TRACKING BIAS: USING EYE-TRACKING TO MEASURE THE EFFECTS OF COGNITIVE CONTROL IN HIRING SITUATIONS

A Thesis
By
RICHARD B. WAGNER

Submitted to the Graduate School
at Appalachian State University
in partial fulfillment of the requirements for the degree of
MASTER OF ARTS

August 2018
Department of Psychology

TRACKING BIAS: USING EYE-TRACKING TO MEASURE THE EFFECTS OF COGNITIVE CONTROL IN HIRING SITUATIONS

A Thesis
by
RICHARD B. WAGNER
August 2018

APPROVED BY:

____
Christopher A. Dickinson, Ph.D.
Chairperson, Thesis Committee

____
Shawn M. Bergman, Ph.D.
Member, Thesis Committee

____
Kenneth M. Steele, Ph.D.
Member, Thesis Committee

____
Rose-Mary Webb, Ph.D.
Chairperson, Department of Psychology

____
Michael J. McKenzie, Ph.D.
Dean, Cratis D. Williams School of Graduate Studies

Abstract

TRACKING BIAS: USING EYE-TRACKING TO MEASURE THE EFFECTS OF COGNITIVE CONTROL IN HIRING SITUATIONS

Richard B. Wagner
B.A., North Carolina State University
M.A., Appalachian State University

Chairperson: Christopher A. Dickinson

The use of social media websites such as Facebook, LinkedIn, and Twitter is becoming increasingly popular in both academic and professional research settings. While they are a valuable tool, many have raised ethical concerns about the access to protected class information such as race, gender, and sexual orientation. Although access to this information through a social media page is legal, the use of these discriminatory factors in hiring situations is an illegal and unethical practice. Little research has been done on how to mitigate the effects of biases formed from these factors. The current study used eye-tracking technology to investigate whether a cognitive control message can affect people's ability to control what they look at during a simulated hiring situation. A between-groups design presented participants with mock Facebook profiles containing information relating to race, gender, age, sex, marital status, and sexual orientation. Following the profile presentation, participants made a final hiring recommendation for the individual as well as additional ratings. Participants in the baseline condition were told only that all candidates are equally qualified for the position and to rate how well an individual would "fit" the position.

Individuals in the cognitive control condition received a cognitive control message indicating that protected class information cannot be used in their final decisions, and that they should therefore avoid looking at this information, in addition to the prior instructions. I hypothesized a main effect of group in that participants in the experimental group would show increased cognitive control indicated by decreased mean fixation durations and number of fixations to protected class information across trials as indicated by a main effect of trial. Additionally, I hypothesized that participants will learn to inhibit fixations to the profile's biographical section and profile picture as indicated by decreased fixation durations and mean number of fixations. Overall, I found evidence consistent with the use of cognitive control in simulated hiring situations as seen by fewer fixations on average less frequent average fixations and shorter fixation durations to target words as well as to the profile picture and biographical information section of the profiles. Individuals given a cognitive control inducing message exhibited patterns of oculomotor behavior consistent with the use of cognitive control using top-down information to reduce but not completely prevent fixations to protected class information contained within the profiles.

Acknowledgments

I would like to thank my mentor, Dr. Christopher A. Dickinson for his support and help throughout this project and my graduate career. I would also like to thank Dr. Shawn Bergman and Dr. Kenneth Steele for their continued support during my time at Appalachian State University as well as my cohort members for their support and friendship. Additionally, I would like to thank Lawton Pybus, Dr. Douglas Gillan, and Dr. Rupert Nacoste for their early mentorship and support that helped me get to where I am now and for fostering a love for psychology, research, and learning in me. Finally, I would like to thank my friends and family for all of their love and support with which I would not be where or who I am today.

Dedication

I dedicate this thesis to my parents, Rick and Judy Wagner as well as my grandparents, Gene and Alice Famer.

Table of Contents

List of Figures

Tracking Bias: Using Eye-Tracking to Measure the Effects of Cognitive Control in Hiring Situations

Richard B. Wagner

Appalachian State University

Abstract

The use of social media websites such as Facebook, LinkedIn, and Twitter is becoming increasingly popular in both academic and professional research settings. While they are a valuable tool, many have raised ethical concerns about the access to protected class information such as race, gender, and sexual orientation. While access to this information through a social media page is legal, the use of these discriminatory factors in hiring situations is an illegal and unethical practice. Little research has been done on how to mitigate the effects of biases formed from these factors. The current study used eye-tracking technology to investigate whether a cognitive control message can affect people's ability to control what they look at during a simulated hiring situation. A between-groups design presented participants with mock Facebook profiles containing information relating to race, gender, age, sex, marital status, and sexual orientation. Following the profile presentation, participants made a final hiring recommendation for the individual as well as additional ratings. Participants in the baseline condition were told only that all candidates are equally qualified for the position and to rate how well an individual would "fit" the position. Individuals in the cognitive control condition received a cognitive control message indicating that protected class information cannot be used in their final decisions, and that they should therefore avoid looking at this information, in addition to the prior instructions. I hypothesized a main effect of group in that participants in the experimental group will show increased cognitive control indicated by decreased mean fixation durations and number of fixations to protected class information across trials as indicated by a main effect of trial. Additionally, I hypothesized that participants will learn to inhibit fixations to the profile's biographical section and profile picture as indicated by decreased fixation durations and

mean number of fixations. Overall, I found evidence consistent with the use of cognitive control in simulated hiring situations as seen by less frequent average fixations and shorter fixation durations to target words as well as to the profile picture and biographical information section of the profiles. Individuals given a cognitive control inducing message exhibited patterns of oculomotor behavior consistent with the use of cognitive control using top-down information to inhibit fixations to protected class information contained within the profiles.

Tracking Bias: Using Eye-Tracking to Measure the Effects of Cognitive Control in Hiring Situations

Workplace Discrimination

Discrimination in the workplace continues to be a common issue that distorts ethical practice in executive hiring situations. Typically marginalized groups are often kept from equal opportunities based on discriminatory factors such as race, ethnicity, and sexual orientation (Leskinen, Rabelo, & Cortina, 2015), otherwise known as protected class information. Federally protected class information includes race, color, sex, age, national origin or ancestry, and individuals falling into these classes are legally protected from employment discrimination on the basis of those characteristics (Thomson Reuters Practical Law, 2017). Although individuals within these ostracized groups may differ in education level or professional skill levels, they are often discriminated against based on their group membership alone. Social perceptions and stereotypes of individuals are often based on their group membership and certain stereotyped traits are attributed to the individual regardless of the actual presence of these traits (Offermann et al., 2014). Differences in types of discrimination have also been found. Krings, Johnston, Binggeli, and Maggiori (2014) found that more highly educated individuals within discriminated groups often experience subtler discriminatory or prejudiced behaviors in the forms of subtle or “back-handed” comments as opposed to less educated or less skilled individuals within the same group. Because of these issues, much research has been done on factors that influence biased decision making in hiring situations (Bendick & Nunes, 2012). Although there are many standardized protocols and policies surrounding hiring professionals and how executive decisions are made in corporate settings, many of these policies are aimed at the conscious behavior of hiring employees. While discrimination in work place settings has been well documented, the introduction of social media websites has created new challenges that have yet to be thoroughly addressed empirically.

Social Media Usage

Social media websites such as Facebook and Twitter are becoming increasingly common research tools in general research settings, academia, and in business environments (Moreno, Goniu, Moreno, & Diekema, 2013). Though social media websites invite many new and unprecedented challenges in the legal and ethical realms of research, these sites offer new and innovative research opportunities that provide unique and advantageous access to information about individuals. Through social media sites, researchers have easy access to study how individuals portray themselves online as well as how individuals perceive others online in a naturalistic way. Further, individuals interact with the social media site as well as indirectly with others in their everyday life in a real-time setting not manipulated by experimenters or lab environments. Researchers often make personality judgments and other assessments about an individual based on the content presented on a social media site (Goodmon, Smith, Ivancevich, & Lundberg, 2014). Additionally, many researchers use social media sites as research tools because of the low-cost nature of accessing these data. This allows large amounts of data to be collected relatively quickly, from a widely varied subject pool, and it can be done online without having to resource external sources (Moreno et al., 2013). Based on these factors, research involving social media sites is becoming increasingly popular in multiple different research settings.

With this increased use of social media sites in research settings, many have called into question possible ethical concerns in using information from these sites (Drouin, O’Connor, Schmidt, & Miller, 2015). Companies often use social media websites to gain further knowledge of applicants outside of their formal application and in-person interviews. Employers may evaluate individuals based on this information and look for provocative photos, references to drinking or drug use, and negative evaluative comments about former employers or coworkers to “weed out” candidates (Stoughton, Thompson, & Meade, 2015). Although the use of these public sites is legal, many have called into question ethical concerns that could arise from the use of information from these sites. Legislation at the state and federal level has long tried to control and mitigate bias that could distort decision making processes by implicating strict hiring protocols (Bielby, 2000). However, due to the nascence of social media usage in research settings, little has been done to adapt to these new practices. No formal guidance has been given in regard to how Internal Review Boards (IRBs) are to handle cases involving research involving the use of social media websites (Moreno et al., 2013). Of specific interest in these types of cases is personally sensitive information implicitly or explicitly gained from social media websites that could be used to discriminate against certain individuals. This information could include discriminatory information such as race, ethnicity, sexual orientation, marital status, sex, political affiliation, or other similar information that could bias professionals in hiring situations. These discriminatory factors can create an implicit bias, an unconscious association of traits with members of a demographic groups. These implicit biases influence biased behavior that acts upon group stereotypes based on information that an individual is associated with a certain group (Nosek, Greenwald, & Banaji, 2005). These biases, when involved in hiring situations, could cause certain individuals of traditionally excluded groups to be assessed and judged differently due to their membership of the group.

While biases do exist in other work-related areas, hiring situations are especially vulnerable to biases due to the limited-information based judgments that are being made, especially in corporate settings. Individuals who work in departments such as human resources, the department that often works in recruiting new individuals to work within a company as well as making hiring recommendations for new employees, work in high-stress environments (Lovelace, Manz, & Alves, 2007). These high-stress environments create increased load on the individual that has been shown to impair performance as well as processing, especially in tasks involving attentional load or shifting attention (Edwards, E.J., Edwards, & Lyvers, 2015). Professionals in the fields, such as human resource professionals, are often presented with multiple sources of information to use to analyze individuals and make hiring decisions. These often are in the form of a resume, formal job application, and a cover letter. In addition, many hiring professionals are now using social media profiles as an additional reference source for information about a potential job applicant (Goodmon, et al., 2014). Accessing multiple sources of information, with attentional focus being switched between each, creates a situation in which cognitive processing of information as well as behavioral performance could likely be impaired. Further, in addition to these cognitive components surrounding the decision-making process for these individuals, hiring professionals are often given limited amounts of information in which to make their decisions about whether or not an individual should be hired (Altonji & Pierret, 2001). When the time-pressured situations in which hiring decisions are often made are combined with the increased cognitive load and impaired processing abilities in the hiring professional, the influence of biases and heuristic judgments based on the presence of external factors are more likely to permeate into these final decisions. In the past, hiring professionals were limited to information explicitly presented to them in the form of job applications, resumes, and possibly cover letters. However, with the modern prevalence of social media sites, hiring professionals now have access to information not previously available to them. With this new research tool comes new concerns about the ways in which certain factors can create implicit biases that ultimately influence decision making processes and whether or not these cognitive and behavioral biases can be mitigated. To investigate whether or not people can actively control their thoughts and behaviors, I turn to the literature on cognitive control. With this, I discuss the broad-scoping literature on cognitive control and cover the many differing variations for how cognitive control has been defined in the field. Then, I discuss eye-tracking literature and research and how this relates to the theoretical principles brought up in this paper. Finally, I discuss the literature covering eye-tracking and reading and how these relate to the cognitive control as well as the current research.

Cognitive Control

In the 1900s researchers from Pavlov and Bouton to Skinner and Thorndike theorized that behavior was driven by reinforcement in a traditional stimulus-response model in which a response is elicited by a certain stimulus. Later learning theorists argued that behavior was instead goal-directed. However, more recent learning theories have begun to blur the lines between this dichotomous relationship and rather view behavior as on a continuum where both factors influence behavior (Abrahamse, Braem, Notebaert, & Verguts, 2016). The term "cognitive control", while varying in definition across both research and literature, broadly refers to processes that allow processing and/or behavior to vary in different situations or contexts based on the goals of a given context. In modern learning theory, cognitive control is typically associated with the mitigation of learned behavior and is often context dependent on situations that call for inhibitory or adaptive behavior in opposition to prior learned behaviors. In other words, cognitive control refers to how individuals are able to control their thoughts and behaviors when placed in a new context that has a predisposed response associated with it. Messages that induce factors related to cognitive control have been shown to influence both learning and behavioral performance outcomes as well as increased allocation of attention to task-relevant stimuli (Schroder, Moran, Donnellan, & Moser, 2014). Theoretically, cognitive control has typically been used to encapsulate a wide range of cognitive functions such as attentional control, context representation, and goal-orientation. However, it has been somewhat limited in its usage, primarily being discussed in associative learning theory (Abrahamse et al., 2016). Botvinick, Braver, Barch, Carter, and Cohen (2001) defined cognitive control as a term for “processes that allow for the maintenance of goal-directed behavior in the face of challenging, ambiguous situations” (pp. 624–652) while Hussey et al. (2016) defined the term as “adjusting thoughts and actions when confronted with conflict during information processing” (p. 1). While definitions and applications of this theoretical construct have varied greatly in the field, the use of cognitive control can be beneficial by allowing the inhibition of undesired information. This inhibition has been shown to lead to faster and more accurate responses in behavioral tasks (Boureau, Sokol-Hessner, & Daw, 2015).

