other two tasks. In the priming of an ambiguous figure task, participants were expected to draw upon past images presented in the survey. Since top-down processing often results in rapid interpretations of a stimulus, the figure is less likely to be deeply analyzed by scholars (Goolkasian, 2010).

Conversely, the scholars were less susceptible to the auditory and visual illusions, including the McGurk and change blindness effects. These illusions both involve processing new information in a way that requires a more in-depth review of nuances. They also require heightened levels of attention, which scholars have refined throughout their educational careers. The data suggests a link between students with academic aptitude and effective processing of external inputs.

Memory

In the memory category, scholars generally had greater susceptibility to cognitive illusions. Scholars were more susceptible to the Moses illusion and DRM false memory paradigm, but there was no significant difference between the scholars' and online participants' results for the penny identification effect. It is possible that the outcomes of the memory experiments are because of the heightened use of skim reading by the scholars in comparison to the online participants. Skim reading is a method utilized during reading where minor details are forgotten in order to comprehend the major details more quickly. For both the Moses illusion and DRM false memory paradigm, skim reading likely caused the influx of incorrect responses. Scholars may utilize skim reading more due to it being an effective way to quickly understand educational material (Mostafa MKI, 2022). Another reason scholars may use skim reading more is because they are younger and have thus been more exposed to the internet, which promotes skim reading through hyperlinks and short articles (James, *et. al.*, 2022).

Judgment/Decision-Making

In the judgment and decision-making category, scholars were typically less susceptible to cognitive illusions, albeit with a few exceptions. The cognitive illusions in this category included the coin toss illusion, hospital births fallacy, intuitive physics, anchoring and adjustment heuristic, and decoy effect. Many of these illusions require knowledge in statistics or science that may be more common among scholars than the online participants. In particular, the coin toss illusion and hospital births fallacy require statistical analysis that may go against intuitive pattern-matching, which may explain why scholars were less susceptible compared to online participants on these tasks. The same is true for the intuitive physics illusion, with the defining concept being physics which many scholars have previously learned.

Heuristics do not affect scholars when they have preexisting domain knowledge. However, in tasks like the anchoring and adjustment heuristic where the scholars do not have domain knowledge, they performed equally to the online participants. For anchoring specifically, extremeness aversion leads people to inadequately adjust from the anchor regardless of intellectual aptitude (Lewis, *et. al.*, 2019). The decoy effect saw a similar phenomenon, where the online participants chose the middle option. Ultimately, scholars excelled in most of these illusions, likely because of their proficiency in analytical processing (Hu, 2014).

Self-perception

Scholars were largely more susceptible to the self-perception tasks, which included the illusory superiority and Forer effects. For the illusory superiority effect, the results display the confidence of the scholars in their intelligence and character traits. Scholars' understanding of their own abilities may have been inflated beyond the online participants' due to their exceptional academic expertise relative to those around them. Concerning the Forer effect, the results suggest that the scholars are in a period where personality is still relatively dynamic. It has also been reported that personality stabilizes after age 30 (Terracciano, *et. al.*, 2006). Because the online participants are 37 years old on average, their personalities are well-established, and they may have a better understanding of themselves. Contrastingly, the scholars are 17 years old on average and may not have formed a rigid personality yet, making them more impressionable to the vague description.

Limitations

One potential limitation is the amount of time and effort spent on the study. The average scholar took 957 seconds while the average online participant took 569 seconds, suggesting a lack of effort from online participants. This may imply that some online participants did not fully read or comprehend the questions. In addition, for some tasks, online participants may have chosen the first choice they saw rather than the one they believed accurate, which would skew the results. An example of this is found in the conjunction fallacy: the online participants answered "banker"—the first choice on the page—abnormally frequently despite "feminist" being a more natural answer based on the provided context. Furthermore, the scholars took the survey under supervised and controlled conditions. It is possible that online participants could have taken the survey in a distracting environment, not had access to headphones, or not read the clarifying instructions since it was not verbally presented to them. The degree to which these varying environmental factors impacted the results is unknown.

Future Research

Although the study overall demonstrates that susceptibility to different cognitive illusions varies between the scholars and the online participants, there are still multiple avenues that remain for future research. One element that can be explored in the future is how closely participants read the survey. Our results suggest that quick reading may partly explain scholars' increased susceptibility to illusions like the Moses illusion and DRM false memory paradigm, but this was inferred instead of being directly measured. Thus, future research should time all of the tasks to assess whether reading comprehension or processing speed can predict susceptibility to memory-centered illusions. An additional area for future research is age. As mentioned previously, the scholars were, on average, 20 years younger than the online participants. In order to better understand the effect of age, a study that specifically delves into age-related differences would isolate the effect of age on susceptibility to cognitive illusions. Finally, because many illusions are experience-based, grouping participants by their interests could allow greater insight into the role that experiences have. Researchers can look into whether musicians are less likely to fall for auditory illusions or whether artists are less susceptible to visual illusions. Ultimately, categorizing participants by defining characteristics such as age, reading comprehension, and background may allow for better comprehension of the influence of demographics on cognitive illusions.

