The Effects of Arousal and Disfluency on the Confirmation Bias

Nancy G. Guzmán

SENIOR HONORS THESIS

Submitted in Partial Fulfillment of Requirements of the College Scholars Program
North Central College
12 May 2014

Approved: ___________________________ Date: ________
Thesis Director Signature

Daniel R. VanHorn, Ph.D., Department of Psychology

Approved: ___________________________ Date: ________
Second Reader Signature

Amy G. Buxbaum, Ph.D., Department of Speech Communication
Acknowledgements

I would like to formally express appreciation to the many individuals who supported me throughout this endeavor without your help this project would have been impossible. Thank you Dr. VanHorn, for agreeing to advise and direct this project, and for your guidance and your valuable input at every stage. I would also like to thank Dr. Buxbaum for her feedback as my second reader and Emily Prather-Rodgers for her contributions to the final version of this thesis.

Outside of North Central College, I wish to express my since gratitude to Mr. Ivan Hernandez, Ph.D. candidate at the University of Illinois-Urbana Champaign. Thank you for investigating disfluency and confirmation bias first, and indirectly sparking curiosity that lead to my own serious investigation on the topic. I will forever be grateful that I read your article at the right moment. Additionally, thank you for being available to answer my questions and more than willing to help with my experiment methodology so that I was able to properly build off the existing foundation.

On a more personal note, thank you Mom for the unwavering support and the late night homemade lattes! Thank you friends, professors, and mentors for helping me reach the finish line by providing kind words of encouragement, hugs, food and plenty of coffee.
Abstract

The confirmation bias is the tendency to search for and interpret information in a way that agrees with preconceived notions and ignores or distorts information that is not consistent with preconceived notions (Nickerson, 1998). This study implements a between-subjects experimental design to explore the effects of arousal and disfluency on the confirmation bias. Level of arousal (high and low) and disfluency (disfluent text and fluent text) are the independent variables. Confirmation bias is the dependent variable and is measured using the method described in Hernandez & Preston (2013). The combination of high arousal and disfluent text was hypothesized to have the most success in reducing the confirmation bias. Results indicated no significant main effects of arousal or disfluency on the confirmation bias and no significant interactions, but the data are trending in the hypothesized direction, highlighting that disfluency and high arousal may be potential variables that can limit biased evaluations of arguments. Limitations of this study include an ineffective arousal manipulation, and a small sample size. These limitations could potentially explain the lack of significant effects. Research focusing on limiting confirmation bias is fairly scant, so it is important to continue to look for ways to minimize the errors people make when evaluating evidence.

Keywords: confirmation bias, arousal, disfluency, fluency, political ideology, capital punishment
Definitions & General Overview

The confirmation bias is the tendency to search for and interpret information in a way that agrees with our own previously held beliefs, and ignores or distorts information that differs from our beliefs (Nickerson, 1998). Confirmation bias is identified by three key factors. 1) It is not intentional; it is automatic, non-conscious process. 2) It increases the difficulty for modifying beliefs and behaviors. 3) Sometimes, when confronted with information that challenges rather than confirms beliefs, disconfirming information is ignored, or, distorted, and opinions of initial beliefs are held with stronger confidence.

The confirmation bias is a ubiquitous phenomenon because the bias itself influences the very nature of how information is selected (Fugelsang, Stein, Green, & Dunbar, 2004). There is a wealth of research exploring the many situations in which the phenomenon takes place; Nickerson (1998) offers the best-detailed overview. The goal of this project is to take the investigation of confirmation bias a step further by exploring a way in which the confirmation bias can be limited. The goal of this study is to explore if the confirmation bias can be limited, for this purpose, we examine two variables arousal (i.e., physiological and psychological state of being awake and ready to respond) and disfluency (i.e., difficulty with information processing).

Surprisingly there is a limited amount of research seeking to limit the bias. The possibility of limiting the confirmation bias opens up opportunities for future research to eventually develop applications that can enhance objectivity in information processing. Decreased confirmation bias aids everyone in making better decisions and judgments that are more accurate, but it is specifically beneficial in law, medicine, counseling, and the sciences where objective evaluations are imperative.
Confirmation Bias Inherently Error Prone

Through a review of the literature, there is an overwhelming amount of evidence suggesting that confirmation bias can take many forms, and has an inherent margin of error that can lead an individual to make costly, wrongful decisions, and judgments in a variety of situations. What follows are some of the highlights; for an in depth overview see Nickerson (1998). Research shows that individuals give more credence to their primary hypotheses even if subsequent information contradicts their initial beliefs (Lord, Ross, & Lepper, 1979; Peterson, & DuCharme, 1967; Wason, 1968) so much so that subsequent information processing becomes deliberate case building to support primary hypothesis (Jonas, Schulz-Hard, Frey, & Thelen, 2001; O’Brien, 2009). Essentially, what begins with confirmation bias takes a life of its own, snowballing into a cemented attitude or belief, one not likely to change.

Clinicians tend to believe that their clinical judgments are more valid, despite the fact that a diagnosis based on statistical findings proves to be more accurate (Meehl, 1954). Reliance on professional experience for clinical psychologists shows that their diagnoses do not increase in accuracy with the number of years of experience (Meehl, 1954; Strohmer & Shivy, 1994). Teachers also tend to treat their students according to vague labels imposed on the children; research shows that their observations of the student’s abilities change by the label the child received. For example, if a teacher is told that a child comes from a high or low socioeconomic background, then the teacher’s attributions to the student will fit the label. Students of high socioeconomic status are more likely to be attributed with more positive qualities than their lower socioeconomic status classmates (Darley & Gross, 1983). In light of the aforementioned evidence, we see a need to develop strategies to limit confirmation bias and enhance decision-making based on available evidence.
Theoretical Framework for Limiting Confirmation Bias

The confirmation bias has been dubbed the “single problematic aspect of human reasoning that deserves attention above all others, a ubiquitous phenomenon that takes many guises” (Nickerson, 1998, p.1). Confirmation bias is one example of the many cognitive processes that suggests we are not as rational, objective, or detached, as we may like to be when the conditions require it. Rationality implies that the individual can detach one’s own biases and beliefs as well as objectively evaluate all available information regarding problems, situations or people. Although higher cognitive processes are highly sophisticated, the system remains limited in significant ways. Empirical evidence suggests that our ability to be objective processors of information is nothing but fiction (Darley & Gross, 1983; Fugelsang, Stein, Green & Dunbar, 2004; Lord, Ross, & Lepper, 1979; O’Brien, 2009; Pinkley, Griffith, & Northcraft, 1995; Wason, 1968).