One example of cognitive control can be demonstrated behaviorally using the Stroop task. In a typical Stroop task, an individual is presented with a list of color words such as red, green, and blue. In some conditions of the task, the color of the text of the word is different from the color word itself where in others the color of the text and the color is the same (i.e., the word red in red font as opposed to the word red in green font). The cognitive control exercise comes when the individual is told to name the color of the word as opposed to the word itself. Individuals are much slower at accurately performing the task when the color of the word and the word itself do not match. This example elaborates a task in which individuals are asked to exhibit inhibitory cognitive functioning by naming the color of the word rather than the prepotent response of naming the color word. This is an example of cognitive control being exhibited in the context of a behavioral task. Overall, cognitive control has been behaviorally measured using tasks (such as the Stroop task) in which there is an inherent conflict elicited by either the response or the task itself.

A growing amount of research in the field has begun to focus on identifying the cognitive and neural mechanisms that may underlie cognitive control capacities. Congruency tasks such as the Stroop task have been frequently used to help identify these underlying mechanisms and further understanding of cognitive control processes (Botvinick et al., 2001). Performance on such congruency tasks has been theorized to reflect two distinctive pathways: a direct pathway and an indirect pathway (Botvinick et al., 2001; Cohen & Huston, 1994; Erb, Moher, Sobel, & Song, 2016). The direct pathway reflects the more automatically generated response activation that favors the prepotent response of the individual. The indirect pathway reflects the pathway which requires top-down control to match more stimulus or task relevant features to the appropriate response. Using the Stroop task as an example, the direct pathway would favor the response of the text meaning of the word whereas the indirect pathway would require increased cognitive effort - and control - to inhibit this prepotent response activation and use the task-relevant feature of the color of the text to respond correctly. This indirect pathway therefore requires top-down processing and increased cognitive effort to respond correctly based on the task-relevant or context specific demands of the situation. Additionally, one of the prominent models of cognitive control has proposed that three subsequent processes are activated when the direct and indirect pathways produce conflicting response activations (Shenhav, Botvinick, & Cohen, 2013). The monitoring process is first activated to register the conflict between the two pathways' response activations (Botvinick et al., 2001). The response threshold adjustment next inhibits motor output responding in response to the registered conflict (Wiecki & Frank, 2013). Neurological evidence has been found in support of these processes. The dorsal anterior cingulate cortex has been identified as a key area in both the monitoring process and the response threshold adjustment as well as general inhibitory functioning (Botvinick, Cohen, & Carter, 2004; Botvinick, Nystrom, Fissell, Carter, & Cohen, 1999). Finally, the controlled response selection provides top-down support for the indirect pathway and therefore resolves the conflict between the direct and indirect pathways. Neurological evidence has been found for this process in the lateral prefrontal cortex being activated in support of the controlled response selection (Shenhav et al., 2013). Overall, the goal of cognitive control processes is to monitor the consequences of decisions and adapt to task-relevant demands (Zendehrouh, 2015) and to adapt our thoughts and actions to a context specific goal.

Evaluating cognitive control requires measuring some aspect of cognition. Traditional measures used within the body of research on cognitive control, such as response times and error rates, are fairly-global indices of task performance because they are much more indirect measures of cognitive processing and function. Another measure that has been used to investigate more fine-grained measures of cognition are oculomotor – or eye movement – measures. Eye movement behaviors that are commonly analyzed in these settings are saccades and fixations. Saccades are the actual movement of the eyes while fixations are the period of time in which the eyes remain relatively still and information can be processed from the visual field. New information is only coded and processed during fixations because under most normal situations visual processing is suppressed during a saccade (Matin, 1974). Due to the anatomy of the eye, eye movements are necessary to fully and accurately process information from the visual field, which is broken down into three regions: the foveal region, the parafoveal region, and the peripheral region (Rayner, 2009). The foveal region is defined as the center 2° in the center of the eye where visual acuity is at its highest. The parafoveal region is defined as a roughly 5° region on either side of the fixation point. Finally, the peripheral region is defined as anything beyond the parafoveal region where visual acuity is at its lowest. Additionally, eye movements are an oculomotor response that require time and planning to execute (Becker & Jürgens, 1979) and therefore are used as a measure of cognitive processing during visual search tasks as well as other types of tasks such as reading (Rayner, 2009). In the current study, I used eye racking to analyze participants' ability to control and inhibit their fixations to certain items within the profiles they will be viewing and to see if participants can learn over time to avoid this information.

Cognitive Control in Reading

Does conceptual information influence individuals' eye movements? If so, can people actively control where they point their eyes using this information? Within the first question there are two primary questions: 1. Does conceptual information obtained from what is being fixated influence what is fixated next or for how long it is fixated? 2. Does information that is not being fixated influence where the eyes go next? These types of questions have driven prior research to investigate the mechanisms that underlie eye movement behaviors. Much of the research done in cognitive control in the context of reading tasks has analyzed eye movement behaviors to investigate how cognitive factors can influence where the eyes move as well as how long the eyes fixate on certain information. While there has been a relatively small amount of research in this area, there is a substantial amount of research looking at how cognitive factors influence fixations in reading (Rayner, 2009). It is important to note here that cognitive control conceptually differs in this context compared to the aforementioned conflict-monitoring literature. Here, cognitive control broadly refers to the use or influence of top-down information on behavior depending on a given task, context, or goal.

Looking at cognitive control in the context of reading, Luke and Henderson (2013) used a standard reading task as well as a mindless reading paradigm which replaced letters within words with unreadable block shapes to analyze how cognitive factors can influence eye movements. Participants were told to move their eyes in a normal fashion as if reading standard text, even if letters were replaced (in the mindless reading condition). These results showed that fixation durations (as well as regression to skipped words) were influenced by top-down factors, evidenced by longer mean fixation durations for the mindless reading condition. This indicates that increased cognitive processing occurred in the mindless reading and showing that cognitive factors, in this case the mindless reading condition where words were replaced with unreadable shapes, were influencing what the eyes are doing during a task. Dambacher, Yang, Slattery, Kliegel, and Rayner (2013) found further support for the established claim that fixation durations depend on the processing difficulty of the word being processed and the delay of lexical information by precluding parafoveal preview. This was done by obscuring a word until it was fixated on and then masked (by covering a word) after fixation in order to prevent any extrafoveal processing of that target - as well as well as manipulating the onset of the display of the word once the eyes landed on it. These results imply that conceptual factors influence eye-movement behavior. Together, this research can be taken to show that top-down cognitive factors influence how long people fixate to information.

Extrafoveal Processing

Returning to the question posed previously of whether or not information that is not being fixated influences where the eyes go next, this question relates to whether information obtained from a to-be-fixated word influences whether or for how long that word is fixated as well as relating to extrafoveal factors guiding visual search. In the context of reading, as discussed, many factors influence how individuals process words. Additionally, words that people have not yet fixated - but are about to be fixated on - may provide information about them (Angele et al., 2015; Reinhold & Glaholt, 2014). If this is the case, then individuals may be able to use this information to avoid fixating upon that word. Additionally, this may be beneficial when information such as context or predictive words that may be used to “predict” upcoming words is not available. Some current research has found that individuals are only able to fixate on and, thus process, one word at a time in reading tasks (Angele et al., 2015). This has led to much debate over how well upcoming words can be processed prior to an eye-movement to that word, with this process called extrafoveal processing. Additional research has estimated that the area in which individuals can obtain useful information while reading extends to about 15 spaces to the right - for readers whose language reads left to right - of the current fixation (Rayner, 2009). This research indicates that the preview benefit is applied only to the next word to be fixated and does not span multiple words. While some research has been done on the role of extrafoveal processing in reading and other related areas, there has been clearer evidence showing the influence of yet-to-be-fixated information on where the eyes go.

In addition to this evidence for extrafoveal processing in reading, additional research has found similar effects in the field of visual search. Current work in the field of visual search has distinguished between two separate tasks that are necessary in visual search: the peripheral selection task and the central discrimination task (Reingold & Glaholt, 2014). The peripheral selection task mainly determines the saccadic endpoint whereas the central discrimination task is where the observer analyzes the foveated stimuli in the visual field and decides whether that stimuli is a target or distractor. The majority of findings from research in this area point to the role of extrafoveal processing initiated during the prior fixation in determining where the eyes land with the peripheral selection task (Hooge & Erkelens, 1999; Shen, Reingold, & Pomplun, 2000). In other words, information outside of the currently fixated region is processed and is influential in determining the next location in which the eyes will fixate. With this, it can be taken that individuals can use information processed extrafoveally to decide, whether consciously or subconsciously, where to attend their eyes as well as how they will then scan and process information within the attended visual space. Neider and Zelinsky (2006) found further evidence that, in addition to these scene-based search factors, contextual information based on the individual's expectation of the location of the target within a scene can guide search in that conceptual and perceptual information can influence where individuals point their eyes during search.

While evidence has been shown for the influence of top-down factors on fixation location and fixation durations, little research has been conducted to investigate the active inhibition of eye-movements to certain targets. Kemper and McDowd (2006) found that manipulating the color of a distractor word within a sentence influenced individuals' ability to actively inhibit their fixations to these words. This was evident in increased termination of fixations - as indicated by a saccade away from the target being fixated on - to colored distractor words as well as decreased regressive fixations, or refixations to something that had been previously fixated, to colored words. In addition, Rosek, Kemper and McDowd (2012) presented individuals with four distractor-free paragraph blocks followed by four paragraphs with distractors and had participants read the sentences out loud. They were explicitly instructed to not read words that were italicized (distractors) and should try to ignore these words. They found that younger individuals learned to avoid distractor words, indicated by an italicized and semantically unrelated word, over time. The authors went on to state that this learned avoidance seems to involve a level of inhibitory control in order to actively inhibit fixations to distracting information based on a given situation or context. Additionally, Rinck and Becker (2006) found that individuals with a fear of spiders showed attentional bias toward images of a spider indicated by initial fixations to spider images compared to individuals who did not have a fear of spiders. However, over trials, fearful individuals showed decreased frequency of fixations over time to anxiety provoking images to lower rates than non-fearful individuals. This showed a recognition of anxiety-provoking information followed by subsequent avoidance of said information. While tangential, this study shows the influence of top-down information on fixation durations over time in that individuals fearful of spiders, when presented with images of spiders along with other images, learned to avoid the undesired information by actively inhibiting their fixations to that information.

Current Study

In summary, there has been a fair amount of research showing that cognitive factors influence fixations in reading as well as showing that cognitive factors can influence where the eyes go during visual search processes. However, little research has investigated whether people can apply cognitive control during reading to actively avoid fixating on or reading specific words, either with or without predictive sentence context. This study seeks to bridge this gap in the literature.

The current study used eye-tracking technology to investigate the efficacy of cognitive control induction in a simulated hiring situation. While cognitive control has been shown to play a role in language and memory performance and ability to resolve information-conflict across domains (Hussey et al., 2016), much of the body of research on cognitive control has been focused in associative learning. Little research has explored cognitive control in other domains. This study investigated whether individuals can utilize cognitive control processes to inhibit their eye movements (in terms of fixation number, fixation duration, or both) to protected class information within mock Facebook profiles. Additionally, this study analyzed whether extrafoveal information is a sufficient indicator of upcoming protected class information and, if so, whether participants can learn to avoid processing this information by inhibiting their fixations to this information. Some of the information was contained within the posts on the profiles. Some were preceded by sentence context that would be predictive of an upcoming word containing protected class information while some protected class words were not preceded by this predictive sentence context. This allowed investigation into whether people use contextual information when available as well as if they are able to use information available parafoveally when sentence context is not available. Additionally, protected class information was also contained in the profile picture (skin color and gender) and the biographical section (age, gender, relationship status, sexual orientation).

This study was a 2 (condition) x 20 (trial) between-groups design. Participants were either in the experimental group that receives the cognitive control message or the baseline group that does not. With this, I hypothesized that there would be a main effect of group on oculomotor behaviors in that eye-movements would be statistically different between the baseline group and experimental group. Specifically, I hypothesized decreased fixation frequency, fixation duration, and percentage of words containing protected class information fixated in the experimental condition. Additionally, I hypothesized an interaction of group and trial number in that eye-movement behaviors would be significantly impacted across trial number within the experimental condition with decreased fixation frequency to protected class information across trial number. This simple effect of decreased fixation frequency to protected class information across trials would be taken as a “learning” effect in that individuals in this group are learning over time to avoid protected class information.

Method

Participants

Participants consisted of 136 college students at Appalachian State University. Participants volunteered for participation in the study through the university’s SONA recruitment system. All participants were required to have normal or corrected to normal vision in order to participate in the experiment. Participants were credited two experiential learning credits (ELCs) upon completion of the study. All participants were treated in line with ethical guidelines established and accepted by the IRB on February 23, 2018 (see Appendices C and D).

Materials

The study was conducted using an EyeLink 1000 (SR Research) video-based eye-tracking system. The system used a high-speed video camera to record pupil position. To calculate eye position, a sampling rate of 500 Hz was used. The spatial resolution of eye position was estimated to be less than 0.5°. The system used two computers linked by an Ethernet connection with the host computer recording the eye data in real time and the display computer presenting stimuli and recording participants' responses. The display computer was a Dell PC with an Intel I-5 processor, 16 GB of RAM, and a video card with 2 GB of video memory. The LCD monitor was a 23 in.wide-screen monitor with a resolution of 1920 x 1080 pixels and with a refresh rate of 60Hz. The program used to display stimuli and collect participants responses was created using SR Research Experiment Builder software. The distance from the participant to the monitor was 60cm.

