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THE EFFECT OF RELEVANT AND IRRELEVANT COGNITIVE EFFORT ON DECEPTION DETECTION ABILITY

By

Lauren M. Hamel

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ABSTRACT

THE EFFECT OF RELEVANT AND IRRELEVANT COGNITIVE EFFORT ON DECEPTION DETECTION ABILITY

By

Lauren M. Hamel

Research has found that high levels of cognitive effort result in a decreased ability to distinguish truth from deception. Research has also used very artificial methods to induce high cognitive effort (number memorization etc.).To improve upon this research, an experiment was conducted in which different forms of cognitive load were induced before participants completed a judgment task requiring them to detect deceptive and truthful interview responses. College student participants were assigned to one of four conditions. The conditions intended to induce high cognitive effort required them to process and retain (1) task-relevant information, (2) task-irrelevant information, or (3) series of numbers that were an irrelevant task. A fourth control condition omitted the extra information and task. It was hypothesized that task-relevant cognitive effort would aid detection accuracy, whereas irrelevant information and an irrelevant task would hinder accuracy.

Results were not significant, however, the predicted pattern did emerge with participants whose cognitive effort was relevant to their detection task having an increased detection ability. In addition, the low cognitive effort condition, which usually has the highest accuracy, had the lowest accuracy in this case.

Implications for how people believe and process information are discussed.

DEDICATION

I would like to dedicate this thesis to my wonderful, loving family, my mother, my father, and my little sister Amanda. They have always encouraged me to go after my dreams and to stay strong in the face of adversity. Their undying love and support were my foundation during this experience.

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Decades of research concerning deception in communication have made apparent not only that deception exists in everyday life (DePaulo, Kashy, Kirkendol, & Epstein, 1996) but also that most people are ill equipped to detect it (Bond & DePaulo, 2006). Bond and DePaulo's (2006) meta-analysis, which included 184 studies concerning the ability of individuals to detect deception, concluded that on average people correctly identify truth 61 % of the time and deceit 47 % of the time.

Many researchers have tried to determine variables that, depending on their level of influence, could inhibit or facilitate deception detection. Among the variables that have been found to influence detection accuracy are interacting with the deceiver (Burgoon, Buller, Ebesu, & Rockwell, 1994; Burgoon, Buller, White, Afifi, & Buslig, 1999), priming of suspicion (McCornack & Levine, 1990b), attention to particular communicative elements (DePaulo, Lassiter, & Stone, 1982), relationship to deceiver (Comedena, 1982; Gagne & Lydon, 2004), training in deception detection (Levine, Feeley, McCornack, Harms, & Hughes), probing the deceiver (Stiff & Miller, 1986; Buller, Strzyzewski, & Comstock, 1991a) and level of cognitive effort (Gilbert, Pelham, & Krull, 1988; Gilbert, Krull, & Malone, 1990).

The current study concerns the latter--the effect of cognitive effort on deception detection. More specifically, it is concerned with the manner in which previous research has induced cognitive effort and attempts to improve upon past efforts to make some more refined conclusions about how cognitive effort influences deception detection. It will attempt to do so by inducing cognitive effort in a more situationally relevant manner and comparing its effects to those of the traditionally used methods. These traditional methods, which will be explained in greater detail in

the following section, generally consist of number memorization or arithmetic problems as a means to induce greater cognitive effort in experimental participants.

Literature Review

Belief Debate

Before a review of previous research regarding cognitive effort is given, a background on the theoretical debate of how individuals process and accept incoming information will be outlined. This argument is important to understand because it is what has helped start and develop much of the research that has thus far been conducted concerning cognitive effort and many of its implications.

The process of belief is divided into the Cartesian viewpoint and the alternative Spinozan view. The Cartesian viewpoint states that incoming information is judged as true or false before it can be comprehended and stored in one's memory. An individual can hold a piece of information, make a judgment concerning its veracity, and then accept it as either true or false (Gilbert, 1991). In other words, an individual does not have to accept a piece of information as accurate before he or she can judge whether it is indeed true or, after further deliberation, is actually false.

Alternatively, the Spinozan view of information comprehension states that when an individual is exposed to new information, it will be initially accepted as true. This initial belief is a necessary precursor for comprehension. Only later if the individual realizes that this new information is inconsistent with previously held understanding will any judgment of truth or deceit be made (Gilbert, 1991).

At first blush, the above argument may appear a bit trivial, however, its implications involving deception and its detection are applicable to everyday life.

More specifically, if people function within the Spinozan view, and are predisposed to believe all information they encounter before they can judge it, both lies and deceit will initially be believed, and only uncovered if one has the ability to make that judgment correction. It is possible for any number of deception attempts to go undiscovered if that final stage of correction does not occur. The current research takes the Spinozan view and a long line of similar research to determine if cognitive effort has an effect on individuals' ability to make that final determination. Moreover, it attempts to make a narrower distinction of what effects certain types of cognitive effort could have on deception detection.