Conclusion

In all, this study provided valuable insights on the cognitive disparities between the group of high-achieving individuals and a diversified online population. Scholars performed better to online participants for illusions involving reasoning, problem solving, and coordinating between different external inputs. However, scholars underperformed or matched the online population in the tasks that invoked automatic thinking rather than deliberation. Since the results varied by prompt, our hypothesis was partially supported because scholars were less susceptible to the specific illusory traps that focused on targeting fallacies in deeper analytical thinking. This also presents a connection to crystallized intelligence, as scholars utilized prior knowledge from schooling to answer these prompts correctly rather than demonstrating a sole reliance upon fluid intelligence. Overall, intelligence is not a foolproof defense against all forms of cognitive illusions, and it is important to be cognizant of everyday illusions that may sway opinion, distract, or deceive.

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APPENDIX

I. Consent Form

Welcome to the Personality Survey!

This survey is designed to determine the personality types of Governor's School students in a manner that provides unique insight into the thinking and decision making used in their cognitive processes. Many of these questions may seem simple or basic; however, in most cases, we are testing both accuracy and reaction time, so please work as quickly as possible without sacrificing accuracy. Please keep your eyes on your screen and your headphones in at all times to eliminate potential distractions. Your overall time for the survey, as well as timings for certain individual question sets, will be recorded.

The survey should take approximately 15-20 minutes and involves simple questions intended to assess the most common personality characteristics. If at any point during the test should you wish to discontinue participation, you may do so without penalty. All answers you provide are completely anonymous. Please refrain from discussing your results. Your decision to participate is entirely voluntary. By pressing "continue," you are hereby agreeing to these conditions and providing consent. Thank you!

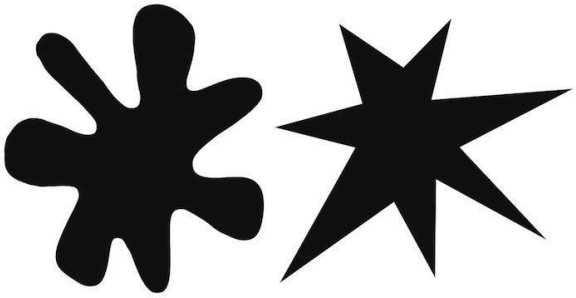
II. Filler Personality Questions

Does your mood often fluctuate?
Do you always practice what you preach?
Are you a talkative person?
Are you good with money?
Would being in debt worry you?
Can you get a party going?
Would you take drugs which may have strange or dangerous effects?
As a child, were you ever bratty to your parents?
Do other people think of you as being very lively?
Do you sometimes put off until tomorrow what you ought to do today?
Do you think marriage is old-fashioned and should be done away with?
Do you think people spend too much time safeguarding their future with savings and insurance?
Have you ever taken anything that belonged to someone else?
What type of learner do you consider yourself? (Check all that apply.)
- Choices: Auditory, Visual, Kinesthetic, or None of the above

Have you ever broken or lost something that belonged to someone else?
Have you ever taken advantage of someone?
Are you a worrier?
Were you ever greedy by helping yourself to more than your fair share of something?
If you say you will do something, do you always keep your promise no matter how inconvenient it might be?
Are you an irritable person?
Have you ever said something bad or nasty about anyone?

Have you ever blamed someone for doing something you knew was really your fault?
Do you enjoy meeting new people?
Are all your habits good and desirable?
Do you like plenty of bustle and excitement around you?
Have you ever cheated at a game?
Are your feelings easily hurt?
Do good manners and cleanliness matter much to you?

III. Kiki/Bouba Effect



IV. Priming Of An Ambiguous Picture









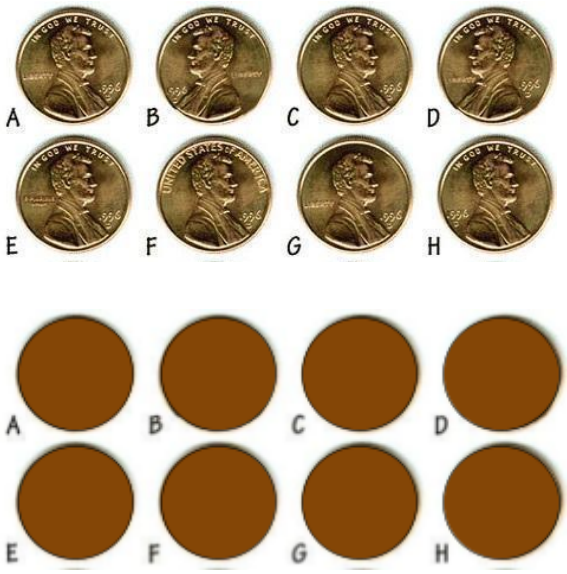
V. McGurk Effect

Links to pictured videos:
Fa: https://www.youtube.com/watch?v=9DmCtvPvfFk&t=6s
Ba: https://www.youtube.com/watch?v=MV_bo6fULZo