Mock Facebook profiles were created using Adobe Illustrator. Figure 1 contains an example of a mock profile. Profile pictures were generated using pexels.com, a standardized image database. The spatial location of profile picture, biographical information, pictures, and posts within the profiles were kept constant to maintain the real-world similarity to the layout of a Facebook profile. Protected class information was varied by race (white or non-white), sex (male or female), marital status (single or married), and sexual orientation (heterosexual or homosexual) within the biographical section in the top left corner below the profile picture. For each of these categories, half of the profiles fit in one category, half fit in the other, and these categories were not crossed. Protected class information within the profile posts remained relatively constant across profile sentences and protected class information within posts was limited to marital status (single, married, or in a relationship). Additionally, some posts did not contain any protected class information. Specifically, the number of posts containing protected class information ranged from four to six, the number of low predictability posts ranged from one to four, and the number of high predictability posts ranged from one to three. Profile pictures in each of the profiles were kept relatively consistent with photographs being from the shoulder up, in color, and all individuals dressed relatively similarly. In regards to the visual presentation of stimuli, profiles were presented as full-screen images and were held spatially constant with the sizes of the specific profile elements as followed: the profile picture was 3.78x4.02° pixels, the biographical section was 4.53x7.29° pixels, the word height was 1.39° pixels, the shortest target word width was 0.86° pixels, and the longest target word width was 1.69° pixels.

Participants were presented with a standardized hiring recommendation sheet following the profile presentations. Appendix A contains the hiring recommendation sheet that was used. Each question within the hiring recommendation sheet was scaled on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree." Participants indicated their response by clicking one of the five options using the computer mouse.

A cognitive control inducing message was used within the experimental group in addition to the standard scripted instructions participants in both groups received. These control messages instructed the participants that they were not allowed to look at or gather any information related to race, age, gender, marital status, political affiliation, or sexual orientation when making their final hiring decisions and should try not to look at any information in the profiles that provide this type of information.

Procedure

Participants were randomly assigned to one of two groups: the experimental (cognitive control message) group or the baseline (no cognitive control message) group. Once informed consent was obtained, participants were placed in front of the eye-tracker with their chin placed on the chinrest and each participant was individually calibrated for accuracy within the EyeLink system. Participants were read instructions from a standardized script. The script instructed participants that they are to act as hiring professionals and will be shown a Facebook profile of an individual applicant for a mid-level management job position and would then have to make a hiring recommendation for that individual. Participants were told that all applicants are equally qualified for the position as indicated by their job applications and resume. Participants did not see this information and were instructed that the profiles are their only source of information so they should be thorough in examining them. Participants were instructed that they would be making a hiring decision based on whether or not a given candidate would be a good "fit" for the position and if so, to what degree. This wording was chosen based on prior research showing that perception of fit by hiring professionals can be used to predict hiring recommendations (Kristoff-Brown, 2000). This choice of language was also used to enforce the use of external information, in this situation information gained from the Facebook profile, about an applicant outside of their qualifications for the position in which they applied. Participants in the baseline group were read only these instructions before beginning the trials. Participants in the experimental group were read the same instructions but additionally received the following cognitive control message stating: "Keep in mind that, at Appalachian State University, protected class information such as sexual orientation, marital status, age, race, ethnicity, or gender is prohibited from being used in a hiring decision and therefore you should try to avoid looking at this information while viewing the profiles." This message was repeated three times during the course of the instructions. After this, participants were given the opportunity to ask questions before the experimental trials begin.

On each trial the Facebook profile displays were presented for an unrestricted interval, followed immediately by the eight dimensions along which the job candidates were rated, followed by the hiring recommendation. Each dimension measured within the hiring recommendation was presented one at a time in the same order each time and the hiring recommendation was presented after the completion of all trials (see Appendix A for dimensions on which candidates were rated and the hiring recommendation). Each participant completed 20 trials within their assigned condition; each testing session lasted no longer than 45 minutes from start to finish. After completion of all trials, participants completed a manipulation check for prior knowledge of protected class information as well as to analyze whether or not participants who were explicitly told this information prior to the start of the experiment showed evidence of retention of this information throughout the experiment. The manipulation check presented a list of words, some which would be grouped as protected class and other words that are not grouped as protected class, and participants were to choose a "yes" or "no" response to indicate if they believe the given word is classified as protected class information. Appendix B contains the manipulation check that was used.

Results

In order to analyze eye data for a region within a profile, a rectangular interest area was created containing the information of interest. For instance, to analyze eye data for the biographical information section of the profiles a rectangular interest area was created around the biographical information section and fixations falling within this interest area were classified as fixations to the biographical information section. Interest areas were defined as followed: the profile picture was 3.78x4.02°, biographical information section was 4.53x7.29°, word height was 1.39°, the shortest word length was 0.86°, and the longest word length was 1.69°. The visual angle of the full profile was 39.12 degrees x 22.62 degrees.

For each region for which eye data was analyzed, separate analyses were conducted to look at frequency of fixation and duration of fixation. In terms of the biographical information, frequency of fixation was operationalized by analyzing the number of fixations that fell within the interest area surrounding the biographical information while duration of fixation was defined as the total duration of all fixations that fell within this region beginning with initial fixation until termination of a fixation. This was also the case for the profile picture in regard to how these measures were operationalized except that the interest area surrounding the profile picture only encompassed the image and was separate from the biographical information. For target words within the profile posts, fixation frequency was operationalized by the number of fixations that fell within an interest area surrounding only a given target word while the duration of fixation was defined by the amount of time from the initial fixation to the word to the termination of fixation within the given interest area. Percentage of target words fixated was defined by looking at the percentage of target words fixated within posts compared to the overall amount of target words. These aspects were operationalized differently due to the fact that fixation to individual target words were of interest (in regard to hypotheses related to fixations to protected class information) and therefore interest areas surrounding them only included the word of interest. In contrast, the biographical information section contains information that is classified as protected class and therefore any fixation within this area was considered of interest. Additionally, the profile picture implicitly communicates protected class information (skin color, visible gender, etc.) and therefore any fixation to this region was classified as a fixation due to interest in fixations to protected class information. For the picture and biographical section, total fixation duration was calculated for each profile while for target words, average fixation duration was calculated for each profile. With this, for both fixation frequency and fixation duration, lower values for either would indicate evidence for the use of cognitive control because this would indicate that an individual is using top-down information to inhibit fixations to protected class information (a decrease in frequency of fixation) and, if fixated, a shorter time spent fixating and thus a quicker termination of fixation to a given target word (a decrease in duration of fixation).

I used a 2 (control message vs. no control message) x 20 (trial) to analyze the efficacy of the cognitive control message used in the experimental group. For any cases in which Mauchly's test of sphericity was significant, *p*-values and degrees of freedom using a Greenhouse-Geisser correction are reported. I first looked at the main effect of group to see if significant group differences exist between the experimental group that received the cognitive control message compared to the baseline group that did not receive the cognitive control message. To reiterate, shorter fixation durations, fewer fixations, or both for the experimental group would be consistent with the use of cognitive control. Next, I looked at the simple effect of trial for each group. With this, a main effect of trial for these analyses does not inform us very much because it is averaged across group membership. Thus, main effect of group, the two simple effects with contrasts, and interaction terms are reported.

Finally, I looked at the group x trial interaction to see if the change over time was different for the baseline and cognitive control group (significant interactions are reported and discussed). To do this, we look at the change in behavior across trials between the two groups by seeing if average fixation durations to protected class information decrease across trials. With this, average fixation duration on protected-class information words in the posts was calculated for each profile and analyzed as a function of profile number to see if fixation durations to target words decreased over trials. Identical analyses were conducted for the percentage of protected class words that were fixated as well as for the mean number of fixations on protected class words (i.e., the total number of fixations on protected class words in a profile divided by the total number of protected class words in a profile). If the simple effect of trial was found to be significant, repeated contrasts were conducted that compared each trial to the one following it (e.g., Trial 1 to Trial 2, Trial 2 to Trial 3, etc.). For any significant contrasts that are reported, means decreased over time.

Reading Time

One of the hypotheses for the current study is that for protected class information, fixation frequency and duration will decrease over time for the cognitive control group based on the development of cognitive control across trials, as this pattern has been observed in prior research (Rosek et al., 2012). Initial analyses on overall profile-viewing behavior, such as reading time, allows for global level analyses to see if observable changes occurred for both or either groups and if these changes in behavior are comparable. For instance, if both groups showed comparable decreases in reading time across trials (over time), any observable changes in oculomotor behavior in the cognitive control group could thus be interpreted as a consequence of decreased profile-viewing time over time as compared to being attributable to implementation of cognitive control. In contrast, if reading time behaviors decreased at a differential rate for individuals in the cognitive control condition compared to the baseline group then these subsequent changes in fixation frequency and duration could be interpreted as implementation of cognitive control processes. Thus, reading time analyses provide a global index in which to contextualize subsequent analyses.

A 2 (control message vs. no control message) x 20 (profile number) ANOVA was performed for overall reading time. Figure 2 shows overall reading times for each trial for each group. The analyses revealed a significant main effect of group [$F(1, 134) = 8.67$, $p = .004$, $\eta_p^2 = .51$] where reading times were significantly shorter for the cognitive control group ($M = 28175.14$, SD=10472.62) compared to the baseline group ($M = 32948.49$, $SD = 12454.19$). This shows that overall reading times were significantly shorter for individuals who had received a cognitive control message compared to individuals in the baseline group. This finding is consistent with the use of cognitive control in the experimental group. A main effect of trial was also found for the baseline group [$F(11.55,762.48) = 7.47$, $p < .001$, $\eta_p^2 = .10$] as well as for the cognitive control group [$F(9.62,654.37) = 11.58$, $p < .001$, $\eta_p^2 = .15$] revealing that, over time, overall reading time significantly for both the baseline and cognitive control group. However, the group x trial interaction was not found to be significant showing that the effect of trial was not significantly different for either group [$F(12.42,1664.13) = 1.52$, $p = .106$, $\eta_p^2 = .01$].

Results of the repeated contrasts showed significant differences for the baseline group for trial 18 vs. trial 19, [$F(1,66) = 6.53$, $p = .013$, $\eta_p^2 = .09$]. Contrasts for the cognitive control group showed significant differences for Trial 1 vs. Trial 2, [$F(1,68) = 5.73$, $p = .012$, $\eta_p^2 = .08$] and for Trial 2 vs.Trial 3 [$F(1,68) = 5.45$, $p = .023$, $\eta_p^2 = .07$].

Biographical Information

Number of Fixations. Looking at the biographical information section, identical analyses were run as with reading time. These analyses allow us to investigate cognitive control processes specifically in regard to fixating information contained within the section of the profile that contains biographical information about the individual. Individuals in the cognitive control condition should be able to readily learn to avoid this information because all information contained within this area falls under the category of protected class and this information was held spatially constant across profiles. To investigate this, a 2 (control message vs. no control message) x 20 (profile number) ANOVA was performed for number of fixations on the biographical information section of the profiles. Figure 3 shows number of fixations on the biographical information for each trial for each group. In regards to number of fixations to biographical information contained within the biographical section of the profiles, analyses revealed a significant effect of group [$F(1,134) = 51.98$, $p < .001$, $\eta_p^2 = .28$] where individuals in the cognitive control group fixated on information contained within the biographical section significantly less frequently than participants in the baseline group that did not receive a cognitive control inducing message. A main effect of trial was also found for the baseline group [$F(11.50,23034.90) = 26.23$, $p <.001$, $\eta_p^2 = .28$] as well as for the cognitive control group [$F(9.59,13682.14) = 42.46$, $p <.001$, $\eta_p^2 = .38$] revealing that, over time, number of fixations to the biographical section significantly decreased for both the baseline and cognitive control group.

Additionally, looking at the group x trial interaction, a significant interaction was found [$F(12.32,1650.96) = 2.03$, $p = .018$, $\eta_p^2 = .02$] showing significantly different changes over time between groups indicating that individuals in the cognitive control condition showed a greater change across trials. To further understand these relationships, repeated contrasts were run to assess changes across trials.

Looking at contrasts for number of fixations across trials for the baseline group, significant differences were noted for Trial 1 vs. Trial 2, [$F(1,66) = 8.70$, $p = .004$, $\eta_p^2 = .12$] as well as for Trial 7 vs. Trial 8, [$F(1,66) = 5.61$, $p = .021$, $\eta_p^2 = .08$]. In the cognitive control group, significant differences were noted in four different levels at Trial 1 vs. Trial 2 [$F(1,68) = 32.24$, $p <.001$, $\eta_p^2 = .32$], Trial 3 vs. Trial 4 [$F(1,68) = 7.29$, $p = .009$, $\eta_p^2 = .10$], Trial 11 vs. Trial 12, [$F(1,68) = 4.64$, $p = .035$, $\eta_p^2 = .06$], and Trial 15 vs. Trial 16, [$F(1,68) = 5.73$, $p = .019$, $\eta_p^2 = .08$].

Fixation durations. Identical analyses were run for total fixation duration on the biographical information section of the profiles. Figure 4 shows total fixation durations to the biographical information for each trial for each group. These analyses revealed a significant effect of group [$F(1,134) = 49.83$, $p <.001$, $\eta_p^2 = .27$] where individuals in the cognitive control condition fixated on the biographical section within the profiles for significantly less time than individuals in the baseline group. A significant effect of trial was found in the baseline group [$F(10.37,684.65) = 21.83$, $p < .001$, $\eta_p^2 = .25$] as well as for the cognitive control group [$F(8.77,596.13) = 41.40$, $p < .001$, $\eta_p^2 = .38$] revealing that, over trials, total fixation durations to the biographical section significantly decreased for both the baseline and cognitive control group. Additionally, looking at the group x trial interaction, a significant interaction was found [$F(11.53,1545.52) = 2.05$, $p = .019$, $\eta_p^2 = .02$] showing significantly different changes over time between groups indicating that individuals in the cognitive control condition showed a significantly greater effect of trial.

Additionally, looking at contrasts for fixation durations to the biographical information section of the profiles, significant differences were noted in the baseline group for trial 1 vs. trial 2, [$F(1,66) = 7.16$, $p = .009$, $\eta_p^2 = .10$] as well as for trial 16 vs. trial 17, [$F(1,66) = 4.26$, $p = .043$, $\eta_p^2 = .06$]. In the cognitive control group, significant differences were noted in three different levels at trial 1 vs. trial 2 [$F(1,66) = 26.25$, $p < .001$, $\eta_p^2 = .28$], trial 2 vs. trial 3 [$F(1,66) = 4.54$, $p = .037$, $\eta_p^2 = .06$], and trial 3 vs. trial 4, [$F(1,66) = 10.44$, $p = .002$, $\eta_p^2 = .11$].