The contemporary information-processing paradigm offers a more reasonable model of human information processing than the model of the “rational man (i.e. economic man)” which assumes humans are capable of truly objective processes. The current paradigm stems from the seminal work of Herbert Simon who first proposed the concept of “bounded rationality” (Simon, 1955; 1956; 1982) which now provides the theoretical and methodological foundation for research on judgment and decision-making. In this current approach, the limits of the cognitive (brain/mind) system are acknowledged, while highlighting the ability to logically, and rationally come to conclusions. The purpose of the “bounded rationality” model in Simon’s words is, “to replace the global rationality of the economic man with a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed [by humans]” (Simon, 1955, p.99).
One of the main limits of the cognitive system, is the issue of limited internal (energy, will, and motivation) and external (time, situational factors, and incentives) resources it can allocate to information processing tasks. In coping with its limited processing capacity, the cognitive system processes information to the best of our ability. It selects only what is important, necessary, and relevant as it sifts through the vast amount of information it receives. It determines what is ‘important, necessary, and relevant’ by taking mental shortcuts often referred to as cognitive heuristics.

Cognitive heuristics are part of a complementary dual-process system model of information processing. This dominant theoretical framework explains how information processes operate within the bounds of rationality. Researchers agree that system 1 thinking refers to the highly rapid, automatic, associative, parallel pre-attentive heuristical processes. System 1 evokes little to no attention demands, and yields rapid responses based on intuition. System 2 thinking refers to the higher levels of consciousness, attention demanding, analytical rule oriented processes (De Nays, 2006; Evans, 1984; Evans, & Stanovich, 2013; Payne & Bettman, 2004; Sloman; 1996).

Confirmation bias is a heuristic operating on system 1 processes determining what information is ‘important, necessary, and relevant’ by comparing the new information to the existing belief framework. Previous research shows, heuristics in general are useful and adaptive, especially when working with incomplete, ambiguous or uncertain information. Nonetheless, cognitive heuristics are inherently error prone and open to biases that in turn influence judgments leading to inaccurate conclusions (Tversky & Kahneman, 1974). However, from the perspective of a dual-systems approach to cognitive processing, there is a gap in the literature demonstrating a need to identify factors that can shift confirmation bias from a system 1 thinking style to system 2 thinking style.
Limiting Confirmation Bias: Previous Research

Research exploring the question of whether the confirmation bias can be limited or not is scant. Few experiments have yielded successful outcomes, where a decrease in confirmation bias was observed, however, due to the low amount of evidence available it is too soon to make any conclusions about what exactly decreases confirmation bias. O’Brien (2009) created a mock trial to explore procedural changes that could increase or decrease confirmation bias in the mock trial. In experiment 1, participants were divided into two groups: a hypothesis and no-hypothesis group. The hypothesis group was asked to indicate early in the trial who they believed was the perpetrator, whereas the no-hypothesis group evaluated the evidence without articulating a hypothesis.

Results from the hypothesis group show that participants framed the case on the person named to be the possible perpetrator. The no hypothesis group, on the other hand, provided a less biased evaluation of the available evidence. In the second experiment, participants were placed either in the hypothesis group or in the no-hypothesis group. In the middle of the evaluation, the hypothesis group was asked to 1) indicate a possible perpetrator, 2) provide three reasons as to why, and 3) provide three reasons why the perpetrator could possibly be innocent. This time, the results indicated that the hypothesis group showed less confirmation bias (O’Brien, 2009), indicating that, in order to be able to make a decision on all available evidence, one needs to not articulate an initial hypothesis at all before all evidence has been evaluated. If a hypothesis needs to be articulated, than the research suggests that person also consider why that hypothesis may be false and articulate some reasons to decrease confirmation bias.

An experiment by Young, Tiedens, Jung and Tsai (2011) explored the effects of laboratory-induced anger on the confirmation bias. They explored the potential of a prior psychological
state (i.e. anger) to see its effects on the confirmation bias. In their study, participants were induced into an angry or sad state using mood induction techniques. In the first experiment, researchers first induced an angry or sad state. Next, they surveyed the attitudes and beliefs of their participants regarding the use of hand-held devices while driving. Next, they surveyed the attitudes and beliefs of their participants regarding the use of hand-held devices while driving. After that, the participants read a fictitious excerpt on a debate claiming that the use of hands-free devices while driving reduces accidents. Participants were then tasked to read the topic sentences of the excerpts and select those that they wanted to read in their entirety. Researchers found that those that were in an angry state chose more topic sentences that disagreed with their initial position indicating a decrease in confirmation bias.

In experiment 2, the researcher replicated the first study only changing the topic; this time they picked a political debate as the stimulus material, and found the same results. An angry state resulted in less confirmation bias compared to a neutral or sad state (Young, Tiedens, Jung & Tsai, 2011) indicating that an angry mood can motivate the individual to seek information that goes against self-interests. This research brings attention to the importance of internal states for information processing suggesting it may be possible to limit the confirmation bias from a cognitive approach. In the second experiment, the researchers replicated the first study, but only changed the topic; this time, they picked a political debate as the stimulus material and found the same results. An angry state resulted in less confirmation bias compared to a neutral or sad state indicating that an angry mood can motivate the individual to seek information that goes against one’s beliefs and attitudes. The research brings attention to the importance of internal states for information processing suggesting it may be possible to limit the confirmation bias from a cognitive approach.
Confirmation Bias & Disfluency

The most recent investigation on limiting the confirmation bias takes a cognitive approach to limit the bias. Hernandez & Preston (2013) explored the effects of disfluency on the confirmation bias. Fluency is the subjective metacognitive experience of relative ease and speed with which information is cognitively processed. Disfluency is the added difficulty with information processing introduced by noise, such as, low legibility of a font.

Researchers set up two experiments to test the effects of disfluency on the conformation bias. In the first experiment, they presented a pro-capital punishment passage to self-identified liberals and conservatives. They chose political ideology as the grouping variable for the participants because it is a robust factor that polarizes attitudes and beliefs, heavily influencing subsequent information processing (Lord, Ross, & Lepper, 1979; Jost, Federico, & Napier, 2009). The message presented was printed in either highly or poorly legible font (i.e. an absence or presence of disfluency). Results indicated that the presentation of the message in the disfluent font caused liberal and conservative attitudes toward capital punishment to become more moderate.

In the second experiment, participants played the role of a juror in one of four conditions: fluent or disfluent text with or without a cognitive load (time constraint). Participants were given a positive or negative verbal description of a defendant. Following that, they were given a written description of the alleged crime in fluent or disfluent text. Participants had to decide if the defendant was guilty based on evidence provided, and then determine the appropriate jail sentence.

Results indicated, participants determined guilt, and convicted accordingly based on the positive or negative description provided. In this experiment, disfluency also played a mediating role. A negative description presented in a fluent font yielded more severe sentences, a negative
description presented in a disfluent font yielded less severe sentences. Additionally, researchers also found that a negative description in disfluent font with a cognitive load yielded a severity of sentences similar to the fluent text and no cognitive load condition (Hernandez & Preston, 2013).

Results suggest that changing the font face to one that makes it more difficult to read can decrease confirmation bias, but the effects of disfluency are subject to change under a cognitive load (i.e. added mental pressure that splits cognitive resources), suggesting cognitive resources are necessary for the disconfirmation to occur. While metacognitive difficulty promotes a deeper processing of the information leading to less reliance on heuristic modes of information processing, too much difficulty reverses the effect.

