Effects of Self-Deception on Recognition Memory of Nonverbal Symbols

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Abstract

Self-deception has long been an understudied topic in human behavior as well as perplexing researchers with the assumption that self-deception entails an interpersonal dialog with the conscious and unconscious mind. The focus of this research is self-doubt as it relates to self-deception. This study was part of a companion study in which the purpose was to identify and assess behavioral markers of self-deception. This study specifically involved a visual-spatial processing task using nonverbal symbols. The participants studied a set of 50 ambiguous symbols presented individually. After a two minute verbal distractor task, the participants were shown a test set of 25 individual symbols that all appeared in the original set of symbols. The participants were asked to identify which of the symbols they recognize from the original set. Reaction times and accuracy of responses were recorded during the presentation of the test set of symbols. Because all symbols in the test set appeared in the original set, a correct response was that the participant recognized the symbol from the previous set. The results of the study yielded a large effect size. The participants responded incorrectly 33% of the time, and incorrect response times were 200 milliseconds greater than the correct response times. This delay during incorrect responses indicated the brain engaging in a mechanism that allows an individual to doubt oneself. These findings suggest that the mechanism that caused the delay in incorrect response times may represent a form of self-deception.
Effects of Self-Deception on Recognition Memory of Nonverbal Symbols

Self-deception is a behavioral phenomenon that has long been a topic of debate amongst philosophers, biologists, and psychologists alike. It has also been known as denial, but this occurs more often in the clinical domain (Freud, 1933). The mere act of deceiving one’s self poses many paradoxical questions. Even though humans display bounded rationality, why is it that they know information and then behave in a way that supports a contrary belief? Is self-deception a human behavior that increases one’s evolutionary fitness, or has it evolved somehow despite its seemingly maladaptive nature? We might also ask whether it is the product of an internal dialog between the conscious and unconscious self. An investigation of the etiology of self-deception may provide a clear basis for understanding and ultimately coping with this behavior.

To begin this investigation, one must first examine the extent to which one “knows” something. In order for an individual to be self-deceived, they must have some form of information displaying what is or is not the case. This information can exist in any form of memory representation, from simply experiencing an event to recurring verbal instructions. It may be visual, auditory, or multimodal. For example, John is looking at the grass and perceiving that its color is green. From that, if John believes and insists that the grass is purple, he is deceiving himself because he “knows” that the grass is green from his earlier experience with it. Self-deception can also be seen in cases in which self-deceived individuals are putting themselves in danger despite receiving information that most people would deem credible. For example, a cancer patient was informed of her illness by her doctor after a slew of medical tests confirmed her condition. Yet, she initially does not believe she has cancer and refuses any treatment. This is consistent with the research beginning with “On Death and Dying”, in which
Kübler-Ross (1969) emphasized that denial begins the process of promoting psychological wellbeing throughout the progression of a terminal illness. These patients are prematurely faced with their own mortality, and denial is a form of initial coping found in the first of several steps towards acceptance. This is illustrated with the common thought “it could not happen to me, this cannot be”. This denial of mortality may be present in all humans until they are faced with death and it could arguably be the grandest form of self-deception in modern societies. More recently, Stephenson (2004), and Rabinwitz and Peirson (2006) examined cases of self-deception in cancer patients that is consistent with the extant literature. In another example, a man is a reckless and unsafe driver who has been in several accidents, although he believes himself to be a superior driver. Therefore, the man gawks at critics of his driving and dismisses any suggestions of taking driving lessons. Both of these cases involve a particular idea or position being introduced, followed by behavior that supports an interpretation that conflicts with it. This illustrates an inherent tension or conflict between one’s behavior and beliefs present in some cases. Despite the self-induced deception, the individual still “knows” or has evidence of the truth, and may sporadically become aware of the truth. This form of denial has been referred to as a failure of one’s self-knowledge “that involves epistemic negligence”, suggesting that the self-deceived thoughts contradict the grounds for that belief (Fernandez, p.399, 2013). What remains to be accounted for is the motivation for lying to oneself.

Self-deception is the product of some form of internal contradiction. This inconsistency may reside fully in one’s consciousness, involve a dialog between unconscious and conscious thought, or be a product of motivated reasoning. As a rational agent in denial, the individual plays the role of the deceived as well as the deceiver, causing internal conflict (Doucet, 2012). Early works suggested that one believes both $p$ and $\sim p$ (not $p$) (Demos, 1960). This view
supports the notion of a split consciousness, wherein, conscious thought believes \( p \), while unconscious thought knows \( \neg p \) to be true. Sackeim and Gur added to this the idea that two contradictory beliefs must be held simultaneously and that motivated reasoning is the cause of one of the contradictory beliefs to be brought into conscious awareness (p.150, 1978). A partitioning of the mind is necessary in these views of self-deception. Both \( p \) and \( \neg p \) are stored in one’s memory, generally speaking, but the truth is stored in the unconscious, while the contradicting belief is held in the conscious mind. Either active memory suppression or subconscious motives lead the mind toward deciding which contradictory view to raise to the level of awareness at a certain time (Trivers, 2011).

