Impatience and Driving Speeds:

A Driving Simulator Study

by

Mistey L. Taggart

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Approved April 2014 by the
Graduate Supervisory Committee:

Russell Branaghan, Chair
Nancy Cooke
Hyunjin Song

ARIZONA STATE UNIVERSITY

May 2014

ABSTRACT

Research on priming has shown that exposure to the concept of fast food can have an effect on human behavior by inducing haste and impatience (Zhong & E. DeVoe, 2010). This research suggests that thinking about fast food makes individuals impatient and strengthens their desire to complete tasks such as reading and decision making as quickly and efficiently as possible. Two experiments were conducted in which the effects of fast food priming were examined using a driving simulator. The experiments examined whether fast food primes can induce impatient driving. In experiment 1, 30 adult drivers drove a course in a driving simulator after being exposed to images by rating aesthetics of four different logos. Experiment 1 did not yield faster driving speeds nor an impatient and faster break at the yellow light in the fast food logo prime condition. In experiment 2, 30 adult drivers drove the same course from experiment 1. Participants did not rate logos on their aesthetics prior to the drive, instead billboards were included in the simulation that had either fast food or diner logos. Experiment 2 did not yielded faster driving speeds, however there was a significant effect of faster breaking and a higher number of participants running the yellow light.

DEDICATION

To my husband, thank you for your incredible support in helping me pursue my goals and dreams. To my mom, whom passed away, thank you for teaching me how to be strong and independent woman who can achieve anything she believes.

ACKNOWLEDGMENTS

I would like to express my appreciation and gratitude to my committee chair, Dr. Russ Branaghan, who has been my mentor since my undergraduate career. Thanks for all the knowledge shared and continued advice. I want to thank Dr. Nancy Cooke for her efforts in providing funding and for her valuable expertise throughout the years; specifically with experimental design, analysis, and writing reports. Dr. Hyunjin Song, thank you for contributing your expertise in social phycology. Thank you all for the guidance throughout my journey as a graduate student. I cannot wait to see what the future holds!

I thank Dr. Zhong for permission to include the aesthetics rating survey as part of my thesis/dissertation. Thanks to Michael Kuzel (M.S.) who helped program the data collection for my course in the driving simulator.

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Introduction

The fast-food restaurant industry began with a handful of modest hotdog and hamburger stands on the west coast of the United States. They now have expanded into a fast-food craze across the world. Millions of people buy fast food every day without giving it much thought (Schlosser, 2001).

The mere exposure to food chain symbols has been reported to unconsciously influence behaviors that are unrelated to eating (Zhong & E. DeVoe, 2010). Specifically, fast food symbols have been suggested to induce haste and impatience (Zhong & E. DeVoe, 2010). These behaviors are thought to derive from the activation of goal driven behaviors, for example hunger, which increases desirability of goal relevant actions, such as locating food (Zhong & E. DeVoe, 2010). Goals are theorized to be represented mentally as cognitive constructs, which can be activated by situational cues and then operate automatically to shape behavior (Bargh 1990).

Fisher (1992) argued that noticing a road sign, processing its meaning, and being able to recall the sign once passing it, was not a true measure of effectiveness of the sign. He conducted an observational study with a sample of 64 drivers. The research was conducted on a 9-km cross-country stretch and took place between 10:00am and 2:00pm on clear, bright days. Fisher indiscriminately hitchhiked in vehicles heading westbound to an intersection. After passing two signs, a hazard sign and a reduce speed sign, Fisher asked the driver, “Do you remember what was shown on the last road signs we passed?” He recorded the accuracy of the driver’s response as well as whether or not the driver had reduced their speed in unity with the sign hazard. Fisher found 36 drivers recalled the signs and 28 did not. Of the 28 drivers that did not recall the hazard signs, 39%

reduced their speed appropriately. This may suggest that hazard signs may have been perceived at an unconscious level, which may have influenced their driving behavior.