**Fluency & Disfluency**

The evidence on fluency-disfluency indicates that fluency is best associated with faster, smoother, heuristic information processing (system 1) and disfluency with slower, deeper, intensive processing (system 2). Evidence strongly suggests that the added effort associated with processing disfluent information prompts a deeper, more analytical, and critical processing of the information presented. Alter, Oppenheimer, & Epley (2007) found disfluency has the ability to increase performance on the Cognitive Reflection Test (CRT) and a Syllogistic test, two measures assessing the ability to suppress an intuitive and spontaneous (system 1) wrong answer in favor of a reflective and deliberative (system 2) right answer. Participants that took the test in a disfluent font answered significantly more correct questions than participants who took the test in fluent font (Alter, Oppenheimer, & Epley, 2007). Previous research also found that conceptually inconsistent information is rarely detected or even acknowledged if presented in a fluent font (Reber & Schwarz, 1999; Song & Schwarz, 2008) and that information is perceived
to be more typical if it is presented in fluent text rather than disfluent text (Oppenheimer & Frank, 2008).

In Hernandez & Preston (2013), the reason why disfluent text was able to decrease confirmation bias was that disfluency tends to act as a mental speed bump shifting information processing from an automatic (system 1) to an analytical (system 2) style (Alter, Oppenheimer, & Epley, 2007; Oppenheimer, 2008; Diemand-Yauman, Oppenheimer, & Vaughan, 2011; Song & Schwarz, 2008). In light of this evidence, what remains unclear is what exactly is too much cognitive difficulty capable of reversing the effect of disfluency. Hernandez & Preston (2013) suggest that dividing attention is enough to eliminate the benefit of disfluency. However, more research is needed to better understand the relationship disfluency shares with the dual processing cognitive system, with special attention to available cognitive resources.

**Arousal, Cognitive Resources, and Confirmation Bias**

**General overview of arousal.** Arousal generally is defined as the physiological and psychological state of being more awake or ready to respond to stimuli. Arousal is a multidimensional concept that occurs on a continuum from energetic arousal, to tense arousal, and has fatigue is its polar opposite. Fatigue refers to the feeling of having reduced capacity or energy to complete mental and physical activities. Tense arousal is a psychophysiological nervous system response to a threat: it is an activation prompting an immediate response to a threatening situation (i.e. “fight/flight” response) and is associated with stress and anxiety (Thayer, 1967; 1989). Energetic arousal is the type of activation that underlies the natural sleep-wake cycles in a general way, reflecting tiredness and energy. An energetically aroused person is generally characterized as wide-awake, alert, vigorous, excited, and full of energy. For the purpose of our study, this is the specific type of arousal that we are concerned with which we
claim can potentially limit the confirmation bias. Any further reference to arousal from here on, unless otherwise noted, refers to energetic arousal.

**Music increases arousal.** Previous researchers have induced arousal through a variety of methods in the laboratory; a common one is physical exertion (i.e. aerobic activity that increases heart rate). A less utilized method of inducing arousal is through music, evidence from animal and human neurobiological research reveals that musical stimuli can change autonomic and neurochemical indices of arousal (Rickard, Toukhsati & Field, 2005). Although musical experiences are idiosyncratic by nature, there are standard qualities of music that are better able to modify level of arousal than others; tempo and mode, have been identified as the two most salient characteristics able to modify indices of arousal (Hevner, 1937; Hirokawa, 2007; Rickard, Toukhsati & Field 2005; van der Zwaag, Westerink, & van den Broek, 2011). Most recently, van der Zwaag et al., (2011) empirically demonstrated that music increases physiological arousal, and have identified tempo to be specifically associated with energetic arousal. They observed and concurred with other researchers that slow tempo music is significantly associated with lower levels of arousal, and fast tempo music is significantly associated with high levels of arousal.

**Arousal and cognitive resources: the depletion hypothesis.** The connection between arousal and cognitive resources is complex, but it is important to unpack, especially for the current investigation. Overall, as previously discussed, humans have a limited amount of cognitive resources available. Just like the physical body, the brain uses energy from glucose to function. Every attempt to focus, think, and process information exerts energy, and depletes cognitive resources. Previous research shows that energy, whether it is in the form of glucose circulating though the body, or, a perceived mental state of high or low energy influences how
we think, and carry out behavior (Clarkson, Hirt, Jia & Alexander, 2010; Fery, Ferry, Vom Hofe, & Rieu, 1997; Galliot, et al., 2007; Janssen, Fenns, Fennis and Pruyn, 2010; Johnson, 2008).

Previous research on cognitive depletion (i.e., mental exhaustion) shows that mental exhaustion, whether real or perceived is a crucial variable that regulates system 1, and system 2 processing influencing which one is activated (Johnson, 2008).

**Arousal’s effects on cognitive processes.** Arousal’s ability to interact with and have an effect on mental processes is not conclusive, primarily due to the lack of a single arousal type and varying methods of manipulating arousal. However, there is evidence to suggest that energetic arousal specifically can benefit higher order functions. Arousal has the ability to increase cognitive energy resources and focus attention; the combination of more energy and focused attention increases cognitive performance (Burges & Hokanson 1964; Dickman, 2002; Jones, West, & Estell, 2006; Roets & Van Hiel, 2011).

The Yerkes-Dodson law of arousal is an inverse-U relationship that explains the correlation between arousal and performance in general. This law states that as arousal levels increase, performance levels also increase, but levels off after reaching the peak point. That maximum is the optimal level of arousal; past this point, arousal will continue to increase, but performance will actually decrease (see Figure 1). The law suggests that moderate levels of arousal are the best for performance (Yerkes & Dodson, 1908). Although the law has explanatory power for arousal’s effects on performance, it lacks quantifiable thresholds that define what is low, medium (or moderate), and high arousal.

Previous research on the effects of arousal, when looked at as a whole, do support the inverted-U relationship previously discussed, highlighting the need to identify a moderate range of arousal. Dickman (2002) examined the effects of the circadian rhythm’s peak arousal on
reading comprehension, with results that indicated the accuracy on a reading task was higher at intermediate levels of arousal. At tense levels of arousal (i.e. past the optimal maximum) speed on the reading task increased, but accuracy decreased (Dickman, 2002). Burges & Hokanson (1964) examined the effects of increased heart rate and frustration levels on intellectual performance, finding similar results to Dickman (2002). Researchers found the best performance on the test occurred when heart rate reached a moderate range through physical exertion. Worse performance was observed when the participant experienced induced frustration. Results show that the frustration put the individual over the optimal level of arousal and thus decreased their performance (Burges & Hokanson, 1964).