Researchers have conflicting views on the theory that self-deception requires one know \( p \) consciously and at the same time know \( \neg p \) unconsciously. This idea of a fragmented psyche in self-deception has led researchers to adopt a model without distinct levels of consciousness. Mele (2001) laid out a definition of self-deception that does not depend on believing two contradictory beliefs or the level of consciousness the belief resides in:

1. The belief that \( p \) which \( S \) acquires is false.
2. \( S \) treats data relevant, or at least seemingly relevant, to the truth value of \( p \) in a motivationally biased way.
3. This biased treatment is a non-deviant cause of \( S \)’s acquiring the belief that \( p \) [is true].
4. The body of data possessed by \( S \) at the time provides greater warrant for \( \neg p \) than for \( p \) (Mele, p. 50-51, 2001).

This and similar accounts of self-deception attempt to revise the early theories to alleviate the perplexing concept of knowing and not knowing some bit of information. Pratarelli (2008) explained this occurrence with the notion of a continuum of conscious thought along which the
truth and self-deceptive believes both reside. One’s motivation for $p$ to be true may lead to deceiving oneself despite the knowledge of $\neg p$. Baumeister referred to these false beliefs as “preferred conclusions” (p. 210, 1998), thus perpetuating the view of information processing that has succumb to motivation bias. Some research suggests that there is flexibility in this motivated reasoning that allows an individual to unknowingly select and alternate between simple and more complex decision making mechanisms in such a way that promotes the desired belief (Mata, Ferreira, & Sherman, 2013). Moreover, these self-deceived thoughts may be products of fantasy or imagination. Gendler (2007) describes self-deception as a pretense, in that our projective attitudes of wishing to be in a $\neg p$ world are essentially indifferent of the humans’ commitment to rationality, thus resulting in behaviors that avoid coming across any evidence of $p$.

These accounts follow a traditional homuncularist approach in which two somewhat autonomous subsystems are involved, one of which aids in deceit (McLaughlin & Rorty, 1988). This suggests that self-deception involves a coordination of various executive cognitive functions, yet this may not be the case. Comparative psychology research describes an alternate explanation. Carruthers (2005) states that these mechanisms of higher-order human cognition may be “described erroneously” when the causal mechanisms are those “first-order ones, shared with other animals” (p. 92). Animals display primal emotional feelings (affect) to make decisions that promote survival, thus suggesting some capability of secondary learning and memory functions. In addition, animals have been known to use deceptive techniques, such as signaling in the presence of a predator because of fear. If animals are capable of conscious deliberate deception, can they display self-deceptive behaviors similar to humans? Pratarelli (2003) recounts an experiment he repeatedly conducted with his dogs, in which he observed their behavior after he suspended their habitual feeding times. The dogs would display self-doubt, in
that they doubted that they would not be fed, and therefore, refused any other activity aside from waiting in anticipation of being fed. Eventually, after a significant amount of time, the dogs would give up and reconcile that a feeding was not going to happen.

Panskeep (2012) found that a lack of distinction between an animal’s emotional and cognitive functions may describe an animal’s ability to make motivationally biased decisions. These primal emotional networks shared with humans are the cause of various behavioral disorders and other human phenomena; therefore, the causal mechanism of self-deception may not be executive cognitive functioning. Moreover, Smith, Shields, and Washburn (2003) found that Rhesus monkeys (*Macaca mulatta*) and dolphins (*Delphinus delphis*) display similar self-doubting behavior as humans in recognition tasks, thus further suggesting some level of higher-order cognitive capabilities in animals, while also suggesting that self-deception in humans may not be due to executive mechanisms that only humans possess.

Many of these views of self-deception stem from observations and behavioral studies, but there is a lack of brain imaging data that would help explain the temporal and spatial nature of this behavior. Beauregard (2009) examined the very specific motivationally biased effects of the placebo phenomenon using fMRI and PET data of the human brain. This demonstrates the internal deceptive nature of the placebo effect influencing processes on a biological and cellular level, although these experiments did not address the physiological basis of the self-deceptive behavior. Because self-deception and denial are forms of general deception, the neural activity in deception is worth noting and perhaps someday, it may shed light on the paradox of self-deception. Deception involves a conscious choice of deceptive behavior, suppression of memory (or creating alternatives to the truth) and the need to subdue the truth from recurrent awareness (Visu-Petra, Miclea, & Visu-Petra, 2012). Recurrent awareness is the condition wherein the
truth tends to pop back into awareness during deceptive activity, causing the need for suppression of these thoughts so as to not give away behavioral cues of lying to the receiver or victim of the lie.