Gilbert's Three Stage Model of Information Processing

A major researcher in the area of cognitive effort and its effects on information processing and deception detection is Gilbert (Gilbert et al., 1988, 1990). His work in this area has led him and his colleagues to outline three steps of cognitive processing. The first is categorization, the second is characterization, and the third is correction. While in the categorization stage of processing, individuals will recognize what someone is doing (Amanda is telling her professor that she missed her last exam because her grandmother passed away). While in the characterization stage individuals will make inferences about what trait that person is demonstrating through that particular action (Amanda is a good student because she has a legitimate excuse for missing her exam). Last, while in the correction stage individuals will consider what possible situational constraints or prior knowledge may help form a more accurate perception of the person's action (Amanda has already used this excuse two times earlier this semester, so she must be lying) (Gilbert et al., 1988).

It is believed that the first two stages of categorization and characterization occur automatically and with very little effort (Gilbert et al., 1988). However, it appears that the final stage of correction is much less automatic and requires more cognitive resources to complete than the previous two stages (Gilbert et al., 1988). To refer back to the previous of example of the lying student, it is easy to see what Amanda is doing and to make the obvious inferences. However, it takes an increased amount of cognitive effort and resources to find and apply the extra situational information that changes the perception of the interaction entirely. Distinguishing among these three stages is important here because it provides a framework for what occurs when people take in and process new information, even when that information may not be truthful.

Gilbert et al. (1990) examined the consequences incompletion of this final stage has on deception detection. Through experimental manipulation of cognitive effort and deception, they found evidence that if people are being deceived, they will detect it in the correction stage of information processing. In this study, participants were given a list of propositions regarding the translation of English words into Hopi Indian words. Some of these propositions were true and some were false and participants were instructed to judge their veracity. To determine the consequences of the incompletion of the final stage of correction, some participants were interrupted during their judgment tasks and forced to make their decisions more quickly. As predicted, participants' ability to accurately determine truthful statements was not affected by the interruption (55 % when uninterrupted vs. 58 % when interrupted), but did reduce their ability to detect deception (55 % when uninterrupted vs. 35 %

when interrupted). This is evidence that when people are cognitively busy, they will not enter into the correction stage and therefore be unable to detect the deception attempt.

To further examine this three stage process of information processing, Gilbert and Osborne (1989) conducted an experiment to see if and how participants who make inaccurate judgments of others are able to correct those inaccuracies. Participants either watched a muted video tape of a person discussing an anxious topic or a mundane topic. They were all kept cognitively busy by rehearsing an eight-digit number. Once the tape was over, participants stopped their cognitive busyness by recalling the number for the experimenter. Next, half of the participants were asked to think about the videotaped person in a variety of mundane and anxiety-provoking situations (other-thought) and the other half were told to think of themselves in the same situations (self-thought). All participants then rated the video taped person's trait anxiety. Next, subjects who had previously taken part in other-thought now took part in self-thought and vice versa. Finally, participants rerated the video taped person's trait anxiety. As predicted, participants who took part in other-thought were more likely to correct their previous erroroneous trait attributional assumptions when taking situational contexts into consideration. This is further evidence that not only does cognitive effort reduce judgment accuracy, but the final stage of correction does not inevitably follow the reduction of the cognitive effort. This indicates that the final stage is much more effortful in comparison to the first two stages of categorization and characterization.

Previous research has made strides in determining how the induction of cognitive resources will effect information processing, and more specifically deception detection, however, there are some issues regarding the ecological validity of the manner in which cognitive effort has been induced. In past research, cognitive effort has usually been induced by having individuals engage in cognitive rehearsals (Gilbert et al., 1990), memorize long numbers (Gilbert & Osborne, 1989; Crisp, Perks, Stone, & Farr, 2004; Weary, Vaughn, Stewart, & Edwards, 2004), work under time pressure (Silvera, 2000), count backward by a consistent interval from a high number (Feeley & Young, 2000), or work on arithmetic problems (Millar & Millar, 1997). These cognitive effort manipulations are irrelevant to the task of determining truthfulness and might be producing results that will not generalize to the effects of more message-relevant forms of cognitive effort. In other words, there may be a difference between cognitive effort that acts as more of a distractor and cognitive effort directly related to the task in which the participants are involved. Put in the context of deception, the ability to detect deception may not be the same for those who are induced with relevant versus irrelevant cognitive effort. Thus the current investigation seeks to expand upon previous research concerning the effect cognitive effort has on deception detection ability by comparing relevant cognitive effort and irrelevant cognitive effort.

Heuristic Systematic Model

The Heuristic Systematic Model (Chaiken 1980, 1987) of information processing will serve as a framework to guide the current research. Its inclusion of

dual modes of processing will allow for the different types of cognitive efforts being studied.

The HSM posits that individuals can process information through two different routes, a systematic route and a heuristic route. The systematic route of processing involves a purposeful scrutinization of incoming information. All new information is carefully evaluated until the individuals can make an efficient decision or form an educated opinion on what is being communicated to them. In addition, those who process systematically will differentiate between strong and weak arguments and are unaffected by heuristic elements of the message that do not pertain directly to the content of the message. Conversely, the heuristic route of information processing is based on peripheral contextual information. Decisions and opinions are formed by the influence of heuristics such as the sources of the message or the length of the message (Todorov, Chaiken, & Henderson, 2002).