**Arousal & confirmation bias.** Confirmation bias and arousal previously have not been tested together; this investigation is the first to explore the possibility that arousal can be helpful in limiting confirmation bias during evaluation of evidence. The present study uses music to manipulate arousal, which we propose is subtle enough to produce a response, but not strong enough to move the individual past a physiologically moderate range of arousal. Following the bounded rationality and the dual-system mode of processing framework of analysis, we hypothesize that arousal (a system 1 mechanism) can contribute to limiting the confirmation bias if used together with disfluency (a system 2 mechanism). Together the possibility of shifting confirmation bias from a system 1 process to a system 2 process is greater than either variable alone. Hernandez & Preston (2013) indicated the need for available cognitive resources in their investigation to counter cognitive resource depletion brought on by the additional cognitive load placed on the task; to counterbalance the depleting resources, energetic arousal is introduced.
**Present Study**

The aim of the present study is to extend the work of Hernandez & Preston (2013) on disfluency’s effect on the confirmation bias, identifying that poorly legible font decreases the bias, but the effect is not robust. This study employs a majority of their methods, and adds the variable of arousal. This study examines the following questions:

Are there effects of fluency and arousal on confirmation bias in people that have prior beliefs inconsistent with the evidence presented to them? Are there effects of fluency and arousal on confirmation bias in people that have prior beliefs consistent with the evidence presented to them? Does the combination of high arousal and disfluent text effectively limit the confirmation bias?

The dependent variable is confirmation bias, which is measured by quantifying agreement with a pro-capital punishment argument. High-low arousal is the independent binary variable, manipulated by high and low tempos, respectively. The second independent variable is disfluency (i.e. text of high and poor legibility). Political ideology is the grouping variable for participants diving the sample into liberals and conservatives.

We hypothesize that conservatives and liberals will rely on preconceived notions to appraise the passage presented to them, such that their preconceived notions will affect their evaluations of the pro-capital punishment argument in a biased manner. It is expected that conservatives will appraise the pro-capital punishment more positively than liberals will because the content of the passage will closely align with their political ideology. We also expect that the combination of arousing, disfluent text will bring extreme evaluations (i.e. highly positive and negative) of the passage back to the middle range.
Methods

Participants

The participants in this research consisted of 117 undergraduate students, 63 females and 54 males ages 18 to 29 years old (\(M = 19.03, SD = 1.46\)) enrolled in an Introductory Psychology course at North Central College, a small liberal arts Midwestern private institution. As part of a course requirement, Introductory Psychology students must complete either five research credits, or five alternate assignments; this study was one of many research studies of which participants voluntarily signed up to complete during fall and winter trimesters. As compensation for participating in the present study, students earned one research credit.

Materials

Hernandez & Preston’s (2013) investigation of confirmation bias and disfluency served as the foundation for the current study’s methodology. Several of the materials used in this study were adapted directly from the aforementioned study. The current study employed the pro-capital punishment argument used in Hernandez & Preston, (2013), originally adapted from Blanchard-Fields & Horhota (2005) in order to bring out confirmation bias in participants. See Appendix C to for the full text of the argument. The follow-up questions used to assess the pro-capital punishment argument in this study, as well as the disfluency manipulation were taken directly from Hernandez & Preston (2013); for more details see Appendix C and Appendix D respectively. The disfluency manipulation consisted of light gray bold & italicized Haettenschweiler 14-point font. Times New Roman 12-point font was used for the disfluency control, as the fluent condition (for a comparison of the two see Appendix D).

The arousal manipulation used in this study was high arousal and low arousal music previously analyzed by van der Zwagg et al. (2011) and evidenced to produce low and high
arousal respectively. From the Pop genre, two specific songs were chosen based on their tempo and mode indexes contributing to high/low arousal levels analyzed by Van der Zagg et al. (2011). The two songs chosen with lyrics included had extreme low and high indexes. The Eagles’ “Hotel California” was used for low arousal condition, with 74 beats per minute and 76 minor modes. Gerl Halliwell’s “It’s Raining Men” was used for high arousal manipulation as it had an index of 136 beats per minutes and 96 minor modes. Sound Organizer 1.1. (2011) was used cut to each song to the first four minutes and burned to individual compact discs. At the time of the experiment, the music played on Windows Media Player on a desktop computer with speakers.

In order to determine if the arousal manipulation was effective, a manipulation check was conducted in the experiment. The Activation Deactivation Adjective Checklist (AD ACL) (Thayer, 1967), was used to determine efficacy of the arousal manipulation. This self-report measure consists of 20 items designed to assess multiple arousal dimensions in the present moment, with internal reliability of .92 (O’Connor, 2004).

Procedure

A between-subjects experimental design was implemented to test the effects of the independent variables: high-low arousal and disfluency (disfluent-fluent text). Confirmation bias was the dependent variable. Data were collected in a group setting of approximately 10 to 20 participants with time kept by researchers. In an effort to minimize the confounding effect of the natural circadian rhythms on the arousal variable, sessions were scheduled at random times throughout the day. Prior to the start of the experiment participants were randomly assigned to one of four experimental conditions: high arousal with fluent text, high arousal with disfluent text, low arousal with fluent text, and low arousal with disfluent text.
Prior to the experiment, participants read and signed an informed consent form that provided sufficient explanation of what to expect throughout the session. The informed consent form sufficiently reminded them that their participation was strictly voluntary; see Appendix A for the form. The experiment consisted of four phases: background, experiment, arousal manipulation check, and capital punishment opinion survey. The researcher proctored all four phases, which lasted a total of 15 minutes. At the completion of the study, participants were thoroughly debriefed verbally and in writing, (see Appendix G) and received one research credit for their Introductory Psychology class.

**Phase 1: Background Questionnaire.** All participants were asked to complete a basic demographic questionnaire asking about gender, age, year in school, and major, as well as their religious and political ideology. Political ideology was reported on a 1-7 Likert scale, \((1=\text{strongly liberal}, \, 4=\text{neutral}, \, 7=\text{strongly conservative})\). Participants were instructed not to turn the page until told to do so by the researcher. Once everyone completed phase 1, participants were instructed to turn the page moving on to phase two; for more details about the background questionnaire see Appendix B.

**Phase 2: Experiment.** At the turn of the page, the researcher turned on the music, signaling the start of phase two. In this phase, the pro-capital punishment argument was presented to the participants in either fluent or disfluent text depending on their assigned condition, while listening to high arousal, or low arousal music. The music played for a total of four minutes in the background, while the participants read a passage and answered six follow-up questions. Three of the questions assessed the author of the passage and the other three assessed the argument presented. The task of the participants was to answer the questions using a 1-5 Likert Scale \((1=\text{not at all}, \, 3=\text{neutral}, \, 5=\text{extremely})\). The questions were adapted from
Hernandez and Preston (2013); see Appendix B for a list of the questions and Appendix D for a side-by-side comparison of disfluent text with fluent text. Additionally, in this phase, the researcher instructed participants not to move on to the next page until the music stopped playing, even if they were done answering the questions.