Profile Picture

Number of fixations. A 2 (control message vs. no control message) x 20 (profile number) ANOVA was performed for number of fixations on the profile picture section of the profiles for each trial for each group. Figure 5 shows number of fixations to the profile picture. In regard to mean number of fixations to the profile picture, analyses revealed a significant effect of group [$F(1,134) = 23.03$, $p <.001$, $\eta_p^2 = .15$] showing that individuals in the cognitive control group fixated on the profile picture less frequently, on average, than did individuals in the baseline group. A main effect of trial was found in the baseline group [$F(11.18,737.55) = 3.29$, $p < .001$, $\eta_p^2 = .05$] as well as for the cognitive control group [$F(11.68,793.98) = 7.23$, $p < .001$, $\eta_p^2 = .10$] revealing that, over trials, frequency of fixations to the profile picture significantly decreased for both the baseline and cognitive control group but a group x trial interaction was not [$F(13.53,1812.30) = 1.45$, $p = .112$, $\eta_p^2 = .01$] indicating that this rate was not significantly different between groups.

To further understand these relationships, repeated contrasts were run to assess changes across trials. Looking at mean number of fixations to the profile picture, the cognitive control group showed significant differences at Trial one vs. Trial two [F(1,68) = 11.23, p < .001, η_p^2 = .14].

Fixation durations. Identical analyses were run on total fixation durations on the profile picture. Figure 6 shows total fixation durations to the profile picture for each trial for each group. Results of these analyses revealed a significant effect of group [F(1,134) = 16.97, p <.001, η_p^2 = .11] in that there were significant group differences in fixation durations to the profile picture where individuals in the cognitive control group fixated on the profile picture for a shorter time than individuals in the baseline group. Additionally, a main effect of trial was found in the baseline group [F(10.90,719.14) = 2.98, p = .001, η_p^2 = .04] as well as for the cognitive control group [F(11.88,807.69) = 5.04, p < .001, η_p^2 = .07] revealing that, over time, fixation durations to the profile picture significantly decreased for both the baseline and cognitive control group. Looking at the group x trial interaction, a significant interaction was found [F(13.55,1815.24) = 1.93, p = .021, η_p^2 = .01] showing significantly different changes over time between groups indicating that individuals in the cognitive control condition showed a greater effect of trial.

Turning to contrasts for mean fixation durations on the profile picture, the baseline group showed significant differences at Trial 9 vs. Trial 10 [F(1,66) = 7.22, p = .009, η_p^2 = .10] and Trial 11 vs. Trial 12 [F(1,66) = 5.97, p = .017, η_p^2 = .08] while the cognitive control group showed significant differences at Trial 1 vs. Trial 2 [F(1,68) = 6.75, p = .011, η_p^2 = .09] as well as Trial 16 vs. Trial 17 [F(1,68) = 6.77, p = .011, η_p^2 = .02].

Low Predictability Target Words

Target words were defined by a fixation interest area surrounding a word that was established as the word in the sentence containing protected class information. A target word was defined as low predictability where the word before a target word did not give any indication as to the likelihood of the semantic nature of the target word. For example, the word “husband” in the phrase “my husband” would be considered low predictability target word due to the fact that the word that precedes it does not necessitate any specific semantic category of word to follow it and thus the nature of the preceding word (in this example, the word “my”) does not indicate or necessitate the nature of the words that may be upcoming in the sentence. Because of this, the reader cannot use any lexical or semantic information gleaned from the preceding word before the target word to make judgements about the nature of the upcoming word. It may be possible that the reader could use parafoveal information to inform this judgement.

Percentage of target words fixated. Separate 2 (control message vs. no control message) x 20 (profile number) ANOVAs were performed for percentage of target words fixated, mean number of fixations, and mean fixation durations to low predictability target words. Figure 7 shows the percentage of low-predictability target words fixated for each trial for each group. In regard to percent of target words fixated, results of the analyses revealed a significant effect of group [$F(1,134) = 4.91$, $p = .028$, $\eta_p^2 = .04$] in that significant group differences were shown in percentage of target words fixated where individuals in the cognitive control group fixating a smaller percentage of target words on average when compared to the baseline group.

Additionally, a main effect of trial was found in the baseline group [$F(14.27,941.50) = 1.86$, $p = .026$, $\eta_p^2 = .03$] as well as for the cognitive control group [$F(14.07,956.39) = 1.78$, $p = .037$, $\eta_p^2 = .03$] revealing that, over time, the percentage of target words fixated significantly decreased for both the baseline and cognitive control group. Looking at the group x trial interaction, a significant interaction was not found [$F(16.11,2158.64) = 1.57$, $p = .070$, $\eta_p^2 = .01$] indicating that the way the percentage of target words fixated changed across trials was not significantly different for the two groups. To further understand this relationship, repeated contrasts were run to assess changes across trials.

Looking at contrasts for percentage of target words fixated, the baseline group showed significant differences at three levels of Trial 3 vs. Trial 4 [$F(1,66) = 6.11$, $p = .016$, $\eta_p^2 = .09$], and Trial 10 vs. Trial 11 [$F(1,66) = 4.17$, $p = .045$, $\eta_p^2 = .06$]. Additionally, the cognitive control group showed significant differences at Trial 4 vs. Trial 5 [$F(1,68) = 4.20$, $p = .044$, $\eta_p^2 = .06$].

Number of fixations. Identical analyses were run for mean number of fixations to low predictability target words. Figure 8 shows the mean number of fixations to low-predictability target words for each trial for each group. Results of these analyses revealed a significant effect of group [$F(1,134) = 5.76$, $p = .018$, $\eta_p^2 = .04$] in that there were significant group differences noted in the mean number of fixations to low predictability target words.

Additionally, a main effect of trial was not found for the baseline group [$F(13.53,893.20) = 1.70$, $p = .053$, $\eta_p^2 = .03$] nor for the cognitive control group [$F(13.09,890.06) = 1.45$, $p = .129$, $\eta_p^2 = .02$] revealing that, over time, number of target words fixated did not significantly decrease for either the baseline or cognitive control group. Further, looking at the group x trial interaction, a significant interaction was not found [$F(15.63,2093.81) = 1.59$, $p = .066$, $\eta_p^2 = .01$] indicating that individuals in both groups showed the effect of trial at a statistically non-differential rate and this effect was not statistically different based on group membership.

Fixation durations. Identical analyses were also run to analyze mean fixation durations. Figure 9 shows average fixation durations to low-predictability target words for each trial for each group. Results of these analyses revealed a significant effect of group [$F(1,134) = 5.38$, $p = .022$, $\eta_p^2 = .04$] in that there were significant group differences noted in the mean number of durations.

Additionally, a main effect of trial was not found for the baseline group [$F(13.36,881.81) = 1.62$, $p = .071$, $\eta_p^2 = .02$] nor for the cognitive control group [$F(10.48,712.39) = 1.35$, $p = .194$, $\eta_p^2 = .02$] revealing that, over time, fixation durations to low predictability target words did not significantly decrease for the baseline or cognitive control group. Looking at the group x trial interaction, a significant interaction was not found [$F(14.64,1961.95) = 1.57$, $p = .077$, $\eta_p^2 = .01$] indicating that individuals in both groups showed the effect of trial at a statistically non-differential rate and this effect was not statistically different based on group membership.

High Predictability Target Words

In contrast to low predictability target words, a target word was defined as high predictability where the word before a target word gave indication as to the likelihood of the semantic nature of the target word. For example, as opposed to the word “my” as aforementioned, the words “sweet” or “beautiful” following the word “my” in the context of a sentence could indicate that the upcoming word could be about a romantic partner (for example, the phrase “my beautiful girlfriend/boyfriend”). Thus, in this example, the target word would be considered high predictability due to the fact that the preceding word does provide some information about the specific semantic category of a word that is to follow it and thus the nature of the preceding word (in this example, the word “beautiful”) does indicate or at least provide some lexical information about the nature of the words that may be upcoming in the sentence. With this, the reader might be able to use this information from the preceding word (or words) before the target word to make judgements about the nature of the upcoming word.

Percentage of target words fixated. As was the case with the prior analyses of low predictability target words, separate 2 (control message vs. no control message) x 20 (profile number) ANOVAs were performed for the percentage of target words fixated, mean number of fixations, and mean fixation durations to high predictability target words. Figure 10 shows the percentage of high-predictability target words fixated for each trial for each group. In regard to percent of target words fixated, results of the analyses revealed a non-significant effect of group [$F(1,134) = 2.06$, $p = .153$, $\eta_p^2 = .02$] showing that individuals in the cognitive control group did not show a lower percentage of high-predictability target words fixated compared to individuals in the baseline group.

Additionally, a significant effect of trial was found for the baseline group [$F(14.05,927.05) = 1.70$, $p = .031$, $\eta_p^2 = .03$] as well as for the cognitive control group [$F(14.23,967.48) = 1.82$, $p = .017$, $\eta_p^2 = .03$] revealing that, over time, percentage of target words fixated significantly decreased for both the baseline and cognitive control group. Additionally, looking at the group x trial interaction a significant interaction was not found [$F(15.94,2135.88) = .93$, $p = .533$, $\eta_p^2 = .01$] indicating that individuals in both groups showed the effect of trial at a statistically non-differential rate and this effect was not statistically different based on group membership.

As with prior analyses, repeated contrasts were run to assess changes across trials for measures used with high predictability target words. Looking at percentage of target words fixated, the cognitive control group showed significant differences at Trial 5 vs. Trial 6 [F(1,68) = 5.94, p = .017, η_p^2 = .08], and Trial 13 vs. Trial 14 [F(1,68) = 4.68, p = .034, η_p^2 = .06].

Number of fixations. Identical analyses were run for mean number of fixations to high predictability target words. Figure 11 shows the mean number of fixations to high-predictability target words for each trial for each group. Results of these analyses revealed a non-significant effect of group [F(1,134) = 3.29, p =.072, η_p^2 = .02]. These results are taken to show that there were not significant group differences in the mean number of fixations to high predictability target words where individuals in the cognitive control group did not fixate on high predictability target words less frequently than individuals in the baseline group.

Additionally, a main effect of trial was not found for the baseline group [F(13.68,531.67) = 1.46, p = .124, η_p^2 = .02] but was for the cognitive control group [F(13.17,895.53) = 1.76, p = .045, η_p^2 = .03] revealing that, over time, number of fixations to high-predictability target words significantly decreased for the cognitive control group but not the baseline group. Looking at the group x trial interaction, a significant interaction was not found [F(15.39,2061.58) = .61, p = .872, η_p^2 = .01] indicating that individuals in both groups showed the effect of trial at a statistically non-differential rate and this effect was not statistically different based on group membership.

Further, identical contrast analyses were run for mean number of fixations to high predictability target words. Results of these analyses revealed that the cognitive control group showed significant differences at Trial 9 vs. Trial 10 [F(1,68) = 4.19, p = .045, η_p^2 = .06].

Fixation durations. Finally, identical analyses were run for mean fixation durations to high predictability target words. Figure 12 shows the average fixation durations to high-predictability target words for each trial for each group. Results of these analyses revealed a non-significant effect of group [$F(1,134) = 2.65$, $p = .106$, $\eta_p^2 = .30$]. These results are taken to show that individuals who had received a cognitive control inducing message, on average, did not fixate on targets words that were highly predictive for shorter durations than individuals who did not receive a cognitive control inducing message.

Additionally, a main effect of trial was not found for the baseline group [$F(13.51,891.72) = 1.43$, $p = .137$, $\eta_p^2 = .02$] nor for the cognitive control group [$F(12.50,850.21) = 1.59$, $p = .085$, $\eta_p^2 = .03$] revealing that, over time, fixation durations to high-predictability target words did not significantly decreased for the baseline group but did for the cognitive control group. Looking at the group x trial interaction, a significant interaction was not found [$F(15.04, 2015.61) = .56$, $p = .905$, $\eta_p^2 < .01$] indicating that individuals in both groups showed the effect of trial at a statistically non-differential rate and this effect was not statistically different based on group membership.

Discussion

As mentioned, social media sites are becoming a popular tool for use in academic and professional research but many ethical concerns surrounding the use of these social media websites have yet to be empirically studied. Specifically, access to and use of protected class information that could be used to discriminate against an individual in a hiring situation has been of keen interest but lacks strong empirical evidence as to how to mitigate these issues. Additionally, little research has investigated whether people can apply cognitive control during reading to actively avoid fixating on or reading specific words, either with or without predictive sentence context. This study sought to bridge this gap in the literature. The current study incorporated eye-tracking technology to investigate the extent to which cognitive control can be exerted to inhibit fixations to protected class information contained within mock Facebook profiles during a hiring situation.

This study investigated the extent to which individuals could use top down information to inhibit their fixations to protected class information in a simulated hiring situation. Overall, evidence for the use of cognitive control was found in multiple regards. Individuals in the cognitive control condition showed significant decreases in overall reading time compared to the baseline group and reading time significantly decreased across trials, suggesting that participants' use of cognitive control processes became more efficient across trials. Additionally, individuals in the cognitive control group showed significant decreases in number of fixations as well as fixation durations to both the biographical information section of the profiles and the profile picture. In regard to posts contained within the profiles, individuals in the cognitive control condition showed significant decreases in percentage of target words fixated and number of fixations to low-predictably target words. Looking at high-predictability target words, individuals in the cognitive control group showed significant decreases in percentage of target words fixated, number of fixations, and fixation durations. Overall, these results are taken to show that individuals who received a cognitive control inducing message exhibited oculomotor behaviors consistent with the use of cognitive control by using top-down information to inhibit fixations to target words.