Langleben et al., (2005) found that lie and truth both activated similar frontoparietal networks in a visual recognition task, although lies displayed increased inferolateral cortex activation. This is associated with response selection integral to lying behavior. The differences of response times in behavioral tasks also illustrate this cognitive effort. Deceptive response times were longer than non-deceptive response times, suggesting that “truthfulness” is the default human behavior preceding deception (Spence et al., 2004). In addition, Browndyke et al., (2008) confirmed previous fMRI studies of activation of ventrolateral, dorsomedial and dorsolateral prefrontal cortices during deception that are associated with suppression of prior knowledge. Because both self-deception and deception involve some degree of information suppression, the activated regions of the brain may be similar even though the targets of the deceptive act differ. But in the case of self-deception as an unconsciously driven behavior, is it possible to record unconscious mental activity in a behavioral task? The extant psychological and philosophical literature suggests it ought to be.

The Evolutionary Perspective

While the mechanisms and characteristics of self-deception continue to be debated, there remains the existential question of: why deceive one’s self? An evolutionary perspective can account for the perpetuation of most traits and behaviors for their ability to increase reproductive success, but there is disagreement among evolutionary theorists about the nature of self-deception (Pratarelli, 2008). To examine evolutionary fitness, one must investigate animal behavior, the cultural universality and evolutionary history of the target behavior as well as any
reproductive advantages the behavior affords. As stated in the previous section, comparative psychology has confirmed self-doubting behaviors in nonhuman animals. In response to universal and cross-cultural aspects, the belief in gods is a worthwhile example. Throughout history and across populations, humans have consistently used gods to guide their decisions and provide anxiolytic relief during times of hardship (Triandis, 2009), although, self-deception does display evidence of increasing fitness as well as exhibiting a seemingly maladaptive anomaly.

To be an adaptive trait, a behavior must increase one’s survival or reproductive success. Defense mechanisms and self-preservation techniques are integral to continuing evolution. The Diagnostic Statistics Manual (DSM) refers to denial (synonymous with the term self-deception in experimental psychology) as a narcissistic “disavowal level” of defense mechanisms. This can be illustrated using examples that show a person defending one’s self from what is true for the purpose of happiness or avoiding the pain of troubling thoughts and ideas, such as in the case of information bias. Consider the example of a low-level employee who has accumulated substantial debt due to frivolous spending and gambling. She denies her mismanagement of funds and even disregards overdue credit card bills with the claim that she did not incur those charges. As a way to avoid the troubling reality of her debt, she is in denial which allows her a substitute to dealing with this problem. Alternately, there is the case of a husband who is self-deceived into believing his promiscuous wife is faithful, despite her regular overnight getaways. These explanations could lead to a temporary state of recovery or betterment by avoiding the awareness of painful or troubling thoughts. It could also be argued, however, that what is optimal for survival is accurate perceptions maintained through an objective viewing of the world.
Similarly, Jopling (1996) examined a dialogue from Ibsen’s *The Wild Duck* (1961), in that once the illusion of the character’s self-deception is shattered, “he is left vulnerable, disoriented, and susceptible to irrational over-reaction” (p.525). As Jopling’s example demonstrated, there was a sense of helplessness when confronted with the truth that limited the character’s range of reactive behaviors and emotions towards others (1996).

In *The Folly of Fools* (2011), Robert Trivers asserts that self-deception could not have evolved for purely defensive purposes. He argues that self-deception enhances one’s fitness because self-deceived individuals can more effectively deceive others (1971, 2011). The working logic for this view is that the self-deceived individual does not emit (or emits less) physical and behavioral cues when they are deceiving another person. In other words, they do not outwardly show their *intentional stance* to the target or victim of the deception (Dennett, 1971). This stance relies on a balance of relative attributions of beliefs and other intentional states that lead a person to the belief and assertion that \( p \) may or may not be true (Dennett, 1987). But if the deceiver, in this instance, is self-deceived into believing \( p \), when the truth is \( \sim p \), they are not lying if they say \( p \) is true. Any voiced support for \( p \) would be a perpetuation of the self-deceived truth; therefore, the self-deceived is no better at deceiving others because it is no longer an intentionally deceptive activity of the conscious and aware mind. To illustrate this point, Van Leeuwen (2007) suggested the example of an early man being asked if there is food by the river. It would be beneficial to lie, stating that there is no food by the river, so that the man keeps the food for himself. But if the man was in fact self-deceived into believing his lie, he would not eat any of the food by the river because he believes there is none. However, he must be able to return to the truth in order to benefit from the lie. From this, self-deception would be adaptive in Trivers’s case only if self-deception was exclusive to instances that coincide with an individual’s
deceptive behavior and consequently succumb to the truth during non-deceptive behaviors. In addition, Lynch and Trivers (2012) found that self-deceived individuals displayed less laughter and claimed self-deception would indeed diminish one’s sense of humor. As Storey (2003), and Gervais and Wilson (2005) have asserted, humor is a characteristic that has been selected-for in evolutionary fitness; therefore, it contradicts Trivers’ previous claim that self-deception is adaptive despite the reduction of humor. Van Leeuwen (2007) ultimately maintains that self-deception is a spandrel, as defined by Gould and Lewontin (1979), in that it is not specifically selected-for in evolution. Instead, a spandrel is a derivative of the human cognitive architecture that exploits an evolutionary adaptive trait for different purposes. Hair, for example, evolved to help animals regulate body temperature, but more recently in humans and animals such as peacocks, hair has been useful for sexual selection for the purpose of mate attraction (Buffoli et al., 2014). This suggests a derivative cognitive mechanism is responsible for self-deception.