**Phase 3: Arousal Manipulation Check.** Once the music stopped playing, participants were able to continue with the rest of the packet at their own pace. In phase three, all participants were given the Activation Deactivation Adjective Checklist (AD ACL) to complete as a manipulation check for arousal. Proper instructions for the measure were provided; see Appendix E for more details on the arousal manipulation check measure.

**Phase 4: Capital Punishment Opinion Survey.** Phase four consisted of an opinion survey with questions adapted from the 2012 Gallup Poll on Capital Punishment. This additional measure supplemented understanding of prior beliefs about capital punishment that can contribute to the high or low evaluation of the argument in addition to political ideology. The survey asked participants if they favored or opposed capital punishment and why. It also asked if they personally considered capital punishment to be a moral issue, and more importantly if they believed it to be a deterrent of crime and fairly implemented; for a full survey see Appendix F. These questions were specifically chosen because their content mirrored the arguments expressed in the pro-capital punishment passage presented. The qualitative data collected through this measure served to enhance understanding of what additional factors could also contribute to biased evaluations of the argument. The information from the survey also allows for comparison between the sample’s attitudes on capital punishment and the general public’s attitudes and opinions on capital punishment, informing the boundaries of appropriate generalizations to be derived from the results.
Results

Participants’ Background

As previously discussed, confirmation bias in an individual comes from their preconceived notions, prior beliefs and background. Therefore, in order to qualify the results of this study taking into account the background of the participants is crucial. As mentioned earlier, all participants \( n = 117 \) were undergraduate students, \((63 \text{ females and } 54 \text{ males})\). On the political ideology question, answers from the 1-7 Likert were collapsed into three categories: Liberals, Conservatives, and Neutrals. This was done due to the low number of participants in each category. Answers on the political ideology scale were recoded as follows: \(1-3 = \textit{Liberals} \), \(4 = \textit{Neutral} \) and \(5-7 = \textit{Conservatives} \). The majority (44.2\% or 54) self-reported as neutral on political ideology, \(30\% \text{ or } 36 \text{ participants} \) reported as liberals, and \(23\% \text{ or } 27 \text{ participants} \) self-reported as conservatives. Moreover, in the total sample \( n = 117 \), 74.4\% of participants reported to be religiously affiliated with the Christian (41.9\%) or Catholic (30.8\%) faith.

Data Analysis

All statistical analyses were performed using IBM’s SPSS statistical software package (version 20). All participants who answered \textit{neutral} on political ideology were omitted from further analysis. The sample size was reduced from 117 to 63 participants, 33 males and 30 females who reported political ideology as either conservatives or liberals. In this smaller sample, 35 participants (56\%) favored capital punishment and 27 participants (43\%) opposed capital punishment. Please note all analyses to follow are based on the smaller sample of conservatives and liberals only \( n = 63 \).
Confirmation Bias

In this analysis, confirmation bias is defined as the evaluation of agreement or disagreement with the pro-capital punishment presented, with possible answers ranging from 1 to 5. It was expected that conservatives would rate the argument presented more favorably than liberals would. Results of Independent Samples T-test show that on average conservatives rated the passage presented more favorably ($M = 2.74, SD = .712$) than the liberal participants ($M = 2.44, SD = .684$). However, the difference of the means was only marginally statistically significant, $t(61) = -1.706, p = .093$.

Arousal Manipulation Check

The arousal manipulation check, Activation Deactivation Adjective Checklist (AD ACL), showed that on average high arousal conditions reflected slightly more aroused participants ($M = 2.32, SD = 0.804$) than the low arousal conditions, ($M = 2.30, SD = 0.831$). Independent samples t-test revealed that the difference between the high arousal and low arousal conditions was not statistically significant, $t(61) = .124, p = .902$, indicating energy levels were more similar than different in the two arousal conditions.

Main Analysis: Effects of Arousal & Disfluency

The effects of arousal and disfluency on the confirmation bias for conservatives and for liberals separately were analyzed with separate 2 x 2 between-subjects ANOVAs, with test alpha values set to .05.

Liberals. Liberal participants in the low arousal and fluent text condition, on average, rated the argument more positively, ($M = 2.42, SD = .705$), compared those in the disfluent and low arousal condition, ($M =2.15, SD = .595$) (see Figure 2). Participants in the high arousal fluent text condition, on average, rated the pro-capital punishment argument presented lower ($M = 2.31,$
AROUSAL & DISFLUENCY ON CONFIRMATION BIAS

SD = .651) than in the high arousal disfluent text condition (M = 2.79, SD = .6931) (see Figure 2).

Results showed the argument was evaluated more highly by liberals in the high arousal condition (M = 2.60, SD = .70) than in the low arousal condition (M = 2.25, SD = .63), but there was no statistically significant main effect of arousal on the confirmation bias, F (1, 33) = 1.4, p = .25. Liberal participants rated the argument presented as more favorable when presented in the disfluent font (M = 2.50, SD = .71) than in the fluent font (M = 2.35, SD = .65), but there was no statistically significant main effect of disfluency on the confirmation bias, F (1, 33) = .22, p = .64. The interaction of arousal and disfluency on the confirmation bias approached marginal significance, F (1, 33) = 2.69, p = .11.

Conservatives. Participants in the low arousal and fluent text condition on average rated the argument more favorably (M = 2.83, SD = .94), than in the disfluent and low arousal condition, (M = 2.73, SD = .85) (See Figure 3). Participants in the high arousal and fluent text condition, on average, rated the argument higher, (M = 3.08, SD = .52) than the participants in the high arousal and disfluent text condition (M = 2.61, SD = .62) (see Figure 3).

Results indicated the evaluation of the argument was on average similar in both the high arousal (M = 2.73, SD = .62) and low arousal conditions (M = 2.75, SD = .71), ANOVA indicated no statistically significant main effect of arousal on the confirmation bias, F (1, 24) = 0.04, p = .84. Arguments presented in disfluent text were rated lower (M = 2.65, SD = .71) by conservatives than arguments presented in the fluent text (M = 2.96, SD = .72), but there was no significant main effect of disfluency on the confirmation bias, F (1, 24) = .87, p = .36. The interaction of arousal and disfluency on the confirmation bias was not statistically significant, F (1, 24) = .36, p = .36.
Sub Analysis: Capital Punishment Opinion Survey

Aside from the main effects of disfluency and arousal on the conformation bias, supplemental analysis of capital punishment opinion survey was analyzed, and results compared to the general population. General population data was obtained from Gallup Poll capital punishment historical trends report (2014). Overall, survey responses revealed that 43% of undergraduate sample \( (n = 63) \) is opposed to capital punishment, and 55% favor it for someone convicted of murder, compared to 35% of the general population who oppose and 60% that favor capital punishment; see Table 1 for a group comparison. Analysis of opinions by political ideology, as expected, show that there are differences of opinion on capital punishment; the survey showed 47% of liberals oppose capital punishment and 53% favor it, compared to only 37% of conservatives that are opposed to and 59% who favor it; for more details on the political ideology differences see Table 2.