VI. Change Blindness Effect

Link to pictured video:
https://www.youtube.com/watch?v=16vqQe9dnqg&t=5s

VII. Penny Identification Effect



VIII. Moses Illusion

What shape has a circumference of πr^2?

What is the name of the man in the red suit who rides a sleigh and delivers birthday presents in December?

IX. DRM False Memory Paradigm

Please read the entire list carefully and then choose your favorite word and type it below.

Nurse
Sick
Lawyer
Medicine
Health
Hospital

Dentist
Physician
Ill
Patient
Office
Stethoscope
Surgeon
Clinic
Cure

Please type all the words you remember from the previous list of words.

X. Conjunction Fallacy

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-nuclear demonstrations.

Now rank (click and drag) each of the following three statements from most to least likely, with 1 being the most likely. If you want to keep the current order, just select and release one of the options.

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

XI. Coin Toss Illusion

Imagine a person tossing a fair coin six times in a row. In every toss, the outcome can be head (H) or tail (T). Which of the following specific series is most likely?

A) H T H H T T

B) H H H H H H

XII. Hospital Births Fallacy

A certain town is served by two hospitals. In the larger hospital about 45 babies are born each day, and in the smaller hospital about 15 babies are born each day.

As you know, about 50% of all babies are boys. However, the exact percentage varies from day to day. Sometimes it may be higher than 50%, sometimes lower.

For a period of one year, each hospital recorded the days on which more than 60% of the babies born were boys.

Which hospital do you think recorded more such days?

XIII. Anchoring and Adjustment Heuristic

Low Anchor	Was Mahatma Gandhi older or younger than 9 years when he died?	Is the mean temperature in Tanzania higher or lower than 51° F?
High Anchor	Was Mahatma Gandhi older or younger than 140 years when he died?	Is the mean temperature in Tanzania higher or lower than 106° F?
Final Question	What is your best guess regarding how old Mahatma Gandhi was when he died (please give a specific age)?	What is your best guess regarding the mean temperature in Tanzania? Please give a specific temperature in degrees Fahrenheit.

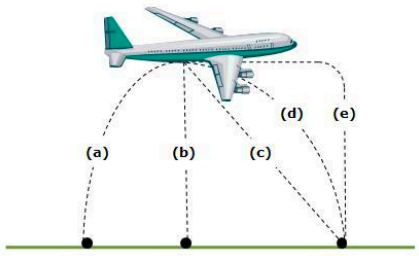
XIV. Decoy Effect



vs.



XV. Intuitive Physics Illusion



In the diagram above, the plane is flying horizontally to the right at a constant altitude and a constant speed. If a ball is dropped from the indicated point of origin, which path do you think the ball will follow once dropped from the plane? Select the letter that corresponds to your answer.

XVI. Illusory Superiority Effect

Using the scale below, rate your skill on each item, in comparison to the average NJ Governor's School Scholar.

1	2	3	4	5	6
Very Unskilled		Skilled			Very Skilled

Skills:		
ability to understand theoretical issues	compassion for other people	motivation to achieve in science
ability to work independently	creativity	oral communication
ability to work with a research team	critical thinking	skills in mathematics
	discussion participation	statistics
	knowledge about science	written communication
	leadership	

XVII. Forer Effect

Personality type QTE (or QTR, QYE, QYR, WTE, WTR, WYE, WYR)
You have a need for other people to like and admire you, and yet you tend to be critical of yourself. While you have some personality weaknesses, you are able to compensate for them with your strengths. You have considerable unused capacity that you have not turned to your advantage. Disciplined and self-controlled on the outside, you tend to be worrisome and insecure on the inside. At times you have serious doubts as to whether you have made the right decision or done the right thing. You prefer a certain amount of change and variety and become dissatisfied when hemmed in by restrictions and limitations. You also pride yourself as an independent thinker; and do not accept others' statements without satisfactory proof. But you have found it unwise to be too frank in revealing yourself to others. At times you are extroverted, affable, and sociable, while at other times you are introverted, wary, and reserved. Some of your aspirations may seem unrealistic but you have a strong motivation and drive.
Please help us refine the system's calculations by rating the above assessment of your personality.

0	1	2	3	4	5
Poor					Excellent