In this companion study, we attempt to identify self-deceptive behavior that is not dependent on motivationally biased processing, and by doing so suggest that subjective motivation may not be a fundamental attribute of self-deception, contrary to accepted ascriptions by Gur and Sackeim (1979). It is hypothesized that participants will display behavioral markers of self-deception consistently in a visual recognition task. This relates to self-doubting behavior, such as the case of a true/false exam in which a student would never imagine that all of the answers are true and in turn denies their own knowledge of what is or is not. The hypotheses include the following:

(1) In a visual recognition task, truth and self-deceptive events can be discriminated with reasonable and quantifiable accuracy, in such a way that the self-deceptive event is independent of motivation.
(2) The self-deceptive response times are lengthened by the recruitment of a secondary mechanism that mediates self-doubt.

(3) A post-hoc Likert rating for certainty will further confirm the occurrence of the self-doubting target behavior observed in the accuracy of participant responses.

Method

Participants

Seventy-five undergraduate traditional and nontraditional students attending a small Southwestern university, ranging in age from 19 to 53 ($M = 25.24$, $SD = 8.74$) years, were selected from a convenience sample. 51 females and 24 males with varying ethnicities participated in this study. All experimental conditions were repeated measures, and all participants took part in the study individually. That is, there was no group administration. One participant, however, required special accommodations due to immobility of the right arm. For this person, one of the response keys was modified to allow the responses using only the left hand.

Materials and Visual Stimuli

This study utilized two sets of shapes derived and modeled from Thorndike’s 1919 visual memory test (Eliot & Smith, 1983). The shapes used in this study, however, consisted only of meaningless black and white symbols. The first set will be referred to as the Study Set (Figure 1). It consisted of 50 symbols, of which three from the original Thorndike stimuli (Shapes 38, 43, and 48) were replaced with variations of a parallelogram. These shapes were replaced to ensure that the stimulus set contained only ambiguous and meaningless figures, in such a way that the participants’ responses would not be effected by the social connotations of the stimuli. For example, Shape 38 was originally a swastika, which is a symbol bearing strong negative
connotations often associated with Nazi Germany; therefore, it would have been more easily recognized during exposure as a target in the test set, resulting in a wasted trial. The second set of visual stimuli consisted of 25 shapes, all of which appeared in the stimulus set (Figure 2). This set of 25 shapes will be referred to as the *Test Set*. This is the critical experimental manipulation because participants are not aware that in fact, all 25 symbols appeared in the previous Study Set. This may be analogized to a true/false exam in which all of the questions are true. Any student taking such an exam would begin to second guess their answers, and include incorrect answers they are self-deceived into believing to be correct.

**Procedure**

Participants were first informed that they would be participating in a visual memory recognition study. They were given the Informed Consent materials to read and sign (Appendix A). Afterward, they were brought individually into the testing area and seated in front of a computer screen that displayed instructions on a white background. The instructions read:

*You are about to be presented with some images.*

*Study each image as it appears on your screen.*

*Afterwards, you will be asked some questions about the images.*

After a space bar response from the participant, presentation of the Study Set began. All of the images in the Study Set appeared in a 2 ¾ inch square in black face, centered on a white computer screen. Each of the 50 shapes from the Study Set were displayed individually in sequential order for 3000 milliseconds. Participants were seated approximately 36-48 inches from the screen with their hands resting comfortably on the computer keyboard.