The top three reasons participant gave justifying why she/he opposed capital punishment included the following: 1) the belief that the justice system is too faulty, and there may be a possibility of innocence for the accused, 2) the notion that the individual deserves a second chance, and 3) the belief that capital punishment is too cruel of a punishment. Participants’ top reasons differed from those of the general population, which included, 1) the belief that it is wrongful to take a life 2) the possibility of a wrong conviction and 3) the belief that punishment ought to be left up to God/religion; for a summary of results see Table 3. In support of capital punishment, the top three justifications provided included: 1) the eye for an eye principle (if a person kills another, she/he deserves to be killed too), 2) capital punishment saves taxpayers money and 3) capital punishment deters future crime.
Moreover, results indicated only 51% of the participants believe capital punishment to be morally acceptable compared to 62% of the general population who believe it to be morally acceptable. Participants believe that capital punishment is fairly applied today more (63%) than the general population (52%). Both groups closely agree that capital punishment does not deter future murders; 63% participants endorse this statement compared to 64% of the general population; for a detailed summary of results see Table 1.

Discussion

Summary of Findings

In this experiment, we expected that evaluations of a pro-capital punishment argument would be consistent with the political ideology of the evaluator, meaning that liberals, which are typically more opposed to capital punishment, would evaluate the pro-capital punishment more negatively compared to conservatives that tend to favor capital punishment, whose evaluations would be much more favorable. Our findings indicated more conservatives favored capital punishment, which is consistent with political ideology literature (Jost et al., 2009). Statistical analysis indicated that the evaluation of the pro-capital punishment argument only slightly differed between liberals and conservatives. The marginal significance found could be explained by several plausible conclusions. It could be that this is an issue related to a small sample size. Another contributing factor to the marginal significance is that evaluations of the pro-capital punishment argument generally tended more toward the neutral range on the scale than either low or high extreme, indicating that the sample was less polarized than expected.

In terms of the effects of arousal and disfluency, we hypothesized that both variables would be effective at limiting the confirmation bias. Specifically, we hypothesized that the high arousal and disfluency condition would be the most effective at limiting the confirmation bias
compared to the low arousal/fluent, low arousal-disfluent, and high arousal-fluent conditions. This prediction was based on evidence suggesting the two variables together would have a greater effect at shifting cognitive processes from system 1 thinking style (automatic, non-conscious processing) to system 2 thinking style (deliberate, analytical processing).

Results show that our hypothesis of arousal and disfluency was not supported for liberals or conservatives. In the liberal groups, we found no statistically significant effects of arousal and disfluency on the confirmation bias, and interaction between disfluency and arousal only approached marginal significance, indicating that perhaps with a larger sample we could have observed a significant interaction. As for the conservative group, we found no statistically significant main effects of arousal and disfluency on the confirmation bias, and interaction of arousal and disfluency was not significant.

Additional results indicated that the manipulation used for arousal was not effective at producing significantly different levels of arousal in the two conditions as was intended. Therefore, our findings cannot accurately account for any effects of arousal; it may be possible that although not significant, arousal conditions could have affected the participants as expected (i.e. high arousal levels and low arousal levels), but we cannot claim the latter with confidence.

Moreover, the opinion survey provides a snapshot of our sample allowing for comparison against the general population. Analysis of this data indicates that our sample does not substantially differ from the general population on its opinion of capital punishment (for a summary of the data see Tables 1-3). What appears to be a salient difference between the two are their reasons for opposing or supporting capital punishment with the sample reporting opposition based on a general distrust of the criminal justice system compared the general population.
opposing capital punishment on moral and religious grounds (for a full summary of findings see Table 3).

**General Discussion**

Even though confirmation bias was not limited through any of the four conditions of arousal music and disfluent text examined in the experiment, it is important to further discuss general trends observed for both liberals and conservatives. Liberals, as previously mentioned, evaluated the argument presented lower on the 1-5 rating scale compared to conservatives. Liberals, on average, in the fluent text and low arousal condition rated the argument higher than in the low arousal and disfluent text condition (see Figure 2). Evidence suggests the combination of disfluency and low arousal increased confirmation bias rather than decreased it, an observation we did not expect to find. It is difficult to identify what caused this to occur; one explanation is that the disfluent properties of the text gave the message much less credibility in the eyes of the liberal participants whom already perceived the message by default to be biased. It must be noted that this is just speculation extrapolating from research on the effects of fluency indicating disfluent text decreases credibility of the message (Oppenheimer, 2008); future research in needed to clarify the trend.

An additional important trend for the liberals was the observation that evaluations in the high arousal/fluent text were lower than those produced in the high arousal/disfluent text condition (see Figure 2). Meaning, in the combination of high arousal and disfluent text, liberals increased their rating of a message that disagreed with their pre-conceived notions. In comparison, conservatives in the high arousal/fluent text condition rated the argument higher than they did in the low arousal/disfluent text condition. Moreover, conservatives rated the argument highest when it was presented in the fluent text/high arousal condition, and rated the
argument lowest in the high arousal/disfluent text condition, a relationship trending in the hypothesized direction. The observed trends exemplify movement in the hypothesized direction for the combination of high arousal and disfluent text, partially corroborating previous findings indicating that disfluency disrupts confirmation bias (Hernandez & Preston 2013). Furthermore, we believe trending observations could potentially be significant if examined with a larger sample.

Study Limitations

The present study had several additional limitations beyond a small sample size. Primarily, the participants in the current sample evidenced moderate political ideologies to begin with, which could be obscuring our results. A large portion (54 participants) of the initial sample self-reported as neutral in their political ideology. All neutral participants were eliminated from any further analysis because previous research suggested they were less likely to have strong preconceived beliefs related to the death penalty. In the remaining group of participants, there were so few cases on either the liberal extreme or the conservative extreme that the categories were collapsed. The moderate liberal and extreme liberal categories were combined, as were the moderate and extreme conservative categories. The lack of extremes on either end of the political ideology spectrum increases the difficulty of detecting extreme attitudes and thus decreasing confirmation bias.

Another limitation of this study is that the arousal manipulation used was not effective. The low arousal group was not any more aroused than the high arousal group; this is an obvious problem when the goal is to quantify its effect on confirmation bias. Additionally, we also neglected to gather a baseline measure of participant’s arousal levels prior to the arousal manipulation; if the arousal manipulation would have been effective, the current design would
have made it difficult to qualify its effect exactly by how much arousal increases without a baseline comparison.

**Conclusions, Future Directions, Implications**

All results considered, the possibility to limit the confirmation bias with arousal and fluency manipulations remains open-ended. This body of work provides a model of methodology for future investigations to consider as the research on fluency, arousal, and confirmation bias continues. Extensive research on the confirmation bias exists, enough to conclude that it is a real and pervasive phenomenon, with potentially endangering consequences. The task moving forward is to identify what factors could limit the confirmation bias in light of evidence suggesting its importance for objective decision making in high-risk situations.