Biographical Information and Profile Picture

Biographical Information. Looking first at the initial hypotheses regarding fixation frequency and fixation durations to the biographical information section, analyses show that individuals in the cognitive control condition showed significant differences in both number of fixations as well as less time fixating when compared to the baseline group. With this, individuals in the cognitive control condition fixated on the biographical information section, on average, less frequently than participants in the baseline condition as evidenced by a main effect of group. Additionally, a simple effect of trial was found for both groups showing that individuals in each group fixated on the biographical information less frequently across trials. A significant group x trial interaction revealed that that changes over time were significantly greater for the cognitive control group, taken to suggest that these individuals became more efficient in their use of cognitive control across trials when compared to the baseline group.

Additionally, individuals in the cognitive control condition spent significantly less time fixating on the biographical information section when compared to the baseline group. These results are taken to suggest that individuals who had been given a cognitive control inducing message were using top-down information to inhibit their fixations to protected class information contained within the biographical section of the profiles or, when this information was fixated on, terminate fixations to that information. Turning to results relating to the profile picture, a similar pattern of results was found compared to data from the biographical information section.

Profile Picture. Overall, individuals in the cognitive control condition showed statistically significant differences in both fixation frequency and fixation duration to the profile picture. Individuals in the cognitive control condition who had received a cognitive control inducing message showed fewer mean number of fixations to the profile as evidenced by a main effect of group. Additionally, a simple effect of trial was found for both groups where individuals in both groups showed significant decreases across trials in number of fixation to the profile picture. A group x trial interaction also revealed that these changes were significantly greater for individuals in the cognitive control group.

Similar results were found in regard to mean fixation durations to the profile picture with a main effect of group showing that individuals in the cognitive control group fixated on the profile picture, on average, for shorter periods than did individuals in the baseline group. A simple effect of trial was found for both groups, which indicated that individuals in both groups showed significantly decreased fixation durations across trials. The group x trial interaction here shows that individuals in the cognitive control group showed a greater decrease in this pattern of oculomotor behavior compared to the baseline group.

These results are taken to show evidence for direct exhibitions of cognitive control in that individuals who had received a cognitive control inducing message were employing top-down information to inhibit fixations to the profile picture or to terminate a fixation to the profile picture more rapidly than individuals in the baseline condition who had not received this message.

Low and High-Predictability Target Words

Results from data related to the sentences contained within the profiles were broken down into multiple measures: percentage of target words fixated, mean number of fixations, and mean fixation durations to low and high predictability target words.

Low-Predictability Target Words. Results from analyses looking at percentage of target words fixated reveal significant group differences between individuals in the cognitive control and baseline groups as evidenced by a main effect of group. Individual in the cognitive control group, on average, fixated on a smaller percentage of target words as compared to the baseline group. Additionally, a simple effect of trial for both groups revealed that each group showed significant decreased in percentage of target words fixated across trials while the group x trial indicated that this decrease was not significantly different between groups.

Looking at number of fixations, a main effect of group revealed significant differences where individuals in the cognitive control group showed fewer fixations to target words compared to the baseline group. Additionally, a simple effect of trial for the cognitive control group revealed that this group showed significant decreased in mean number of fixations to low-predictability target words across trials Additionally, analyses for mean fixation durations to low-predictability target words revealed a significant main effect of group indicating that individuals in the cognitive control group significantly differed from individuals in the baseline group on mean fixation durations showing decreased fixation durations to low-predictability target words. It is worth noting here that while these results may be impacted by inaccuracies in eye tracking because target words are more susceptible than any other aspect of the profiles to be affected by these issues.

High-Predictability Target Words.

Results from analyses looking at percentage of target words fixated reveal significant group differences between individuals in the cognitive control and baseline groups as evidenced by a main effect of group where individuals in the cognitive control group fixated on a lower percentage of high-predictability target words compared to the baseline group. Further, a simple effect of trial for each group revealed that percentage of target words fixated decreased across trials for each group while the group x trial interaction revealed that this effect was not significantly different between groups.

Additionally, looking at number of fixations to target words, a non-significant main effect of group showed that individuals in the cognitive control group did not show significantly fewer fixations to target words compared to individuals in the baseline group. An effect of trial revealed that significant changes occurred across trials for the cognitive control group where mean number of fixations decreased over time. However, a group x trial interaction was not found, showing no significant differences in this pattern between groups. Results for mean fixation durations revealed a non-significant main effect of group showing that individuals in the cognitive control group did not spend less time, on average, fixating on high-predictability target words compared to the baseline group. An effect of trial was also not found for mean fixation durations, revealing that changes in total fixation duration did not occur across trial.

These results together are taken to show that individuals in the cognitive control group exhibited a pattern of oculomotor behavior, in the given cases, that is consistent with the use of cognitive control and, over time, became more efficient in this use of control processes when compared to individuals in the baseline group.

While there are few studies to compare methodologically to the current study, Rosek et al. (2012) uses comparable method to investigate direct used of cognitive control to inhibit eye movement behaviors. Rosek and colleagues found a decrease in reading time across trial (sentence by sentence) when distractors were present within a sentence. The current study did not include distractors and the main focus was participants ability to inhibit fixations to target words. Further, the current study found that reading times were significantly shorter for individuals in the cognitive control group and that reading times significantly decreased across trials, a finding consistent with Rosek and colleagues. Additionally, Rosek and colleagues found a decrease in fixation durations to target words across trials. The current study also found significant decreases in fixation durations to target words but only for high-predictability target words. While not extensive, these results mentioned show to be comparable between this prior study and the current study and while certain aspects of these studies differ, overall results from both are taken to show the use of cognitive control processes to inhibit fixations to target words based on top-down information.

Limitations and Future Directions

One particular limitation for this study is the use of a college student sample. While this is a common concern in much of academic research, this study proposes further limitations by using a college sample population. Part of the theoretical and applied implications of this research are directed towards hiring professionals in a corporate setting. Because it is likely that the majority of the participants in this study had no prior training or experience in professional hiring, their decision-making processes might differ from professionals in the field. Hiring professionals such as those in human resource departments are often trained specifically in techniques and systems focused around conducting recruitment and hiring processes fairly and without bias. In addition, these hiring or human resource professionals are likely required to have advanced or further education in their specific area of work. While not related to the specific aims in this study, this further education could influence the decision-making process in the specific context domain in which hiring situations occur that differ from the context used in the current study. A lack of experience in addition to a lack of context and job specific training in the sample population of undergraduate college students could show to have a significant effect on how hiring decisions are made and what factors play a role in ultimate hiring recommendations.

Additionally, college students that are not trained in this specific job domain may not have the same ability to remember or keep active all of the categories that constitute protected class information such as the six used in the current study. Therefore, it may be the case that professionals trained in this specific type of job may have a more apt ability to use cognitive control processes to avoid looking at protected class information or any other category of undesirable information specific to a given task. To reiterate, while these previous points are not included in the specific aims these points could have implications for additional research and consideration.

Additionally, conducting the current study in a university lab room setting could have a differentiating influence as opposed to an office setting in which hiring decisions are made. As mentioned, prior research has shown that individuals who work in departments such as human resources that often are tasked with conducting hiring decisions work in high-stress environments (Lovelace et al., 2007). This externally stressing environment increases cognitive factors such as cognitive load that play a role in influencing how individuals process information as well as make decisions (Lavie & Dalton, 2013). These taxing situations may increase the likelihood of relying on heuristic based judgements such as the use of external factors like race, gender, etc. to make relative decisions about individuals (as occurs with hiring recommendations). The current study, due to the university lab environment in which the experiment occurs, will not induce this level of stress and therefore may not be fully generalizable to all real world hiring situations.

There may also be task specific limitations or limitations involving the stimuli used in the current study. Facebook profiles used in the study were spatially modified in order to fit the parameters of the eye-tracking technology available. This artificiality could change how the processes discussed operate in a real-world setting with the spatial characteristics of a standard Facebook profile. Additionally, these processes may operate under different circumstances and be influenced by additional factors not discussed in this study with other social media modalities such as LinkedIn or Twitter. While these limitations are evident, of primary interest in this study is the underlying cognitive processes at work when presented with inducing cognitive control in hiring situations.

Further research is needed to help further the understanding of how executive processes such as cognitive control can be used within more applied settings such hiring situations. Controlling for and simulating the stressful environment in which these hiring situations often occur would give a more holistic view of how these decisions are made in the real-world environment in which they take place. As mentioned, the added stress and cognitive load could significantly change the way decision making processes are made which could have an impact on the results of the hiring decision being made. One possible addition for future research could be the use of incentives or rewards which have been shown to modulate cognitive control (Fröber & Dreisbach, 2016). This addition would simulate the more goal oriented nature of the task in a work environment. Varying levels of incentives being given based on performance could show to influence the efficacy of cognitive control and greater influence behavioral outcomes. Another possible addition for future studies would be sampling from a population more adequately representative of the target population of the study. Possibly sampling from human resource professionals or other professionals in the field that typically handle hiring or recruitment could create a more representative sample that would give better insight into the generalizability of the results and implications of this study.

References

Abrahamse, E., Braem, S., Notebaert, W., & Verguts, T. (2016). Grounding cognitive control in associative learning. *Psychological Bulletin, 142*, 693-728. doi:10.1037/bul0000047

Altonji, J., & Pierret, C. (2001). Employer learning and statistical discrimination. *Quarterly Journal of Economics, 116,* 313-350.

Angele, B., Schotter, E. R., Slattery, T., Chaloukian, T. L., Bicknell, K., & Rayner, K. (2015). Do successor effects in reading reflect parafoveal processing? Evidence from corpus-based and experimental eye movement data. *Journal of Memory and Language, 79-80,* 79-96. doi:10.1037/e528942014-650

Becker, W., & Jürgens, R. (1979). An analysis of the saccadic system by means of double step stimuli. *Vision Research, 19,* 967–983. doi:10.1016/0042-6989(79)90222-0

Bendick, M., & Nunes, A. P. (2012). Developing the research basis for controlling bias in hiring. *Journal of Social Issues, 68*, 238-262. doi:10.1111/j.1540-4560.2012.01747.x

Bielby, W. (2000). Minimizing workplace gender and racial bias. *Contemporary Sociology, 29,* 120–129.

Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. *Psychological Review, 108,* 624–652. doi:http://dx.doi.org/10.1037/0033-295X.108.3.624

Botvinick, M. M., Cohen, J. D., & Carter, C. S. (2004). Conflict monitoring and anterior cingulate cortex: An update. *Trends in Cognitive Sciences, 8,* 539–546. doi:// dx.doi.org/10.1016/j.tics.2004.10.003.

Botvinick, M. M., Nystrom, L. E., Fissell, K., Carter, C. S., & Cohen, J. D. (1999). Conflict monitoring versus selection-for-action in anterior cingulate cortex. *Nature*, *402,* 179–181. doi:dx.doi.org/10.1038/46035.

Boureau, Y., Sokol-Hessner, P., & Daw, N. D. (2015). Deciding how to decide: Self-control and meta-decision making. *Trends in Cognitive Sciences, 19,* 700-710. doi:10.1016/j.tics.2015.08.013

Cohen, J. D., & Huston, T. A. (1994). Progress in the use of interactive models for understanding attention and performance. In C. Umiltà & M. Moscovitch (Eds.), *Attention and performance XV* (pp. 453–476). Cambridge, MA: MIT Press.

Dambacher, M., Yang, J., Slattery, T. J., Kliegl, R., & Rayner, K. (2013). Evidence for direct control of eye movements during reading. *Journal of Experimental Psychology: Human Perception and Performance, 39,* 1468-1484. doi:10.1037/a0031647

Drouin, M., O'Connor, K. W., Schmidt, G. B., & Miller, D. A. (2015). Facebook fired: Legal perspectives and young adults' opinions on the use of social media in hiring and firing decisions. *Computers in Human Behavior, 46*, 123-128. doi:10.1016/j.chb

Edwards, E. J., Edwards, M. S., & Lyvers, M. (2015). Cognitive trait anxiety, situational stress, and mental effort predict shifting efficiency: Implications for attentional control theory. *Emotion*, *15*, 350-359. doi:10.1037/emo0000051

Erb, C. D., Moher, J., Sobel, D. M., & Song, J. (2016). Reach tracking reveals dissociable processes underlying cognitive control. *Cognition*, *152*, 114-126. doi:10.1016/j.cognition.2016.03.015

Fröber, K., & Dreisbach, G. (2016). How performance (non-)contingent reward modulates cognitive control. *Acta Psychologica*, *168*65-77. doi:10.1016/j.actpsy.2016.04.008

Goodmon, L. B., Smith, P. L., Ivancevich, D., & Lundberg, S. (2014). Actions speak louder than personality: Effects of Facebook content on personality perceptions. *North American Journal of Psychology, 16,* 105-120.

Hooge I. C., & Erkelens, C. J. (1999). Peripheral vision and oculomotor control during visual search. *Vision Research, 39,* 1567–1575.

Hussey, E., Harbison, I., Mishler, A., Teub-ner-Rhodes, S., Velnoskey, K., & Novick, J. (2016). Memory and language improvements following cognitive control training. *Journal of Experimental Psychology*. doi:10.1037/e505772014-019.

Kemper, S., & McDowd, J. (2006). Eye movements of young and older adults while reading with distraction. *Psychology and Aging, 21,* 32–39. doi:10.1037/0882-7974.21.1.32

Krings, F., Johnston, C., Binggeli, S., & Maggiori, C. (2014). Selective incivility: Immigrant groups experience subtle workplace discrimination at different rates. *Cultural Diversity and Ethnic Minority Psychology*, *20,* 491-498. doi:10.1037/a0035436

Kristoff-Brown, A. L. (2000). Perceived applicant fit: Distinguishing between recruiters' perception of person-job and person-organization fit. *Personnel Psychology, 53,* 643-671. doi:10.1111/j.1744-6570.2000.tb00217.x

Lavie, N., & Dalton, P. (2013). Load theory of attention and cognitive control. In S. Kastner & A. C. Nobre A. (Eds.), *Handbook of Attention.* Oxford, UK, Oxford University Press.