The HSM posits that the processing route used to assess incoming information will be determined by an individual's motivation and ability, which is determined by available cognitive resources. In other words, an individual who is motivated to listen to and understand new information will be more likely to engage in systematic processing when compared to someone who is not motivated to process the information. Also, a person who has the available cognitive resources to conduct this type of extensive processing necessary for the systematic route will be more likely to do so than someone who does not have the required resources available.

Three-Stage Process Model and Heuristic Systematic Model

Gilbert's three-stage model of information processing and the HSM will be used jointly to inform the current research. The first two stages of the three-stage model, categorization and characterization, are thought to occur automatically that is, an individual will make judgments of what another is doing and infer something based on those actions with little effort. However, the third stage of correction, which serves as a time for any erroneous judgments to be corrected, may not occur if an individual is cognitively busy. The HSM corroborates this three-step process by outlining two routes to information processing: systematic and heuristic. As previously explained, the systematic route will be utilized when there is an ideal amount of cognitive capacity available to scrutinize the information. Conversely, the heuristic route will be dominate when very little cognitive capacity is available. The heuristic route can be viewed as the occurrence of the first and second stage of Gilbert's three step model and the systematic route as the entire three-step process. In other words and based on previous research, people who are cognitively busy will default to the heuristic route of information processing and only pass through the first two stages of categorization and characterization and will therefore, be less likely to distinguish between truth and deceit. However, those who are not cognitively busy will be able to use the systematic route, reach the final step of correction in their information processing, and will be more likely to pick out truth from lies. The current research, however, seeks to determine if this relationship between cognitive effort and information processing continues to hold if cognitive effort is relevant to the situation of deceit

Type of Effort

As previously discussed, the current research is concerned with the past operationalization of cognitive effort. Specifically, past research has induced cognitive effort in a very artificial and ecologically invalid manner. The current research is improving on past efforts by offering a more relevant alternative of cognitive effort. In addition, because past research has offered consistent findings in the differences between high and low cognitive effort (Gilbert, Krull, & Malone, 1990; Gilbert, Krull, & Pelham, 1988; Gilbert & Osborne, 1989; Pontari & Schlenker, 2000; Silvera, 2000) the current research is only concerned with high levels of cognitive effort (relevant and irrelevant) because that is where it is anticipated the most important effects will be found. In other words, low cognitive effort relevant or otherwise will not hinder information processing or deception detection ability. For this reason efforts were focused on the different types of high cognitive effort and their effects on detection accuracy.

Conceptual Definitions

To clarify among the different types of cognitive effort being induced in the current research, a conceptual definition of each is provided. *Relevant cognitive effort* is mental load induced through an increased amount of information directly related to the subject the possible truths and lies are regarding. *Irrelevant cognitive effort* is mental load induced through an increased amount of information unrelated to the subject the possible truths and lies are regarding.

Hypothesis and Research Question

Based on past research, it was predicted that high irrelevant cognitive effort inhibits deception detection. However, based on the assumptions of the HSM, it was predicted that high relevant cognitive effort will act as a detection facilitator. It was thought that those who are induced with relevant cognitive effort will take the systematic route of information processing because the increased load will not act as a distracter but as a mechanism for increased higher-order processing. This prediction that high relevant cognitive effort will increase deception detection accuracy is counterintuitive to previous thinking, however, it is theoretically driven. Specifically, if relevant cognitive effort acts as predicted, participants with this type of load will process incoming information systematically because this type of load is directly relevant to the task the participants are required to partake in. With the increased relevant cognitive effort and the expected increase of systematic processing, participants will be better equipped to distinguish truths from falsehoods.

The current research is predicting that high cognitive effort will not always be detrimental to deception detection if it is relevant to the context of the deceit. This prediction is based on the two factors the HSM postulates determine which route of processing is used: ability and motivation. The current research will hold motivation constant and vary ability by inducing either relevant or irrelevant cognitive effort.

Past research has shown that increased cognitive effort inhibits deception detection. However, it is predicted that when high cognitive effort is paired with relevant information, the opposite will be true. In other words, those who are less cognitively taxed will be better at detecting deception except compared to those are

cognitively taxed but by information that is task-relevant. Increased cognitive effort will facilitate deception detection in those who receive task relevant information because they will process this information in a more systematic manner. Because this systematically processed information is relevant to their task, the higher level processing will increase participant knowledge and focus and allow for an increased ability to detect any subsequent deception. When these two types of cognitive effort – relevant and irrelevant– are compared, the following is hypothesized:

H1: Relevant cognitive effort will produce higher deception detection accuracy than irrelevant cognitive effort.