After the last (fiftieth) shape from the Study Set was presented, participants were instructed to take part in a verbal distractor task, which involved 120 seconds of reading. This
was done to prevent continued rehearsal of the 50 study set items. 60 percent of the participants read an article from the daily New York Times, while the other 40 percent read Comics from the Sunday Gazette. Participants were not given options for reading material, although different articles and comic strips were used during experimentation. Because the reading task served as a distractor following the study period, differences in reading material are effectively irrelevant to the results of the study. The logic of using a verbal distractor task was to force a different neural system to be engaged, forcing the areas of the brain used for symbol perception to be disengaged. This is routine practice in memory studies because otherwise, varying levels of rehearsal may have an effect on the results.

Following the two-minute verbal distractor task, participants were given further instructions via the computer screen. These instructions read:

**You will now be presented with more images.**

*If you recognize the image from the previous set of images, press A.*

*If you do not recognize the image, press L.*

**Place your index fingers over the A and L keys, and press the space bar to begin.**

Once the participant initiated the test phase of the experiment, each of the 25 images in the Test Set were displayed individually, in sequential order on the computer screen for 2000 ms. Responses from participants were digitally recorded during the 2000 ms presentation of each of the test set symbols using SuperLab Pro software. A conventional Dell desktop computer was used for stimulus presentation.

For 25 of the participants in the partial replication and extension experiment, the instructions and response criteria were modified to accommodate the Likert rating verbal responses. These participants were verbally instructed with the following prompts:
You will now be presented with 25 more images.

I will ask you after each image, on a scale of 1 to 7, was this symbol in the previous set?

The scale represents different levels of certainty.

A 7 represents that you are absolutely sure that symbol was in the study set.

A 1 represents that you are absolutely sure that the symbol was NOT in the study set.

Please try to make use of the entire scale.

Are you ready to begin?

The participants’ verbal responses were recorded on paper by the experimenter with a number from a 7-Point Likert Scale for certainty. The images appeared in the same fashion as described above, although there was no time limit for responding to the Likert scale. Once again, unbeknownst to the participants, all 25 symbols in the Test Set had in fact appeared in the study set. Since each of these symbols in the Test Set appeared in the original Study Set, a correct response to each would be that the participant recognized the symbol. Effectively, a YES response.

Experimental Design

Response times for correct and incorrect trials were recorded and analyzed using SPSS Version 18 software. A one-way ANOVA was conducted contrasting correct and incorrect (self-doubt) response times. A paired samples t-test contrasted accuracy of trials. The sums of correct and incorrect responses could only be analyzed using a non-parametric test. This necessitated adapting the first experiment in order to generate interval data which could be analyzed using a parametric test. The responses to a seven point post-hoc Likert rating for certainty were analyzed using a one-way ANOVA with repeated measures. The same relative proportions were assumed for the participants of the post-hoc experiment because there was no reason to assume
that the first 50 participants differed from these 25 post-hoc experimental participants. In order to separate the Likert score results into correct and self-doubt responses, the lowest nine Likert means (36% of the sample) we selected and identified effectively as self-doubt responses. This resulted in a Likert mean score cut-off of 4.81 on the 7-point Likert scale. Fortunately, there were only two trials that were approximately 4.8, while the next lowest score was 4.68. Thus, all Likert mean scores between 4.8 and 7 were assigned to the Yes (correct) response, and all responses below that range were effectively No (self-doubt) responses.

Results

Accuracy

For the remainder of this thesis, incorrect trials will be labeled as self-doubt trials while correct responses will remain labeled correct trials. The response accuracy data indicated a significant difference for correct ($M = 16.72, SD = 3.654, SEM = .517$) versus self-doubt trials ($M = 7.26, SD = 3.556, SEM = .503$), $t(1,98) = 9.36, p < .0005$. Figure 3 illustrates this effect. Proportionately, this shows that on average 67% of responses were correct and thus 33% of responses were a product of self-doubt.

Response Times

The ANOVA testing for differences between correct and self-doubt trials using response time as the dependent variable resulted in a significant effect, $F(1, 98) = 29.239, p < .0005$. Figure 4 illustrates this effect. Response times indicated a significant difference for correct trial response times ($M=928.508, SD = 122.882, SEM = 17.378$) and self-doubt response times ($M = 1119.842, SD = 217.953, SEM = 30.823$). The response time differential between the two conditions was 191.33 ms, which is about one fifth of a second delay due to self-doubt.
Post-hoc Likert Rating for Certainty

Responses from the 7-point Likert scale analysis to determine the certainty of correct versus self-doubt trials were averaged across each. Likert means above 4.8 were identified as correct responses as noted earlier to map onto the previous accuracy rate of 67/33 percent. At 4.8 and above, 16 trials were thus labeled correct while the other nine were self-doubt trials. An ANOVA with repeated measures for correctly identified \((M = 5.56, SD = .51, SEM = .13)\) and self-doubt responses \((M = 4.14, SD = .49, SEM = .17)\) yielded a significant main effect of \(F(1, 23) = 45.226, p < .0005\). Figure 5 illustrates this effect.