Leskinen, E. A., Rabelo, V. C., & Cortina, L. M. (2015). Gender stereotyping and harassment: A 'catch-22' for women in the workplace. *Psychology, Public Policy, and Law, 21*, 192-204. doi:10.1037/law0000040

Lovelace, K. J., Manz, C. C., & Alves, J. C. (2007). Work stress and leadership development: The role of self-leadership, shared leadership, physical fitness and flow in managing demands and increasing job control. *Human Resource Management Review, 17,* 374-387. doi:10.1016/j.hrmr.2007.08.001www.elsevier.com/locate/humres

Luke, S. G., & Henderson, J. M. (2013). Oculomotor and cognitive control of eye movements in reading: Evidence from mindless reading. *Attention, Perception, & Psychophysics, 75,* 1230-1242. doi:10.3758/s13414-013-0482-5

Matin, E. (1974). Saccadic suppression: A review and an analysis. *Psychological Bulletin, 81,* 899 –917. doi:10.1037/h0037368

Moreno, M. A., Goniu, N., Moreno, P. S., & Diekema, D. (2013). Ethics of social media research: Common concerns and practical considerations. *Cyberpsychology, Behavior, and Social Networking, 16,* 708-713. doi:10.1089/cyber

Neider, M. B., & Zelinsky, G. J. (2006). Scene context guides eye movements during visual search. *Vision Research, 46,* 614-621. doi:10.1016/j.visres.2005.08.025

Nosek, B., Greenwald, A., & Banaji, M. (2005). Understanding and using the implicit association test: II. Method variables and construct validity. *Personality & Social Psychology Bulletin, 31,* 166 – 180. doi:10.1177/0146167204271418.

Offermann, L. R., Basford, T. E., Graebner, R., Jaffer, S., De Graaf, S. B., & Kaminsky, S. E. (2014). See no evil: Color blindness and perceptions of subtle racial discrimination in the workplace. *Cultural Diversity and Ethnic Minority Psychology*, *20,* 499-507. doi:10.1037/a0037237

Rayner, K. (2009). The Thirty-Fifth Sir Frederick Bartlett Lecture: Eye movements and attention in reading, scene perception, and visual search. *The Quarterly Journal of Experimental Psychology*, *62,* 1457–1506. doi:10.1080/17470210902816461

Reingold, E. M., & Glaholt, M. G. (2014). Cognitive control of fixation duration in visual search: The role of extrafoveal processing. *Visual Cognition*, *22,* 610-634. doi:10.1080/13506285.2014.881443

Rinck, M., & Becker, E. S. (2006). Spider fearful individuals attend to threat, then quickly avoid it: Evidence from eye movements. *Journal of Abnormal Psychology*, *115*, 231-238. doi:10.1037/0021-843x.115.2.231

Rosek, E, Kemper, S., & McDowd, J. (2012). Learning to ignore distractors. *Psychology and Aging, 27,* 61–66. doi:10.1037/0882-7974.21.1.32

Schroder, H. S., Moran, T. P., Donnellan, M. B., & Moser, J. S. (2014). Mindset induction effects on cognitive control: A neurobehavioral investigation. *Biological Psychology, 103*, 27-37. doi:10.1016/j.biopsycho.2014.08.004

Shen, J., Reingold, E. M., & Pomplun, M. (2000). Distractor ratio influences patterns of eye movements during visual search. *Perception*, *29,* 241-250. doi:10.1068/p2933

Shenhav, A., Botvinick, M. M., & Cohen, J. D. (2013). The expected value of control: An integrative theory of anterior cingulate cortex function. *Neuron*, *79,* 217–240. http://dx.doi.org/10.1016/j.neuron.2013.07.007

Stoughton, J. W., Thompson, L. F., & Meade, A. W. (2015). Examining applicant reactions to the use of social networking websites in pre-employment screening. *Journal of Business and Psychology, 30,* 73-88. doi:10.1007/s10869-013-9333-6

Thomson Reuters Practical Law. (December, 2017). Retrieved from http://content.nect.westlaw.com

Wiecki, T. V., & Frank, M. J. (2013). A computational model of inhibitory control in frontal cortex and basal ganglia. *Psychological Review, 120,* 329–355. doi:hx.doi.org/10.1037/a0031542

Zendehrouh, S. (2015). A new computational account of cognitive control over reinforcement-based decision-making: Modeling of a probabilistic learning task. *Neural Networks*, *71*, 112-123. doi:10.1016/j.neunet.2015.08.006

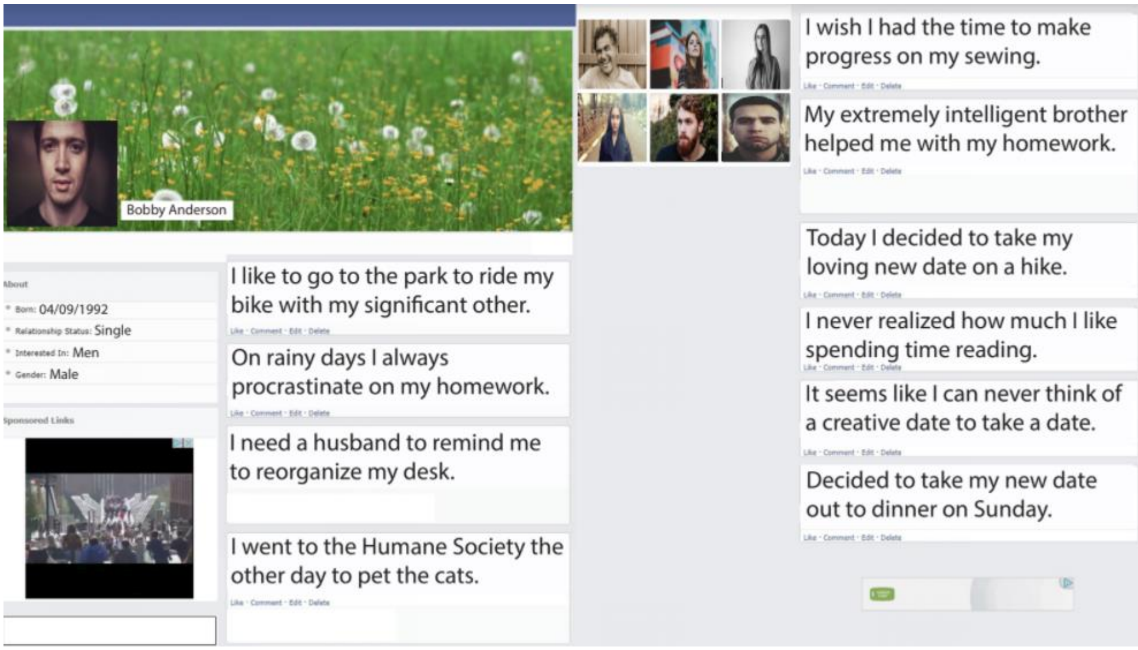

Figure 1. Mock Facebook profile example.

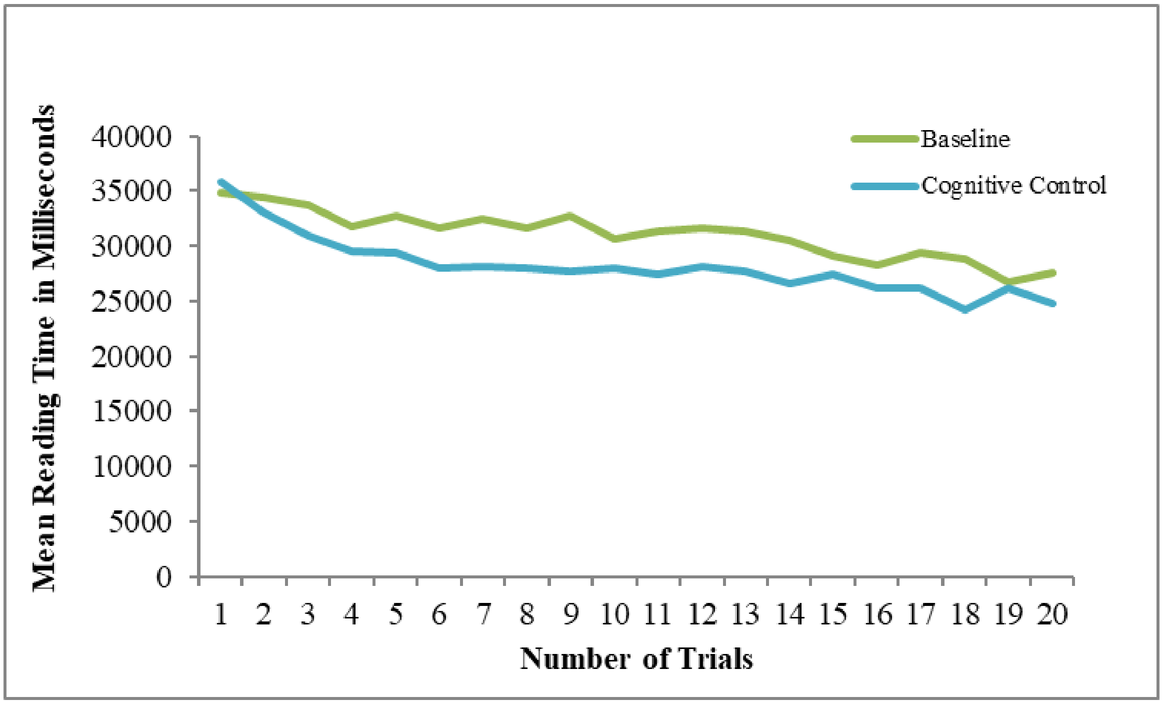

Figure 2. Reading time.

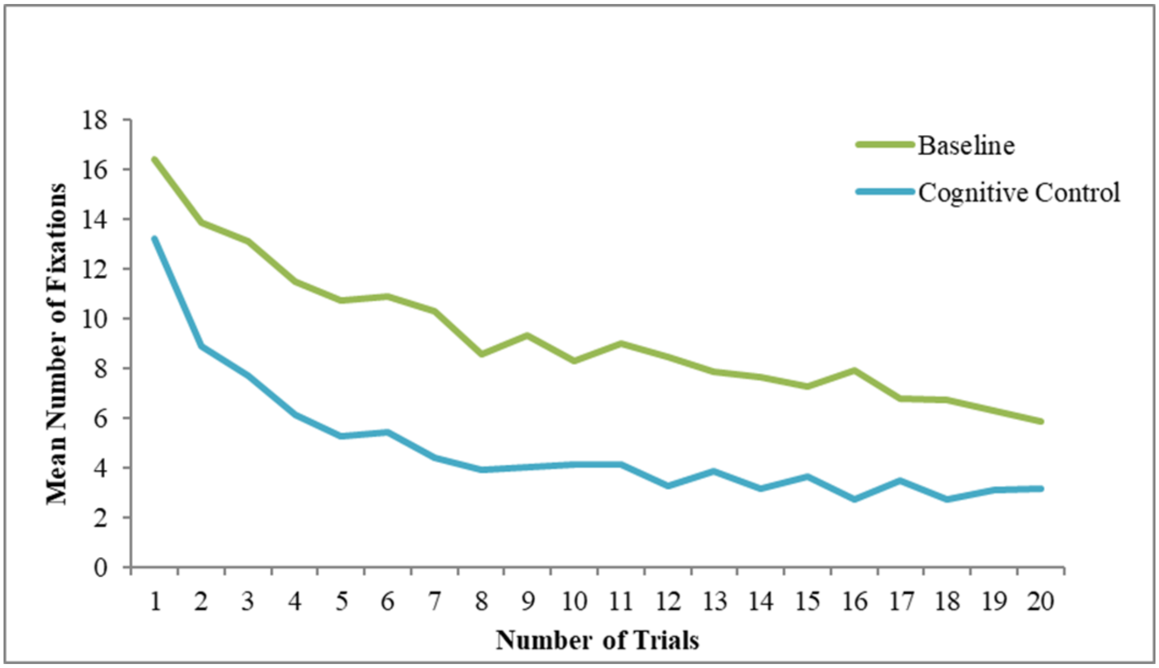

Figure 3. Frequency of fixations to the biographical information.

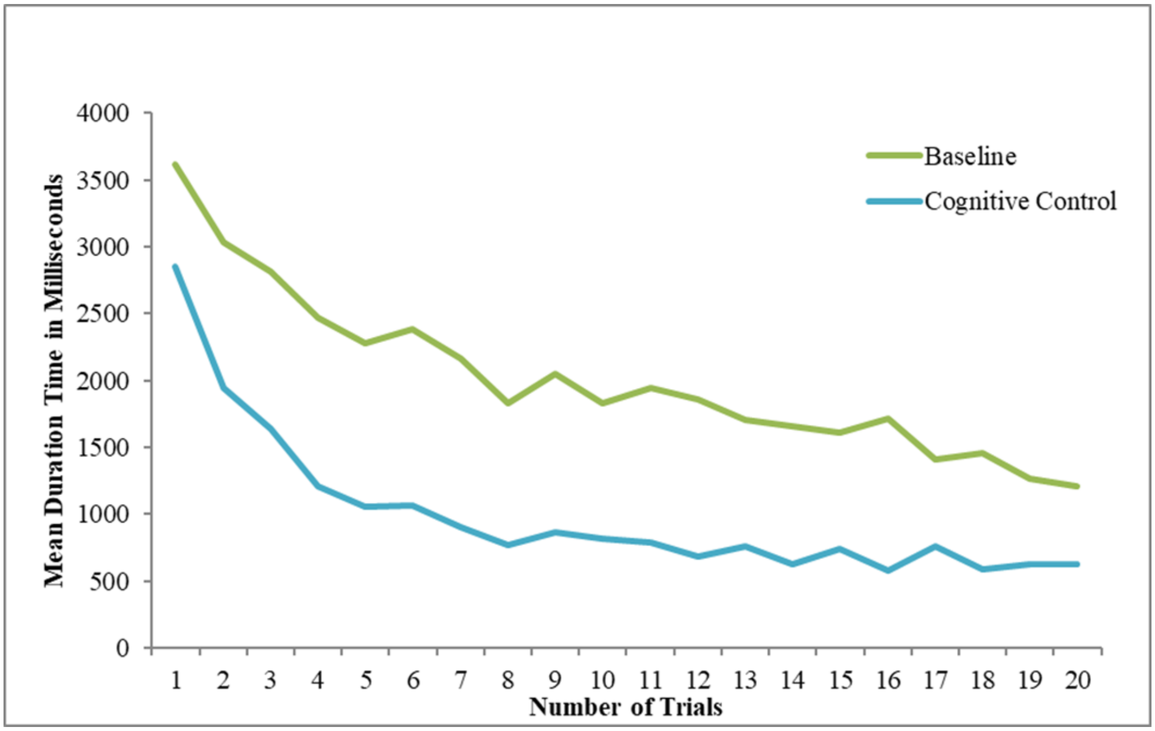

Figure 4. Duration of fixations on the biographical information.