Charlton (2006) examined 33 drivers', (14 men and 19 women) from the local area, reactions to 16 warning signs in a driving simulator. A range of measures were collected and examined, including implicit and explicit recognition and sign priming. Charlton concluded that most drivers who had reduced their speed did not recall seeing the warning sign. Charlton suggested the signs could serve as implicit cues through semantic associations, the meaning of the signs, for unconscious or automatic vehicle control response.

There are two distinct ways from which the driver can obtain information from the environment, explicit or attentional cues and implicit or perceptual cues (Charlton, 2006). Subtle, even subliminal, environmental stimuli can influence social perceptions, decision processes, and behavior (Bargh, Chen, & Burrows, 1996). The priming paradigm could be a valuable tool to explore the automatic or implicit components of the driving task (Crundall and Underwood 2001). Priming is the activation of knowledge stored in long-term memory following exposure to a stimulus. Research conducted on priming has focused on accessibility effects, which is the knowledge stored in memory that will be activated (Althaus & Kim, 2006). Althaus and Kim (2006) suggested that priming effects may be produced in changes in the applicability of relevant knowledge constructs, rather than their temporary accessibility in long-term memory.

Automaticity in Cognition

Automatic processes require no effort, intentionality, or awareness (Fitzsimons, Chartrand, & Fitzsimons, 2008) and 'frees up' cognitive resources for other activities. Behavioral priming effects are believed to result from automatic processes (Fitzsimons, Chartrand, & Fitzsimons, 2008). Primes are often presented unobtrusively, showing that such effects can result even when participants are unaware of the effect of the prime on their behavior or of the activation of the primed construct (Shah 2003).

The theory of automaticity in behavior extends from seminal research in priming by Neely (1977) and Meyer and Schvaneveldt (1971). Meyer and Schvaneveldt used reaction time tests to show that exposure to a stimulus affected the response time to succeeding stimuli. Twelve high school students, paid as volunteers, participated and performed a lexical decision task in which they decided as quickly as possible whether a string of letters formed an English word. They found that responses to the target word were much faster if it was preceded by a closely related word (e.g. Bread-Butter, Nurse-Doctor) than with unrelated control words (e.g. Nurse-Butter, Bread-Doctor).

Stereotype priming effects on driving behavior

An automaticity exists not only in daily tasks, but also in social representations. Exposure to a stereotype can guide behavior in line with information embedded in the stereotype. For example, Bargh et al. (1996) conducted an experiment with 34 students at New York University in which behavior was altered by the mental representation of the elderly. Participants performed a scrambled sentence language task. Participants in the elderly condition were primed with words such as Florida, grey, bingo. After completing the sentence scramble task, participants left the room and walked down a

hall toward the elevator. The experimenters recorded how long it took participants to reach the elevator, and the participants primed with elderly walked on average slower to the elevator. The activation of the concept "slow", links to behavioral representations and leads to an increased likelihood that the corresponding behavior will result. Branaghan & Gray (2008) found similar results when they conducted a driving simulator study which examined driving behaviors and unconscious stereotype activation. Participants completed scrambled sentence tasks while waiting at stop signs. In these sentences one word was related to an elderly stereotype, e.g. bingo, grey, Florida. In the control condition they had age non-specific words substituted in for the elderly words. Participants achieved a lower maximum speed and longer driving time in the elderly stereotype condition than in the control condition.

Social behavior and priming effects

Social behaviors can be primed by environmental cues. For example, exposure to a picture of an exclusive restaurant led people to behave with better manners in a subsequent eating task (Aarts & Dijksterhuis, 2003). Certain objects and symbols can be predictable in certain environments. For example one could predict that an academic office would have books and journals whereas a romantic French restaurant would have flowers (Kay, Wheeler, Bargh, & Ross, 2004). One could also predict that exposure to fast-food concepts can automatically induce time-saving behaviors (Zhong & E. DeVoe, 2010).