Discussion

These findings supported the initial hypotheses of the experiment. Self-deceptive trials were successfully discriminated using accuracy of responses as well as lengthened response times. Doubt leads to inaccuracy and response delays. The ANOVA of the post-hoc Likert rating for certainty found a similar rate of accuracy between the initial \(t\)-test, suggesting the former essentially replicates the initial results. This result increases the confidence in these findings. A distinction was made between self-deceptive trials and self-doubt trials. Because the 7-point Likert ratings displayed no mean scores of 7 (the highest mean was 6.68), each trial displayed some level of self-doubt; therefore, we identified self-doubt as resulting in two outcomes: an accurate response, in which the participant has sufficient evidence of the truth, or an inaccurate response. From this, we can now extend the interpretation, in which an incorrect trial in the presence of self-doubt is self-deception. Essentially, self-doubt without sufficient evidence of the truth, raised to the level that causes inaccuracy, results in self-deception. During debriefing interviews with participants, all of the participants reported some level of insecurity and explained that their insecurity peaked during incorrect (self-deceptive) responses.
Response Times

Consistent with the extant literature on response times of outwardly deceptive behaviors (Anolli & Ciceri, 1997; Walczyk, Schwartz, Clifton, Adams, Wei, & Zha, 2005), the present study found a statistically significant difference of response times in self-deceptive trials. There was a 191.33 ms (about 1/5 of a second) delay in self-deceptive trials that accounts for the added processing time. Essentially, participants had a higher signal detection threshold to meet and exceed on these trials (Macmillan & Creelman, 2005). One limitation in regards to the response time data collected was that we failed to eject response times under 200 ms. These responses may have been an attempted response to the previous stimulus after the 2000 ms time limit expired. Fortunately, there were only six individual responses out of 1250 total individual response times that were under 200 ms; therefore, this limitation would not affect the results in such a way that would make the difference of self-deceptive response times insignificant.

Independent of Motivation

Much of the literature found a level of subjective motivation necessary for identifying self-deception. We arguably have found reasonable evidence of self-deceptive behavior that is not dependent on one’s particular motivation for response. In the present study, participants were given no feedback during responding that may have suggested their accuracy. Moreover, they were fully aware of a lack of incentive for their overall accuracy and individual responses. This measure sufficiently allowed for self-deception to be quantified in an environment that suggests the participants would not have motivationally biased perceptions. Of the four conditions that Gur and Sackeim (1979) found necessary for ascribing self-deception, the present results show no evidence of the absolute need for motivation bias. Although, consistent with the other three Gur and Sackeim conditions, this study showed that participants had evidence of p
and \(\sim p\) simultaneously, and \(p\) was not in the subjects’ awareness during their responses. Moreover, the voice recognition task used to identify self-deception in Gur and Sackeim (1979) has been debated as insufficient of their own four criterion (Douglas & Gibbons, 1983). The present study has filled a gap in behavioral self-deception research because of the lack of empirically based research on general self-deception, rather than the traumatic narratives of self-image based self-deception that dominates the current literature. Presently, we identified self-deception that is independent of one’s motivation for \(\sim p\) to be true. This redefines self-deception to include a level of self-doubt that is due to insufficient evidence of \(p\) (despite knowing \(p\) is true) as well as evidence of \(\sim p\) in awareness, resulting in one’s inaccurate belief of \(\sim p\) to be true.

If one’s motivation for \(\sim p\) to be true causes an individual to perceive the world so that they actually have no evidence for \(p\), it could be argued that the individual’s motivationally biased perceptions of a \(\sim p\) world are not self-deceived under the ascribed criterion because of a lack of evidence for \(p\) in either the aware or unaware mind. This may suggest that motivation bias previously found in self-deceptive behavior may have been a product of motivationally biased perceptions and knowledge retention rather than the knowledge suppression and decision making that is evident in self-deception (Kruglanski, Peirro, Mannetti, Erb, & Chun, 2007). This would include motivationally biased perceptions that precede any acquisition of knowledge, thus preceding one’s ability to deceive themselves. To illustrate this concept, consider an addict that is highly motivated to believe that they do not have an addiction. These individuals also have skewed perceptions that do not allow them to perceive any physical evidence of their addiction, such as weight loss, paleness, scars, hair loss, etc. Because the initial perception is motivationally biased, the addict has no evidence of the truth state; and therefore, cannot be self-deceived. If the product of these motivationally biased perceptions ought to be in the realm of
self-deception, it would be incongruent with the extant philosophical prescriptions of self-
deception, because the addict only has evidence of \( \sim p \) with no contradicting evidence of \( p \).