In addition to comparing the differences between relevant and irrelevant information on deception detection accuracy, an irrelevant task manipulation was included to compare the current research with previous research designs. To determine if irrelevant information and an irrelevant task induce equal levels of cognitive effort and consequent decrements in detection accuracy, the following research question is posed:

R1: Does irrelevant information produce different effects on detection accuracy than an irrelevant task?

Method

Pilot

A pilot effort was implemented to create the stimuli to be used in the main experiment. Ten female participants completed a task concerning how best to survive in the desert called *Imperative Information: Surviving in the Desert*. The information for this task was compiled from several websites and resources on desert survival, including Ganci (1991), Kraus (1978), and Nelson and Nelson (1997). The desert survival task was a stimulus used in past research as a prompt for discussion between study participants (Burgoon, Bonito, & Hamel, 2006). The task involved participants prioritizing what items would be most needed if stranded in the desert. These 10 participants were put into pairs to discuss and create their priority lists. One member of each dyad was privately instructed to be deceitful about her true opinions regarding the prioritizing of salvable items. These discussions were audio recorded and one honest and one deceptive utterance was selected from each dyadic conversation for use as the stimuli in the main experiment.

Independent Variables

Relevancy of Information. One-fourth of the participants were randomly assigned to the high information relevancy condition. They read the background information of the *Imperative Information: Surviving in the Desert* document. This document was used as background information regarding the truthful and deceptive messages the participants would eventually be exposed to. Another fourth of the participants were assigned to the low relevancy of information condition. They instead read a document about desert flora and fauna, a topic that was tangentially

related to the desert scenario but had nothing to do with the desert survival discussion they would eventually listen to. The remaining half of the participants did not receive any background information.

Cognitive Effort Three fourths of participants were induced with high cognitive effort. The desert survival and desert flora and fauna background information were written at a collegiate reading level to induce high cognitive effort. To ensure that equivalent reading levels and length of document were obtained, the documents were evaluated with Word Perfect's Grammatix tool which provides measures of lexical diversity and the Fleish-Kincaid readability index.

Once participants in the previously described conditions read their respective instructions, they listened to conversational excerpts from the pilot. The conversations were segmented into individual utterances. At the end of each segment, participants rated how credible and truthful they felt each person appeared to be.

To maintain a high level of cognitive effort, participants were told that they would be quizzed at the end of the session. They were told they would have to recall five of the 10 statements they listened to. This was meant to utilize participants' cognitive resources, but to do so in a manner that is relevant to their task.

Participants in the irrelevant task condition were not given any background information to read. Instead they were instructed to memorize five three-digit numbers. This condition was implemented to compare the current research's manipulation of relevant cognitive effort to previous research methods for inducing cognitive effort. This third condition was added due to the nature of the comparison of relevant and irrelevant information. A complete 2X2 design (which is typical for

this type of research) could not be created because there does not exist a *relevant task* in the same way there is an irrelevant task. In other words, the relevant information condition requires information that is related to the subsequent truthful and deceptive statements. There cannot be a relevant task condition that involves the same crucial components of the relevant information condition and can still be a task like the irrelevant task condition.

Control An offset control condition was included to compare participants in the other three conditions to participants who were not induced with any cognitive effort and only asked to judge the veracity of each utterance.

Conditions

Level of Effort	Relevant Information	Irrelevant Information	Irrelevant Task
High	-High reading level -On-topic information -Memorize five statements	-High reading level -Off-topic information -Memorize five statements	-No background information -Memorize five three-digit numbers

Control
-No background information -No memorization

Main Experiment

A 1 (amount of effort) x 3 (relevancy of information/task) with an offset control design was implemented to test how high cognitive effort and relevancy of information effect the ability to detect deception.

Participants

One hundred and four undergraduate students from a large Midwestern university were recruited to participate in a deception detection study as a fulfillment

for a requirement for course credit. Participants also had the opportunity to earn a $25 cash prize for being the most accurate at distinguishing between truth and deceit.

Procedure

Participants were brought into a lab and randomly assigned to one of the four conditions. They were told by an experimenter that they were going to engage in a deception detection and memorization task and that their level of accuracy at each task would result in a reward once they have completed their task. The participants were instructed to read the directions on the packet of materials that was in front of them. These materials differed based on condition.

They were asked to read the document relevant to their condition or to memorize a number and then judge the veracity of the same 10 conversational excerpts from the pilot.

Manipulation Check

After participants were finished with the experiment, they were asked to respond to three items regarding how relevant they felt the information was to the conversation they listened to and 18 items regarding how much cognitive effort they felt they had to expend to read through the initial instructions and to memorize the necessary information. These items were included as a manipulation check to ensure cognitive effort and relevancy of information were manipulated as intended.

Dependent Measures

All subjects, regardless of condition, were asked to judge each conversational excerpt on a dichotomous measure of truth or deception. In addition, they were instructed to give perceived credibility ratings for each excerpt. The veracity of each

statement was known by the experimenter so an objective right or wrong answer could be calculated. Separate percentage correct judgments were calculated for truth and deception.