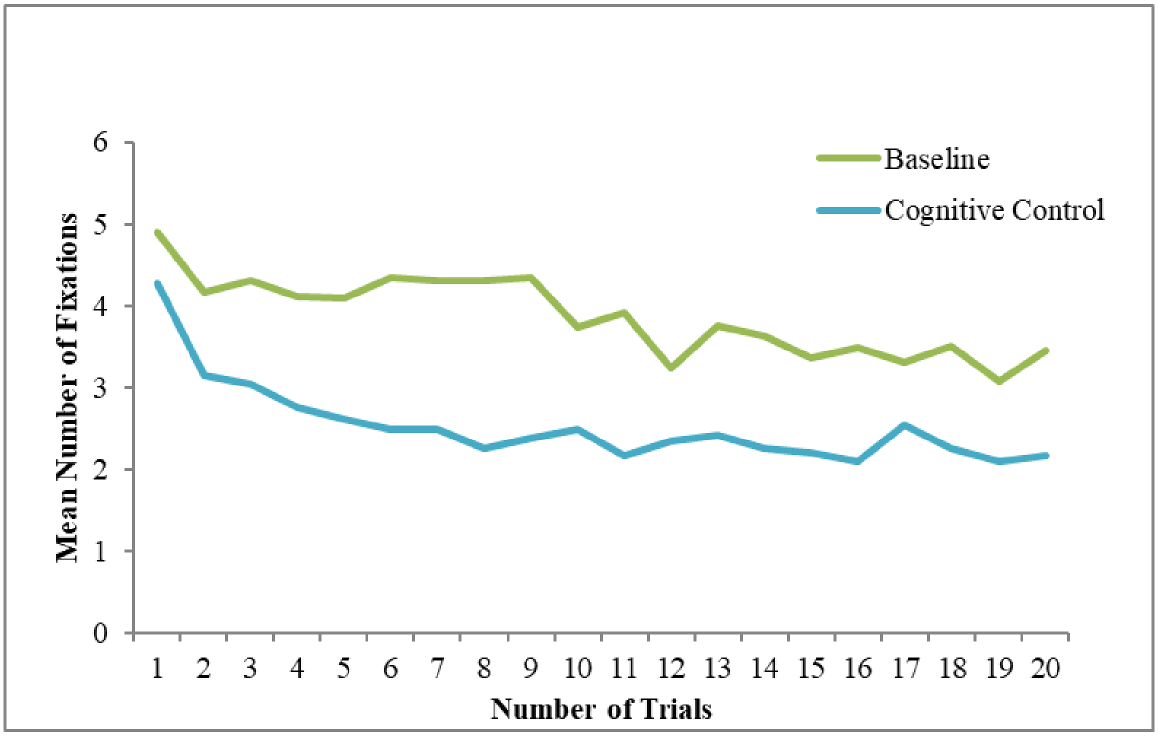

Figure 5. Frequency of fixations to the profile picture.

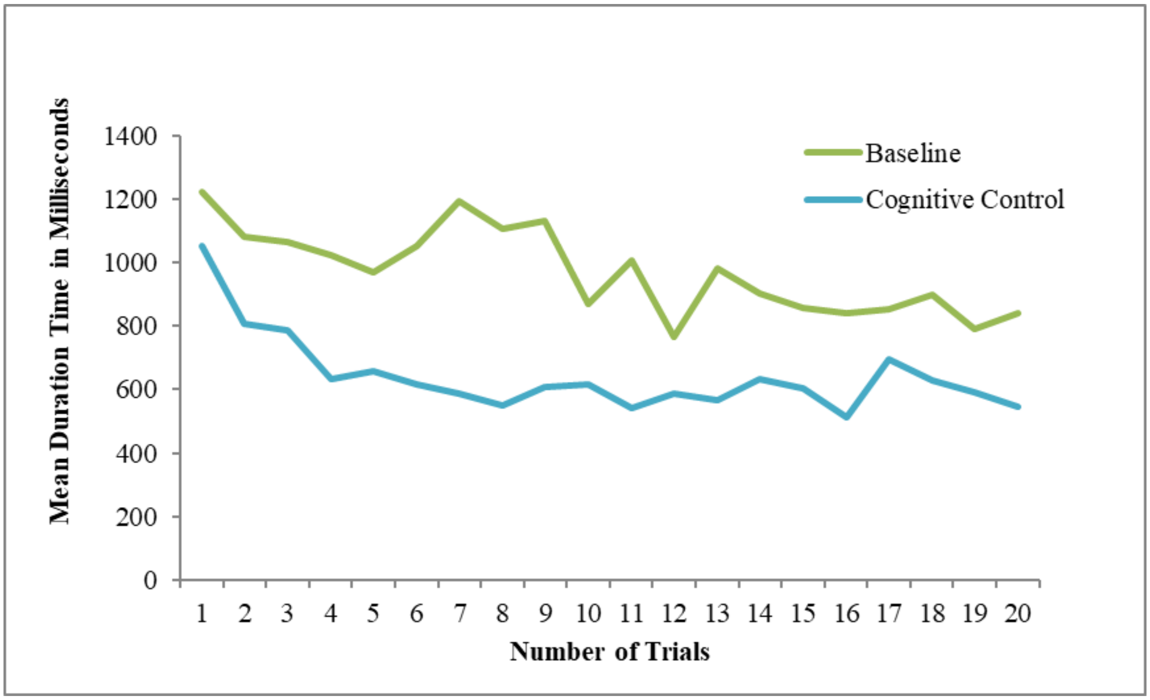

Figure 6. Duration of fixations on the profile picture.

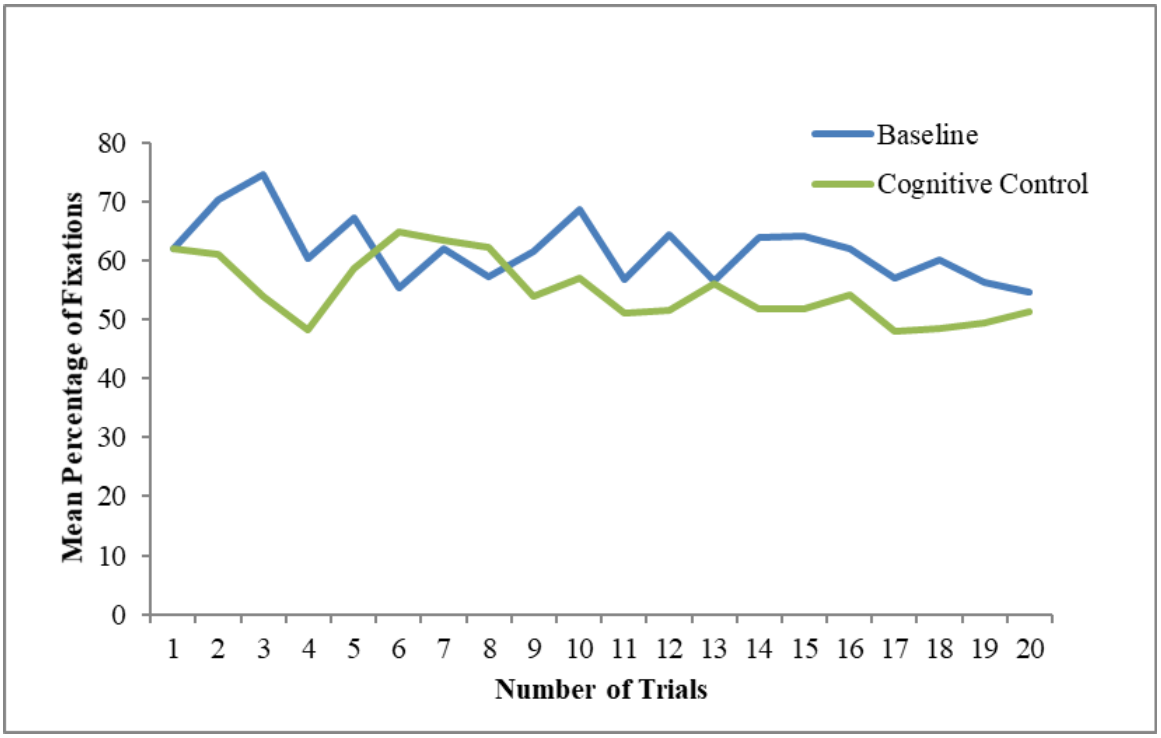

Figure 7. Percentage of low-predictability target words fixated.

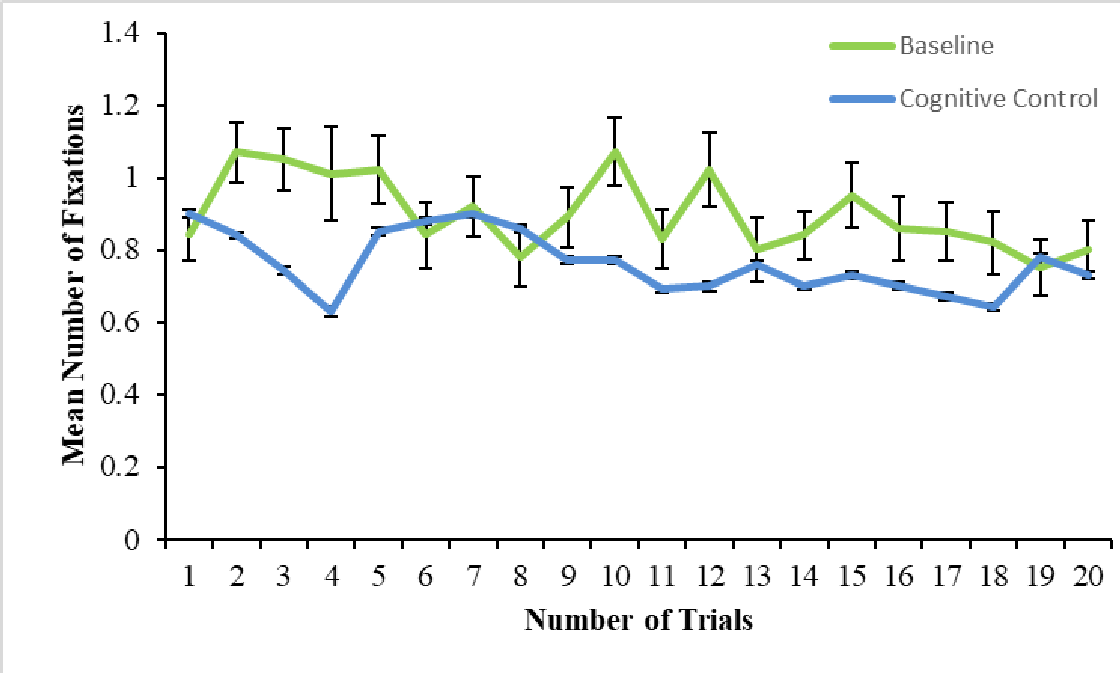

Figure 8. Mean number of fixations to low-predictability target words.

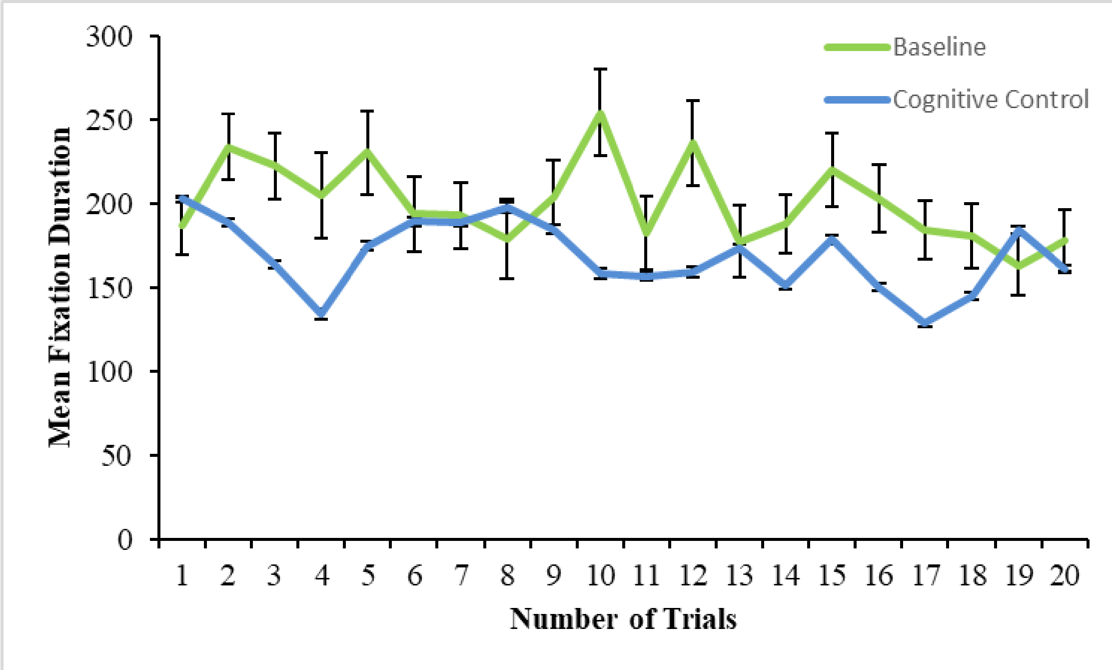

Figure 9. Mean duration of fixation to low-predictability target words.