**Accurate Mapping of Likert Responses to Initial Experiment Responses**

As noted earlier, a *post-hoc* Likert rating for certainty was necessary to increase confidence in the results of the initial \( t \)-test accuracy effects. The Likert cut-off score was 4.8 (the lowest 36% of Likert means), which closely mapped the initial self-deceptive response rate of 33% (Figure 6). In addition, this cut-off score is also consistent with participant answers during debriefing interviews. When prompted for an intuitive sense of their cut-off score of certainty for a forced-choice decision, 18 out of the 25 *post-hoc* participants stated that any response five and above would be assigned a “yes” or correct response. The other seven participants ascribed either 4 or 6 as the cut-off score. This cluster of anecdotal responses further increased the confidence in the accurate mapping of the Likert responses to the initial findings.

**Limitations & Further Research**

One possible limitation or concern with this research is whether or not all of the 25 target symbols were in fact seen and studied in the Study Set. When interviewing the two participants that only gave one incorrect response, they both stated that they did in fact see that individual symbol before, yet responded incorrectly because of an “overwhelming sense of doubt”. This suggests that the 200 ms study time for each symbol was sufficient for flawless performance in the recognition task; therefore, the incorrect responses were a product of self-deception. Another limitation of this study is that, for obvious methodological reasons, response times could not be recorded for the verbal Likert responses, and there was only a replication of the accuracy effects from the initial experiment. In response, any reaction time data that involved pressing seven different keys (as opposed to only two) would undoubtedly have confounding differences due to
mechanisms involved in deciding the answer and then choosing and pressing the correctly numbered key. In response to concerns of latency and primacy in the stimulus sets, Sternberg (1966) found that response times in recognition tasks are independent of a stimulus’s position in the set. Therefore, any significant differences for response times throughout the Test Set of correct and self-doubt trials were not dependent on the order of the symbols, rather, they ought to be due to the processing time resulting from self-deception.

Further research would be needed to better identify instances of self-deception as well as attempt to understand the underlying mechanisms of this behavior. Electrophysiological and event-related brain potential imaging is our next logical step. With further confidence in the ability to discriminate self-deceptive behaviors, researchers will be able to analyze such behavior in the context of brain imaging. In addition, Green (2011) explained that outwardly deceptive acts are characterized by increased heart rate, blood pressure, and respiratory rates, even though these are not sufficient in the detection of concealed information. It would be interesting to research these effects in self-deception. It could be speculated that self-deception may not evoke these sympathetic responses due to the lack of awareness of the internal conflict involved in lying to another.

Companion Study Results

*Verbal Stimuli Results*

A colleague conducted a companion study that tested self-deception and self-doubt using words. An ANOVA testing for differences of response times between correct (859.79 ms) and self-deceptive (909.53 ms) trials yielded a marginal effect $F(1,86) = 2.35, p < .129$. A power analysis suggested that a modest sample size may have contributed to limiting the significance of
this statistical comparison. Roughly doubling the sample size may yield a significant effect. Figure 7 illustrates the subtle response time effect.

**Companion Study Interaction Effect**

The results of the comparison analysis between the two companion experiments, symbols vs. words, were analyzed using a 2X2 ANOVA. The analysis yielded a strong main effect for overall average response times between the two experiments $F(1, 184) = 33.106, p < .0005$. The present study using symbols displayed a longer overall average response time (1024ms) than the companion study using words (884.6). Figure 8 illustrates this effect. The comparison of accuracy in the two experiments yielded a significant effect $F(1,184) = 24.715, p < .0005$. The response time differential between correct and self-deceptive trials in the companion study was 49.8 ms. Once again, the response time differential the present study was 191.33ms. There was a significant interaction effect between the two experiments $F = 8.519, p < .004$. Figure 9 illustrates this effect.

**Interaction Effect Discussion**

The companion study in this research had a similar procedure using words as the target stimuli rather than meaningless nonverbal symbols. The findings yielded a marginal effect for response times. The response time differential for correct and self-deceptive responses in the present study showed about a fifth of a second delay. This delay, as noted earlier, is ascribed to be the processing time for a mechanism that mediates self-deception. However, the response time differential for the companion study was only about 1/20th of a second. To account for this difference of delay, there was a significant difference in overall response times between the symbol and verbal recognition tasks. The companion study using verbal stimuli yielded a shorter overall average response time, which may be attributed to the semantic property of words. The
connotations carried by the words shortened the response times because it made them more recognizable than the abstract and meaningless symbols used in the present study. D’Agostina, O’Neil, and Paivio (1977) conducted various studies focused on concrete vs abstract dimensions of words and how that affects their recognition among other words. He showed that the degree of meaning and usefulness is the strongest attribute of words in language, basically the essence of the benefit of having a semantic nature.