Results

Reliability of Measures

Reliability checks of all the measures taken produced high reliabilities. The scale used to measure cognitive effort was composed of 18 items which assessed cognitive effort with direct items (i.e. how much mental activity was required to complete this task?) and indirect items (i.e. how tense were you while completing this task?). The direct items were measured on an 11-point scale, the indirect items were measured on a seven-point scale and yielded a reliability of $\alpha = .96$. The perceived relevance of the document read by the participants in the relevant and irrelevant information conditions was measured with three items on seven-point scales which had a reliability of $\alpha = .91$. The credibility of the document was assessed with six items on seven-point scales with a reliability of $\alpha = .85$. Last, the self reported motivation of the participants was assessed with three items and had a reliability of $\alpha = .70$.

Manipulation Check

To ensure that cognitive effort was manipulated properly, a planned contrast compared the control condition to the three experimental conditions. Results indicated that those in the control condition experienced significantly less cognitive effort than those in the relevant information condition ,the irrelevant information condition, and the irrelevant task condition (see Table1), $t(99) = 2.71$, $p < .01$. In addition, contrast tests revealed that the irrelevant task did not differ from the two information conditions ($p > .20$) and the relevant and irrelevant information conditions did not differ from one another ($p > .20$) (See Table 1).

A manipulation check was also conducted to determine if the level of participant motivation was comparable across conditions. A one-way analysis of variance produced no significant difference in motivation among the four conditions, $F(3, 98) = .08$, $p = .97$, $\eta^2 = .002$, relevant information, irrelevant information, irrelevant task, and the control (see Table 1).

Last, a manipulation check was conducted to ensure there was a comparable level of memory accuracy among the three conditions that required participants to either memorize facts or numbers. A one-way analysis of variance among the three experimental conditions found no significant difference in memory accuracy was found among the four conditions (see Table 1), $F(2, 74) = 1.14$, $p = .32$, $\eta^2 = .03$.

Table 1 Manipulation Check

	Cognitive Effort		Motivation		Memorization Accuracy	
	M	SD	M	SD	M	SD
Relevant Information	5.10	1.31	4.92	1.11	2.56	.51
Irrelevant Information	4.66	1.05	5.04	.85	2.20	1.08
Irrelevant Task	4.83	1.62	4.98	1.14	2.37	.84
Control	4.06	1.27	5.04	1.04		

Hypothesis 1

The hypothesis predicted that participants induced to expend relevant cognitive effort would be more accurate at detecting deception than those induced to expend irrelevant cognitive effort. Hypothesis 1 was tested with multiple contrast analyses. The relevant information condition was compared to the remaining three as

an aggregate and then the three experimental conditions (relevant information, irrelevant information, and irrelevant task) were all compared to each other using a Dunnett's comparison. No significant differences were found in any of the comparisons. See Table 1 for means and standard deviations of each condition. Inspection of the means reveals that accuracy was higher (though not significantly so) with both the relevant information and irrelevant task than with the irrelevant information; the latter condition was on a par with the control condition. These patterns are contrary to what was hypothesized.

Table 2 Detection Accuracy

	Total Accuracy		Truth Accuracy		Deception Accuracy	
	M	SD	M	SD	M	SD
Relevant Information	.62	.13	.65	.18	.60	.22
Irrelevant Information	.59	.16	.63	.17	.54	.23
Irrelevant Task	.63	.15	.66	.17	.60	.18
Control	.58	.20	.59	.23	.57	.21
Overall	.61	.16	.63	.20	.58	.21

To examine further the relationship between the different types of cognitive effort and the ability to distinguish truthful statements from deceptive statements, separate one- way analyses of variances were conducted for overall accuracy for truthful statements and deceptive statements. Neither the truthful statement analysis $F(3, 100) = .629, p = .60, \eta^2 = .02$ (see Table 2) nor the deceptive statement analysis $F(3, 100) = .412, p = .745, \eta^2 = .01$ (see Table 2) yielded significant differences among the cognitive effort conditions. Lowest deception detection accuracy scores again accrued in the control and irrelevant task conditions, and the control condition

also yielded the lowest truth detection accuracy, although the differences failed to achieve statistical significance. The patterns did not conform to expectations.

As can be determined from the overall accuracy proportions as well as the truth and deception accuracy proportions, these data do not conform with what has previously been reported concerning the ability to distinguish between truthful and deceptive statements. Bond and DePaulo's (2006) meta-analysis reported an overall accuracy rate of 54 % and separate accuracy rates for truth and deception detection accuracy of 61 % and 47 % respectively. The data presented here show an overall accuracy proportion of 61 %, a truthful accuracy proportion of 63 %, and deception accuracy proportion of 58 %. The truth accuracy percentage is not significantly different from what was found in the meta-analysis $t(103) = -1.52$, $p = .132$ but deception accuracy is $t(103) = 2.68$, $p = .009$. A possibility that could account for this 11-point discrepancy is the stimuli chosen for this research.