Future work building off this study’s foundation should aim to address some of the methodological issues identified. A more effective measure of arousal ought to be implemented, and baseline measures should be obtained for this variable. At this time the lack of an effective manipulation leads us to conclude that the effects of arousal remain largely unexplored, particularly in relation to the confirmation bias.

Moreover, observing confirmation bias was a challenge; literature shows that controversial topics work best to polarize beliefs, setting the stage for confirmation bias to surface (Lord, Ross & Lepper, 1979). In this study, capital punishment should have significantly polarized beliefs but this did not occur; evaluations of the capital punishment stimuli were moderate overall. Part of the problem for the lack of polarized beliefs is the age of the participants involved, because older adults tend to have stronger political identities than young adults who may just be starting to become interested in politics. Future research could ameliorate this problem by including a more ecologically valid sample of varied ages or focusing
on a group of older participants, given that political attitudes mature with age (Jost et al., 2008). Arousal and disfluency could be further explored in older adults by providing the same capital punishment stimuli under similar disfluent manipulations and a more valid arousal manipulation.

In sum, this research adds to the collection of studies working to explore ways in which humans can enhance their cognitive skills to be more objective information processors. Although previous research exploring confirmation bias identifies many challenges for limiting the bias, this does not mean that research in this direction is a futile activity. It is important to identify techniques, strategies or variables that can be effective at limiting the bias, before we prematurely conclude that limiting the confirmation bias is not feasible.
References


*Review of General Psychology, 2*(2), 175-220. doi: 10.1037/1089-2680.2.2.175


Table 1
*Personal Opinion Survey Results in comparison to the general population findings of Gallup Poll*

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Study Participants</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favor Capital Punishment for someone convicted of murder</td>
<td>56%</td>
<td>60%</td>
</tr>
<tr>
<td>Oppose Capital Punishment for someone convicted of murder</td>
<td>43%</td>
<td>35%</td>
</tr>
<tr>
<td>Generally speaking, fairly applied today in the U.S.</td>
<td>63%</td>
<td>52%</td>
</tr>
<tr>
<td>Generally speaking, not fairly applied today in the U.S.</td>
<td>37%</td>
<td>40%</td>
</tr>
<tr>
<td>Capital punishment is morally acceptable</td>
<td>51%</td>
<td>62%</td>
</tr>
<tr>
<td>Capital punishment is not morally acceptable</td>
<td>49%</td>
<td>31%</td>
</tr>
<tr>
<td>Deterrent of murder</td>
<td>37%</td>
<td>32%</td>
</tr>
<tr>
<td>Not deterrent of murder</td>
<td>63%</td>
<td>64%</td>
</tr>
</tbody>
</table>

*Note:* General population data gathered from Gallup Poll Historical Trends on Capital Punishment (2014).
Table 2

*Capital punishment survey results analyzed by political ideology*

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Oppose capital punishment</th>
<th>Favor capital punishment</th>
<th>Believe it to be morally acceptable</th>
<th>Believe it is fairly applied</th>
<th>Agree deters crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 males</td>
<td>47%</td>
<td>53%</td>
<td>48%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>21 females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 males</td>
<td>37%</td>
<td>59%</td>
<td>56%</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>9 females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 3 Reasons given in favor of capital punishment</td>
<td>Top 3 Reasons why opposed to capital punishment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Study Participants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. eye for an eye principle, they killed so they</td>
<td>1. justice system is too faulty; possibility of</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>deserve to be killed too</td>
<td>innocence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. saves taxpayers money</td>
<td>2. person deserves second chance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. deters crime</td>
<td>3. it is too cruel of a punishment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. eye for an eye principle, they killed so they</td>
<td>1. wrong to take a life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>deserve to be killed too</td>
<td>2. possibility of a wrong conviction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. saves taxpayers money</td>
<td>3. punishment should be left to God/religious</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. deters crime</td>
<td>belief</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* General population data gathered from Gallup Poll Historical Trends on Capital Punishment (2014).
Figure 1.

The Yerkes-Dobson law of arousal depicted: As arousal increases, performance increases until it reaches the maximum point; as arousal continues to increase, performance decreases.
Liberal Evaluations of Argument

<table>
<thead>
<tr>
<th>Evaluation of Pro-Capital Punishment Argument</th>
<th>Level of Arousal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluent</td>
<td>Low</td>
</tr>
<tr>
<td>2.42</td>
<td></td>
</tr>
<tr>
<td>Disfluent</td>
<td></td>
</tr>
<tr>
<td>2.15</td>
<td></td>
</tr>
<tr>
<td>Fluent</td>
<td>High</td>
</tr>
<tr>
<td>2.31</td>
<td></td>
</tr>
<tr>
<td>Disfluent</td>
<td></td>
</tr>
<tr>
<td>2.79</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.

Liberals’ evaluation of pro-capital punishment passage under varying conditions. No significant effects and no significant interactions found, however, the combination of high arousal and high disfluent text on average yielded the greatest difference in evaluations of the passage.
Conservative Evaluations of Argument

![Bar chart showing evaluations of pro-capital punishment passage under varying conditions. The chart indicates that high arousal and high disfluent text on average yielded the greatest difference in evaluations of the passage.](chart.png)

**Figure 3.**

Conservatives’ evaluation of pro-capital punishment passage under varying conditions. No significant effects and no significant interactions found, however, the combination of high arousal and high disfluent text on average yielded the greatest difference in evaluations of the passage.
Appendix A: Experiment Informed Consent

**Study Title:** Evaluating Arguments

**Purpose of the research**
To better understand the underlying cognitive mechanisms involved in the evaluation of arguments.

**What you will do in this experiment**
You will answer a variety of questionnaires, listen closely to music, read an argument on capital punishment, and answer follow-up questions based on the reading.

**Time required**
The study will take less than 30 minutes.

**Risks**
The topic of capital punishment tends to be a sensitive topic. Negative thoughts, feelings, or emotions may arise during the experiment. If you would like to withdraw from the study please let the researcher know at this moment by raising your hand (no questions will be asked). If any negative thoughts and feelings arise during the study, we encourage you to seek counseling from the Dyson Wellness Center.

**Benefits**
You will receive credit in your psychology class for participating in this experiment. In addition, at the end of the experiment, we will provide you with an explanation of the experiment and of our hypotheses so that you may learn about the topic of our investigation. If you wish, you can send an email to Nancy G. Guzman (ngguzman@noctrl.edu) and she will send a summary of the study’s results at the end of the 2013-2014 year.

**Confidentiality**
Your participation in this research will remain confidential. Your responses will be assigned a code number, and your identity will not be stored with any of your data.

**Participation and withdrawal**
Your participation in this study is voluntary. If you feel uncomfortable at any point during the course of this study, then you should feel free to stop your participation. Once started you may withdraw from the study at any time without penalty or negative impact or standing in your PSY 100 course and will still receive credit. You may withdraw by informing the experimenter that you no longer wish to participate (no questions will be asked).