Conversely, the symbols took longer to process and recognize on average because they lacked the concreteness that D’Agostina, O’Neil, and Paivio (1977) described. Nonetheless, asides from the differences of response delays that may be due to semantics, there is still a consistent response delay in both companion studies that can be attributed to a common mechanism facilitating self-deception. A possible replication of this study could test this hypothesis. If a replication using meaningful, nonverbal symbols yielded a similar pattern of self-deceptive responses as well as shorter response times than the meaningless symbols used here, then the processing difference between the two present companion studies may be accounted for by semantics. Thus, we could better argue that the delay of response times in self-deceptive responses may be due to a mechanism that facilitates self-doubt.

To bring the present results full circle, we have successfully discriminated self-deceptive behavior in an experimental recognition task, although this does not explain whether the subjects’ performance was modulated by conscious or unconscious mechanisms. Nonetheless, we can provide reasonable evidence for the question raised in the opening paragraph. We can ask whether their performance reflected an internal conflict between what they know to be true against a contrary belief. As stated earlier, it is in fact possible that all 25 targets were seen and studied in the Study Set. From that, all trials technically required a Yes response, the incorrect
responses can only be explained as resulting from sufficient self-doubt driven by some kind of need to self-deceive. Explaining the purpose of this possibly conscious or unconsciously driven behavior requires a definition of its evolutionary fitness, although, that too remains a topic of debate.
References


Figure 1

Figure 1. Study set of 50 meaningless nonverbal symbols presented to participants individually in sequential order for 200ms.
Figure 2. Test set of 25 meaningless symbols, all of which appeared in the Study Set.

Participants responded during a 2000ms timeframe to whether the symbol was recognized from
the previous set.
Figure 3. Average number of responses for correct and incorrect trials are shown. This displays a self-deceptive (incorrect) response rate of 33% of trials.
Figure 4. The average response time delay for incorrect (self-deceptive) responses was 191.33 ms.
Figure 5. Average Likert responses displays a self-deceptive rate of 36%.
Figure 6. A comparison of mean accuracy scores for the initial experiment and the post-hoc Likert ratings found a similar pattern of self-deceptive behavior.
Figure 7. The companion study average response time found a delay of about 1/20\(^{th}\) of a second for self-deceptive responses.
Figure 8. Overall average response times that included correct and incorrect response times were compared between the present study and the companion study using words. This shows the possible effect of semantics, in that participants could more readily recognize meaningful words than the ambiguous symbols used in the present study.
Figure 9. The interaction effect between the present study and the companion study displays a delay in response times that has been explained by the recruitment of a secondary mechanism that facilitates self-deception.
Appendix A

Informed Consent Form

You are invited to participate in an experiment dealing with visual perception and memory. This research is being conducted by Dr. Marc Pratarelli of the Psychology Department at Colorado State University-Pueblo and his research assistants: Kristi Haugen and Samantha Villanueva, both from the University Honors Program and Psychology.

With your consent (to be indicated by signing and dating the Informed Consent Form), you will participate in a 15-20 minute experiment in which you will be required to observe several images prepared by the experimenters and respond to each stimulus either with a verbal response of a button press on a desktop computer. One study involves words and the other involves nonverbal symbols, but you will only have the opportunity to do one of them today.

This experiment poses no additional risk to you other than those which you normally encounter in day to day activities on campus like attending class, driving to the University, etc. In any case, you may decline to participate, or suspend your participation at any time during the session without penalty. Your participation is entirely voluntary. If you do not complete the experiment, however, you may not receive any extra course credit offered by your instructor from the class in which you were solicited.

*Your participation is also entirely confidential.* individual results are kept in locked storage with access only available to the Principle Investigators listed above. These records are destroyed 5 years after completion of the study in accordance with established regulations of the American Psychological Association. Moreover, at no time will your name be used, since individuals are identified by code numbers, and our data analysis only reports averages across many participants.

If you have any questions please feel free to ask the research assistant you are working with today, or the Principle Investigator in Psychology Room 158, who may also be contacted by phone; Dr. Marc Pratarelli may be reached at (719) 549-2625.

Sincerely,

Marc Pratarelli
Sam Villanueva
Kristi Haugen
Colorado State University – Pueblo
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Appendix A

Informed Consent Form (SIGNATURE PAGE)

I have read the attached consent form and have received a copy for my records. I agree to participate in the visual perception study described by Dr Pratarelli and his assistants. I understand that my participation is strictly voluntary, and that I am free to withdraw this consent at any time without penalty. I also understand that by signing this document I am acknowledging that I am physically and mentally competent to perform the tasks described in the Informed Consent Form. Also, if you would like to receive information about the results of this study once completed, please feel free to write your contact information below your signature on this page.

Signature: ___________________________ Date: ________________
Your name printed: ____________________________
Witnessed by: ___________________________ Date: ________________