In line with previous research, these data show that accuracy was generally higher among truthful statements when compared to deceptive statements. However, accuracy for deceptive statements was higher than what is typically reported. A closer examination of the accuracy rates on a per question basis indicates that several questions were consistently judged correctly across all conditions (T1, T5, and D5). In addition, although not significantly different from the accurately judged questions, several questions were also consistently judged incorrectly across all conditions (T2, T3, and D4). This suggests that the results may be due to a poor choice in stimuli. In other words, participants were consistently able to discriminate between truth and deception for some statements, but for others the stimuli appear to be either too easy

or too difficult to offer any real possibility for cognitive effort to play a part in inhibiting or facilitating accurate judgments.

Table 3 Accuracy Proportions for Each Statement

		Condition				
Truthful Statements	Category	Relevant Information	Irrelevant Information	Irrelevant Task	Control	Overall
T 1	Accurate	.88*	.84*	.89*	.85*	.87*
	Inaccurate	.12	.16	.11	.15	.13
T 2	Accurate	.48	.44	.37	.22*	.38
	Inaccurate	.52	.56	.63	.78	.62
T 3	Accurate	.40	.44	.67	.44	.55
	Inaccurate	.60	.56	.33	.56	.45
T 4	Accurate	.84*	.56	.63	.44	.55
	Inaccurate	.16	.44	.37	.56	.45
T 5	Accurate	.64	.88*	.74*	.78*	.76*
	Inaccurate	.36	.12	.26	.22	.24
Deceptive Statements						
D 1	Accurate	.76*	.72*	.81*	.78*	.77*
	Inaccurate	.24	.28	.19	.22	.23
D 2	Accurate	.52	.36	.59	.63	.62
	Inaccurate	.48	.64	.41	.37	.38
D 3	Accurate	.68	.68	.59	.67	.65
	Inaccurate	.32	.32	.41	.33	.35
D 4	Accurate	.40	.40	.41	.30	.38
	Inaccurate	.60	.60	.59	.70	.62
D 5	Accurate	.64	.56	.59	.48	.57
	Inaccurate	.36	.44	.41	.52	.43

* Significantly different within condition at $p < .05$

In addition, a simple tally of how many statements resulted in a majority of inaccurate judgments shows that, although indicated as the most accurate condition in previous research, the control condition resulted in the most statements that were judged inaccurately. The control condition contained five statements judged inaccurately by the majority whereas the relevant information, irrelevant information, and irrelevant task conditions resulted in three, four, and two statements misjudged, respectively, by the majority.

An item analysis also confirmed that although a few statements were consistently judged either correctly or incorrectly, those who had the highest overall accuracy were also the participants who consistently judged statements correctly, even if those statements were generally judged incorrectly. In the same vein, the item analysis also confirmed that those who have low overall accuracy, judged statements incorrectly even when those statements were generally judged correctly.

Consistent with previous research, a main effect was found for accuracy. That is, accuracy was significantly higher for truthful statements when compared to deceptive statements $F(1, 100) = 5.521, p = .021, \eta^2 = .052$. The estimated marginal mean of truthful accuracy was $M = .63$, $SD = .02$ and deception accuracy was $M = .58$, $SD = .02$.

An interaction effect was also found between accuracy and the specific stimuli used. Specifically, the main effect for accuracy was not consistent across all ten statements $F(1, 100) = 7.867, p < .000, \eta^2 = .245$. See Table 4 and Figure 1 for accuracy means for all ten statements. In Figure 1, the five statements represent the five consecutive stimuli that were truthful or deceptive.

Figure 1 Truth and Deception Accuracy per Statement

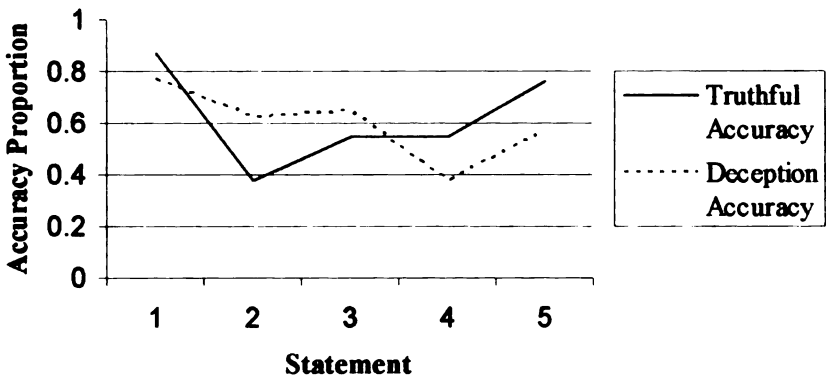

Figure 1 demonstrates that some statements (T1 and D1, for example) are consistently judged accurately. However, other questions (T2 and D4, for example) are consistently judged inaccurately. This finding is a problem in regard to testing the effect cognitive effort has on deception detection. These findings pertain across all conditions, so it is apparent that regardless of the effect of the different types of cognitive effort induced, participants were consistently accurate or inaccurate on the statement being judged in certain cases. Although this interaction effect does not pertain directly to the hypothesis being tested, it does provide evidence that testing different types of cognitive effort should not end here.