**Contact**
If you have questions about this study, please contact Nancy Guzman at ngguzman@noctrl.edu

**Agreement**
The purpose and nature of this research have been sufficiently explained, and I agree to participate in this study. I understand that I am free to withdraw at any time without incurring any penalty.

I certify that I am 18 years of age or older. __________ (Initials)

Signature: _______________________________ Date: ________________

Name (print): ________________________________
Appendix B: Phase 1 Materials and Instructions

**Background Information**
Please respond to the following items

**Gender:** M F

**Age:** _______

**Year in school:** 1 2 3 4 5

**Major:** ___________________________

**Ethnicity/Race** (Please check all that apply)

_____Caucasian

_____Asian

_____African American

_____Latino/Hispanic

_____Native American

_____Other (Please specify):_______________

**Are you religiously affiliated?** Yes No

**If so, with which religious faith**__________________________

Please report your personal political ideology using a 1-7 point scale
(1="strongly liberal", 4= "neutral", 7= "strongly conservative")

1 2 4 5 6 7

Strongly Liberal Neutral Strongly Conservative

[Please look up when you complete this section and do not continue until signaled to do so]
Appendix C: Phase 2- Capital Punishment Argument and Questions

The pro-capital punishment argument and verbatim instructions below

INSTRUCTIONS

During the next 4 minutes you will hear music in the background, make yourself comfortable but do not focus your attention on the music itself. Your task is to read the following passage and answer the follow-up questions.

Capital punishment should be legal in all states. There are many reasons for having this position. Capital punishment decreases crime because it acts as a deterrent to criminals who engage in serious or life-threatening crimes. It also is useful because capital punishment reduces the amount of government taxes necessary for the upkeep of prison facilities by reducing the number of criminals who are incarcerated at a given time. Another benefit is that capital punishment teaches youths morality by making clear the line between right and wrong. Finally, capital punishment is the only just means to punish a murderer. Clearly, there are many good reasons why capital punishment should be legal in all states.

Passage adapted from Blanchard-Fields & Michelle Horhota (2005)

Now that you have read the passage please answer the following questions using the 1-5 rating scale

II.    1  2  3   4  5
Not at all            Neutral                                   Extremely
How reliable is the message? ________ (argument evaluation)
How mature did the writing seem? ________ (assessment of author)
How intelligent do you consider the argument? ________ (argument evaluation)
How considerate do you consider the author to be? ________ (assessment of author)
How much do you believe the facts that were in the reading? ____ (argument evaluation)
How understanding did the author seem to be? ________ (assessment of author)

Questions adapted from Hernandez & Preston (2013)

[ONLY when the music is over you may continue on to the next portion of the packet]

Appendix D: Disfluent ant Fluent Text Contrasted
Passage in disfluent text

Capital punishment should be legal in all states. There are many reasons for having this position. Capital punishment decreases crime because it acts as a deterrent to criminals who engage in serious or life-threatening crimes. It also is useful because capital punishment reduces the amount of government taxes necessary for the upkeep of prison facilities by reducing the number of criminals who are incarcerated at a given time. Another benefit is that capital punishment teaches youths morality by making clear the line between right and wrong. Finally, capital punishment is the only just means to punish a murderer. Clearly, there are many good reasons why capital punishment should be legal in all states.

Font and text characteristics specified by Hernandez & Preston (2013)

Passage in fluent text:

Capital punishment should be legal in all states. There are many reasons for having this position. Capital punishment decreases crime because it acts as a deterrent to criminals who engage in serious or life-threatening crimes. It also is useful because capital punishment reduces the amount of government taxes necessary for the upkeep of prison facilities by reducing the number of criminals who are incarcerated at a given time. Another benefit is that capital punishment teaches youths morality by making clear the line between right and wrong. Finally, capital punishment is the only just means to punish a murderer. Clearly, there are many good reasons why capital punishment should be legal in all states.
Appendix E: Arousal Manipulation Check (AD ACL)

INSTRUCTIONS
Using the following words of feelings or moods, please use the rating scale next to each word to describe your feelings at this moment. Work rapidly, but please mark all the words. Your first reaction is best.

<table>
<thead>
<tr>
<th>active</th>
<th>Definitely feel</th>
<th>Feel slightly</th>
<th>Cannot decide</th>
<th>Definitely do not feel</th>
</tr>
</thead>
<tbody>
<tr>
<td>placid</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>sleepy</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>jittery</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>energetic</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>intense</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>calm</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>tired</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>vigorous</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>at rest</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>drowsy</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>fearful</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>lively</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>still</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>wide-awake</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>clutched-up</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>quiet</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>full-of-pep</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>tense</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
<tr>
<td>wakeful</td>
<td>Definitely feel</td>
<td>Feel slightly</td>
<td>Cannot decide</td>
<td>Definitely do not feel</td>
</tr>
</tbody>
</table>
Appendix F: Capital Punishment Personal Opinion Survey

1a. Are you in favor or opposed to the death penalty for a person convicted of murder?
   a. Favor
   b. Oppose

1b. List the top three reasons for your position listed in question 1?
   1.__________________________________________________
   2.__________________________________________________
   3.__________________________________________________

2. Please check the category that best applies to you
   a. Capital punishment is morally acceptable
   b. Capital punishment is not morally acceptable

3. Generally speaking, do you believe the death penalty is applied fairly or unfairly in this country today?
   a. Fairly
   b. Unfairly

4. Do you feel that the death penalty acts as a deterrent to the commitment of murder, that it lowers the murder rate?
   a. Yes
   b. No

All questions adapted from Gallup Poll

Source: (http://www.gallup.com/poll/1606/death-penalty.aspx)
Appendix G: Study Debriefing Form

Study Title: Evaluating Arguments

Thank you for participating in our study!

This study is concerned with the effects of arousal and difficulty in cognitive processing (disfluency) on the confirmation bias.

The confirmation bias is the tendency to search for and interpret information in a way that agrees with our own previously held beliefs and ignores or distorts information that differs from our beliefs (Nickerson, 1998). Few studies have focused on ways in which we can limit the confirmation bias. This study explores factors that could limit the confirmation bias. We have chosen the topic of capital punishment to explore the confirmation bias because it is a highly political and controversial topic considered to be equally important across age groups (Blanchard-Fields & Horhota, 2005).

We used experimental research to explore the effects of arousal and disfluency on the confirmation bias. This was done by manipulating arousal (high and low) and disfluency (difficult text and fluent text). Based on previous research, we hypothesize that the combination of high arousal music and disfluent text will have the most success in limiting the confirmation bias when evaluating arguments.

If you would like to receive a summary of the results at the end of the 2013-2014 academic year, please contact Nancy Guzman at nguzman@noctrl.edu. If you have concerns about your rights as a participant in this experiment, please contact Dr. Daniel VanHorn (drvnhorn@noctrl.edu) or Dr. Mary Jean Lynch (630-637-5363, mlynch@noctrl.edu) in the psychology department.

If you are interested in learning more about this project, you may want to consult the following:


Thank you again for your time!