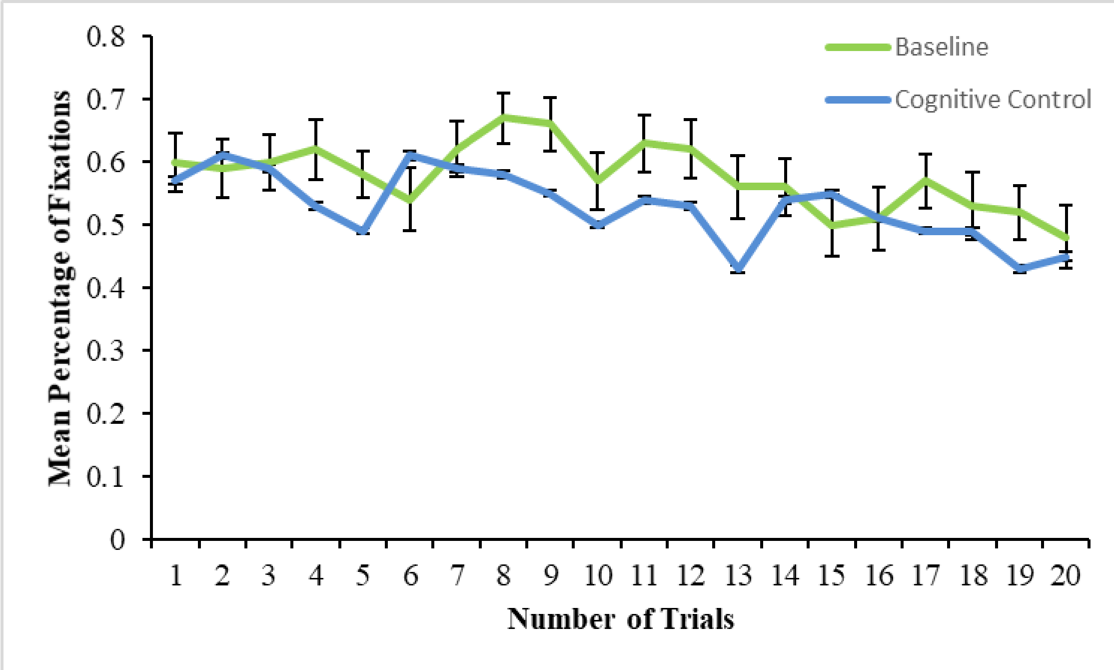

Figure 10. Percentage of high-predictability target words fixated.

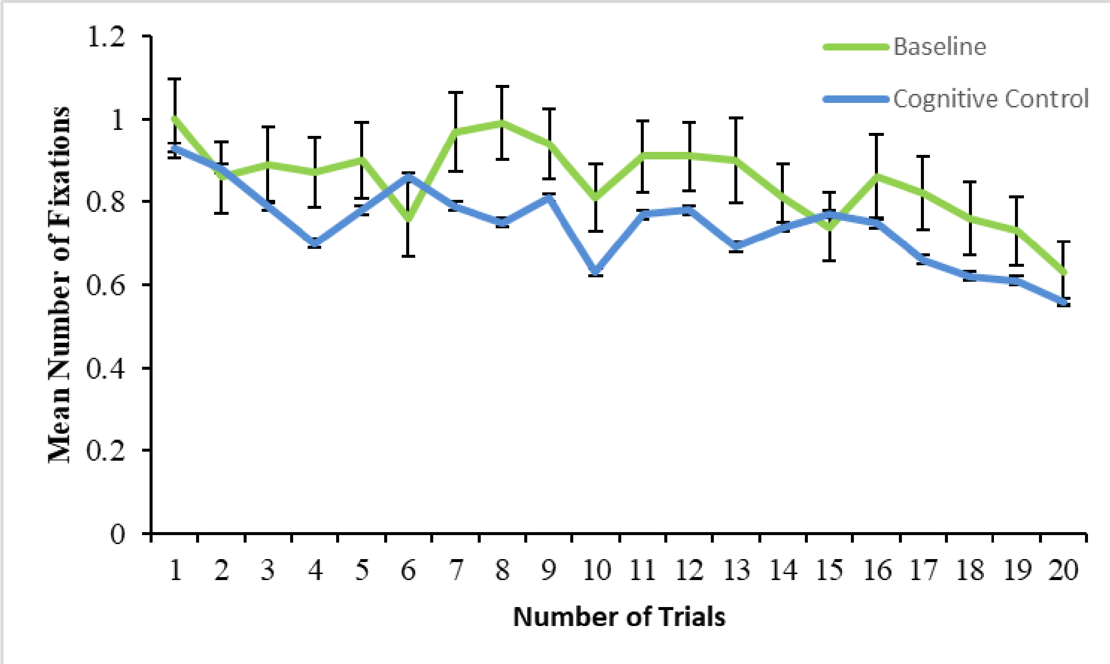

Figure 11. Mean number of fixations to high-predictability target words.

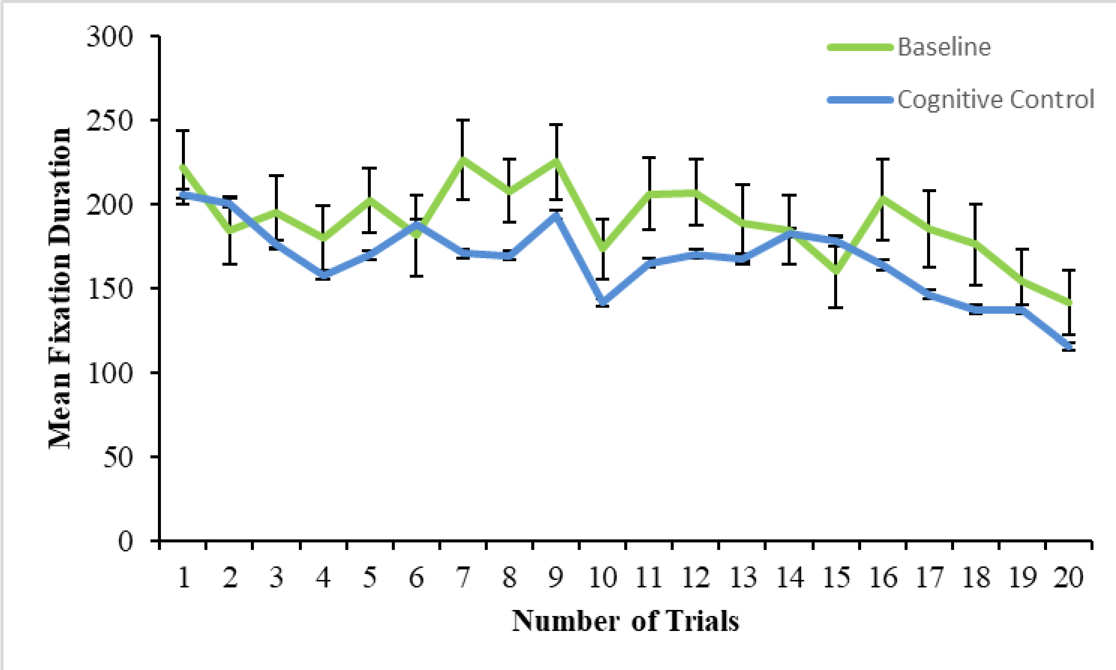

Figure 12. Mean duration of fixation to high-predictability target words.

Appendix A

Hiring Recommendation

Please select the most accurate answer choice for the job applicant.

The candidate is qualified for this position.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate would excel in this position.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate would have a positive impact on this organization.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate is trustworthy.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate is dependable.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate is conscientious.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate is intelligent.

Strongly Agree Agree Neutral Disagree Strongly Disagree

The candidate is extroverted.

Strongly Agree Agree Neutral Disagree Strongly Disagree

You are likely to hire this candidate.

Strongly Agree Agree Neutral Disagree Strongly Disagree

Appendix B
Manipulation Check

Do you think this is considered protected-class information?
“Gender”
Yes No

“Sexual-Orientation”
Yes No

“Education”
Yes No

“Political Affiliation”
Yes No

“Primary Language Spoken”
Yes No

“Dietary Restriction”
Yes No

“Ethnic Background”
Yes No

“Age”
Yes No

“Race”
Yes No

“Place of Residence”
Yes No

Have you taken (or are taking) any Industrial-Organizational Psychology/Human Resource Management courses?
Yes No

Appendix C
IRB Approval

STUDY #: 18-0192

STUDY TITLE: Cognitive Control and Social Media Viewing Patterns

Expedited Category: (6) Collection of Data from Recordings made for Research Purposes,(7) Research on Group Characteristics or Behavior, or Surveys, Interviews, etc.

Approval Date: 2/23/2018

Expiration Date of Approval: 2/22/2019

Appendix D

Consent to Participate in Research

Information to Consider About this Research

Cognitive Control as Assessed with Eye Movements

Principal Investigator: Richard B. Wagner

Department: Psychology

Contact Information: Richard B. Wagner; wagnerrb@appstate.edu

You are being invited to take part in a research study about how people analyze and read sentences. If you take part in this study, you will be one of about 160 people to do so. By conducting this study we hope to learn how people analyze isolated sentences and what factors influence reading.

The research procedures will be conducted at Smith Wright Hall in room 216.

You will be asked to come here one time during the study. This visit will take about 30 minutes. If you agree to be part of the research study, you will be asked to view a series of sentences, as well as to follow instructions given to you during the reading task. Each sentence will be presented individually.

You will receive ELC credit for this study after completion of the study procedures.

You cannot volunteer for this study if are under 18 years of age.

What are possible harms or discomforts that I might experience during the research?

To the best of our knowledge, the risk of harm for participating in this research study is no more than you would experience in everyday life. Eye position is recorded using a commercial eye tracker (EyeLink 1000). This system works by illuminating each eye with a low-energy infra-red light source and tracking each pupil with a camera located about 40 cm in front of your eyes (you will not sense the light). According to the manufacturer, the EyeLink 1000 system produces less than 1 mW/cm2 of energy at the eye, which is less than the recommended limit established by ANSI. This system has been used in many labs all over the world for nearly a decade without any reports of adverse effects. Because an eye tracker requires that your head remain very still during an experiment, you will be asked to place your chin in a chin-cup. Not everyone can participate in eye tracking experiments. Although the eye tracker can track gaze while an individual is wearing glasses or contact lenses, some lenses do interfere with its operation. In addition, there may be other reasons related to the structure of the eye or an individual's ability to accurately fixate that would prevent the tracker from tracking his or her gaze accurately enough to participate in an experiment.

What are the possible benefits of this research?

There may be no personal benefit from your participation but the information gained by doing this research may help others in the future by helping us learn about what factors influence eye movements during reading. In addition, your participation may contribute to overall knowledge about how people analyze sentences during reading.

Will I be paid for taking part in the research?

We will not pay you for the time you volunteer while being in this study. You will receive 1 Experiential Learning Credit (ELC) toward your General Psychology research participation requirement for today's experiment (if you are participating for credit in another class, you will receive 1 ELC for that class). The requirements and options for research participation have been outlined in the syllabus for your General Psychology class. Your course instructor can also provide you non-research alternatives to obtain ELCs. There are other research options and non-research options for obtaining extra credit or ELC's. One non-research option to receive 1 ELC is to read an article and write a 1-2 page paper summarizing the article and your reaction to the article. More information about this option can be found at: psych.appstate.edu/research. You may also wish to consult your professor to see if other non-research options are available.

How will you keep my private information confidential?

All data collected in this study are de-identified. That means that no identifying information will be attached to data that are collected during the study. During the current semester only, a list of names of all people who participated in the study will be available only to members of the research team. Once the current semester has ended, no one, not even members of the research team, will know that the information you gave came from you. Your information will be combined with information from other people taking part in the study. When we write up the study to share it with other researchers, we will write about the combined information. You will not be identified in any published or presented materials.

Who can I contact if I have questions?

The people conducting this study will be available to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at dickinsonca@appstate.edu. If you have questions about your rights as someone taking part in research, contact the Appalachian Institutional Review Board Administrator at 828-262-2692 (days), through email at irb@appstate.edu or at Appalachian State University, Office of Research and Sponsored Programs, IRB Administrator, Boone, NC 28608.

Do I have to participate? What else should I know?

Your participation in this research is completely voluntary. If you choose not to volunteer, there will be no penalty and you will not lose any benefits or rights you would normally have. If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. There will be no penalty and no loss of benefits or rights if you decide at any time to stop participating in the study. If you decide to participate in this study, let the research personnel know. A copy of this consent form is yours to keep.

This research project has been approved by the Institutional Review Board (IRB) at Appalachian State University.

This study was approved on: December 15, 2017. This approval will expire on October 2, 2018, unless the IRB renews the approval of this research.

Vita

Richard Blake Wagner was born in Durham, NC, to Richard and Judy Wagner. He graduated from the Princeton High School in May, 2012. The following autumn, he entered North Carolina State University to study psychology, and in May, 2016, he graduated cum laude with a Bachelor of Arts degree in Psychology. In the fall of 2016, he matriculated into the Experimental Psychology program at Appalachian State University and began study toward a Master of Arts degree. The Master of Arts in Psychology was awarded in August, 2018. After graduation, he will be attending North Carolina State University to pursue a PhD in Human Factors and Applied Cognition.