Research Question 1

The research question asked whether cognitive effort induced by irrelevant information produces different effects on detection accuracy than cognitive effort induced by an irrelevant task. In other words, did those whose increased cognitive effort was due to reading the document regarding desert plant life differ in their ability to detect deception when compared to those whose increased cognitive effort was due to number memorization? An independent sample *t* test reveals that these

two conditions did not differ in ability for (a) overall accuracy of judging truthful and deceptive statements t(50) = -.97, p = .338, (b) judging truthful statements t(50) = -5.7, p = .571, or (c) judging deceptive statements t(50) = -.96, p = .341. These findings are reassuring regarding the current research because, as previously explained, this is the first time cognitive effort was induced using reading level. Previous research has relied on number memorization tasks (similar to the irrelevant task condition in this study), complicated math problems, or counting backward from a higher number using difficult intervals. Despite the fact that significant accuracy differences were not found among the experimental conditions, the current research can offer future endeavors the choice of inducing cognitive effort in a way that appears to be effective and comparable to previous methods.

Discussion

The purpose of this research was to extend previous knowledge of the effects of cognitive effort on the ability to distinguish between truth and deceit. Past endeavors in this area of research have induced cognitive effort in a manner irrelevant to the task of detecting deception and have generally found this type of effort inhibits ability to distinguish between truth and deception. The current research compared the effects of relevant cognitive effort to those of irrelevant cognitive effort.

The data from the current research was not consistent with the proposed hypothesis. Overall, relevant cognitive effort did not facilitate deception detection as the current research predicted. In addition, cognitive effort in general did not inhibit deception detection as previous research has indicated. In fact, results were the reverse of what is generally obtained from deception detection research involving the manipulation of cognitive effort. Specifically, it is usually the case that when compared to participants who undergo inductions to elevate cognitive effort, those in the effortless control conditions generally exhibit increased ability to distinguish between truth and deception. That was, however, not the case here. The control condition was actually the lowest at detecting truth from deception. Despite the fact that the results were not consistent with (a) previous research or (b) the current research predictions, the idea of relevant versus irrelevant cognitive effort should not be dismissed. The results may not have been a result of only the experimental manipulation of the type of cognitive effort. Several factors may also have played a part in the results of this experiment.

After examining the data on a per statement basis, it is apparent that there was a high amount of variability among the stimuli themselves. It is possible that the relative ease of some statements and extreme difficulty of others did not allow for enough discrimination of the observers. More ambiguous stimuli would produce a more reasonable challenge and valid test of the ability to distinguish truth from deception when under cognitive load. Future research is needed to rule out the possibility that the current results represent an artifact of the specific stimulus set.

In addition to the variability of the stimuli given, judgments were based solely on audio recordings. Observers only had a short amount of monologue from which to form their judgments. All ten statements were less than 20 seconds of talk time. If participants were presented with stimuli with more channels of communication, such as visual cues, and periods of communication of a few minutes, results may have been different than what was obtained with the current stimuli.

It is also possible that, although the cognitive effort conditions reported higher levels of cognitive effort compared to the control conditions, not enough cognitive effort was induced to either inhibit or facilitate deception detection. Perhaps a more cognitively taxing task is needed to occupy more of the participants' mental resources which, depending on what type of effort is induced, will either draw attention away from the detection task or allow for greater focus on it.

Another factor that may have had an effect on the results of this study is the sample size. The number of participants allowed for enough power to make reasonable inferences and conclusions, yet it is possible that with more people, the differences among the cognitive effort conditions would become more apparent.

Despite that the results failed to achieve conventional levels of significance. Generally speaking, accuracy was higher in the relevant information condition when compared to the irrelevant information and irrelevant task condition. These findings may indicate a finer difference that requires a larger sample size to detect this effect.

Gilbert's Three Stage Information Processing Model and Heuristic Systematic Model

Although the current data did not fall in line with what was predicted, what has been found here can lend to further knowledge regarding information processing. The three experimental conditions experienced greater cognitive effort than the control group, but these participants were still able to process systematically and therefore had an increased ability to distinguished truth from deceit.

Previous research has reasoned that control groups in deception detection research involving cognitive effort are generally more successful due to the fact that those in this group are able to put their full focus on the possibly deceptive communication. However, due to the innovative manner in which the current research induced cognitive effort, an unforeseen effect may have occurred. Specifically, it is possible that those who were induced with relevant and irrelevant cognitive effort were inadvertently induced to be more attentive generally to the task at hand. This, then, could have resulted in higher awareness and greater focus on the issue of determining truth from deception and therefore an increased ability in doing so.

To recap the three stages of Gilbert's model of information processing, when new information is obtained, the first two stages of categorization and characterization are automatic. These stages allow those who are processing information to evaluate what the information is and then make basic inferences about

where the information has come from. The third stage of correction, however, is less automatic and requires higher level thinking before any mistakes in the previous stages can be corrected. Based on what was found here, although cognitive effort was induced, it did not appear to inhibit that final stage of correction as has been suggested previously. This undiminished ability is even more pronounced when the three high effort conditions are compared to the low effort control condition. Participants in the control condition fared the worst at distinguishing between truthtellers and deceivers.

What can account for this inconsistent finding? One possibility is that those in the high effort conditions had an increased awareness of their task when compared to participants in the control condition. It could be the case that those in the high cognitive effort conditions had to concentrate harder on their task than those in the control condition and thus, more systematic processing occurred in these conditions. The control condition, however, did not require the same amount of concentration. Not being required to read or memorize a list of facts or numbers could have allowed these participants the luxury of peripheral processing and therefore diminished their ability to detect truth and deception. This lack of systematic processing would have left this group susceptible to biases that caused their poorer performance.

Alternative Explanation

These data are evidence of what Langer (1978) has proposed as an alternative conceptualization of cognitive capacity. In her viewpoint, cognitive capacity is not necessarily finite. In fact, when given a cognitively effortful task, cognitive awareness may actually increase rather than decrease. That increased awareness then results in

increased mindfulness and an enhanced ability to perform certain tasks. The increased performance of the high cognitive effort conditions may have been a result of increased mindfulness.

Belief Debate

To review the debate over belief described earlier in this paper, the Cartesian viewpoint states that new information can be held suspended without evaluation while an individual judges it as either truthful or deceptive. After this judgment occurs, the individual can then comprehend the new information. Conversely, the Spinozan point of view argues that one must accept new information as true before comprehension can occur. Only once the new information is accepted as true and then comprehended can an evaluation of its veracity be made. If the previous interpretation of the results is correct, then the data are somewhat consistent with the Spinozan viewpoint. The results from the three high cognitive effort conditions are consistent with this point of view. Despite an increase in cognitive effort, these participants achieved higher overall accuracy that was due to an increase in systematic processing. This higher level of information processing allowed the third and final stage of correction to occur and then resulted in an increased ability.

If it is indeed increased awareness and the resultant systematic processing that facilitated increased ability at distinguishing between truthful and deceptive statements in the high cognitive effort conditions, then this lends partial support to the Spinozan argument of belief. This improved ability is predicted by both the HSM and Gilbert's three-stage information processing model. However, the data do not fall exactly in line with what either model predicts. If the Spinozan view held true across

all conditions then the control condition should have defaulted on a truth more often, resulting in high truth accuracy but low deception accuracy. This, however, was not the case. The control group does not offer overarching support for either side of the belief debate, but with a larger pool of statements to judge more decisive evidence could become apparent. These two findings offer some support that systematic processing and its higher degree of cognitive effort help facilitate the ability to accurately determine when one is telling the truth or lying but more research is needed, especially in the area of low cognitive effort, to provide any more concrete conclusions.

Limitations

As previously mentioned, the sample size of this experiment may have been a limitation. The sample size used was large enough to obtain an effect size of $d = .5$, but only if the relevant information condition was compared to the other three conditions as a group. A larger sample will be needed to increase the power enough to allow for individual comparisons of each group. If a larger sample were used, the differences among the high cognitive effort conditions and the control may have been more pronounced. Although the differences between the high cognitive effort conditions and the control conditions are interesting in terms of level of accuracy, without statistical significance, only speculations can be drawn at this point.

Another component of the experiment that could be improved upon is the stimuli used. The recorded stimuli were naturally flowing from conversation but the deceit within was sanctioned by the experimenter. Although difficult to obtain, naturally occurring deception is ideal for research involving deception detection.

Another limitation of the stimuli is that they were only audio examples of truthful and deceptive communication. If observers were presented with truthful and deceptive stimuli that also allowed a visual channel of communication, the data may have been more informative.

Lastly, the stimuli were relatively short. All audio segments were less than 20 seconds. This limited amount of information may not have allowed observers enough time to acclimate themselves to the potential truthtellers or deceivers speech patterns. It could be the case that given more baseline information regarding communication patterns of those being observed, more informed judgments could be made.

A tangentially related limitation to the issue with limited communication is the problem of lack of conversation. Observers were presented with a few sentences given by one person. Stimuli involving two interlocutors could also provide further information that would alter veracity judgments.

With the previously mentioned changes to the experiment, the already existing pattern of results which include an increased ability of detecting truth from deception in the high effort relevant information condition, may reach levels of significance. In addition, because the control condition did not offer a consistent pattern of results, this condition of low cognitive effort needs the recommended changes as well to allow for a more definitive comparison to the high cognitive effort conditions.

Future Research

The idea presented here of different types of cognitive effort should continue to be explored so that a more nuanced understanding of the influence of cognitive effort can be achieved. No significant differences in accuracy were obtained,

however, preliminary patterns show that the relevant cognitive effort condition did tend to aid in accurately determining when someone was telling the truth or lying. Future research should take the suggested improvements--including stimuli that mimic real life conversation and larger sample size--to further examine the different types of cognitive effort and their effects on deception detection.

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