Nittono et al. (2012) conducted an experiment that examined Kawaii, cute in Japanese, images and their effect on subsequent task performance in unrelated tasks that

require behavioral carefulness and attentional focus. The participants were 48 university students, 24 men and 24 women, who performed a reaction time task in which the screen contained the letter H or T. The participant would have to press the left or right key as quickly as possible after viewing images of baby animals, adult animals, and neutral objects depending on the condition. They found that viewing cute images improved behavioral performance by inducing happiness which seemed to lead to focusing more carefully on the task. Nittono et al. (2012) suggested for future applications, cute images may be used as a facile emotion elicitor because these images induce careful behavioral tendencies, which is beneficial in specific situations, such as driving.

Driving behaviors can be subtly influenced by images in their immediate environment (Mammarella, Fairfield, Di Domenico, & Di Fiore, 2013). Mammarella et al. conducted a driving experiment in which 87 adult participants (age range 19-30 years) viewed a series of images. There were three conditions which depicted images of infants, police or neutral information, which participants would view prior to driving the simulated course. Participants earned points for driving the car through green lights and for stopping the car when the green light turned yellow. Participants stopped more at the yellow lights in the infant condition than in the police and control conditions.

Fast food priming effects on behavior

The present research seeks to add to the findings from Zong and De Voe (2010), examining the effects of fast food priming and impatient behaviors. Zong and De Voe (2010) conducted three experiments that showed that fast food symbols unconsciously

increase reading speeds, preference for time-saving products, and the decision to save money.

In Zong and De Voe's first experiment 57 undergraduates were presented subliminal primes of fast-food logos to participants' and examined reading speed. They conducted this by flashing the fast food logos on a computer screen which the participants were using to write a paragraph. The neutral condition had the same sized squares but they were blank and flashed white. They found that participants primed with fast food concepts read faster than the participants in the neutral condition.

In the second experiment, Zong and De Voe manipulated exposure to fast-food-related concepts and examined impatience in consumer choices among 54 participants. They found exposure to fast-food primes increased preference for time-saving products relative to control products. They had participants either recall the last meal they had at a fast-food restaurant or the last time they went grocery shopping. Then participants filled out a survey, in which they rated the desirability of the eight products on a scale from 1 (*not at all*) to 7 (*very desirable*). Participants primed with fast food desired timesaving products more than participants in the control.

In experiment 3, they primed 58 undergraduate student participants with fast food logos and examined their impatience with long term versus short term financial decisions. Participants primed with fast food logos were much more likely to accept a smaller payment now rather than wait for a larger payment in a week, compared with those in the control condition. Zong and De Voe concluded that the unconscious goal of

saving time, embedded in the concept of fast food, may have an effect on behavior by inducing haste and impatience.

This research suggests that merely thinking about the concept of fast food can induce individuals to be impatient and strengthens their desire to complete tasks such as reading and decision making as quickly as possible. These findings were taken into account in the design of the current experiments. The experiments examined whether fast food logo primes can induce impatient driving behaviors such as breaking fast, accelerating through a yellow light, and driving at a higher speed.

Experiment 1

Method

Experimental design

To test the effects of fast food logos on driving behavior, the aesthetic logos employed by Zhong and De Voe (2010) were used. Participants rated the aesthetics of four different logos. In the fast food condition, two of the logos were from well-known fast food franchises, McDonalds and KFC. In the control condition, those two logos were replaced with two inexpensive diner logos. This was used to extend the priming effect found by Zhong and De Voe. After the participants completed the priming task, they drove approximately five minutes on a slightly windy two-lane rural road. Speed limit signage was removed from the course and no speed feedback was given. The driving course had one green light, which was triggered to turn yellow at the end of the simulation. To increase speed variability, ambient traffic was removed from the simulation. This was done to ensure drivers did not maintain similar speeds as other

cars. We examined the speed as well as the stop rate at the yellow light, predicting that fast food primes would increase driving speed and decrease the stop rate at the yellow light.

Participants

Thirty drivers with valid driver licenses, 23 male and 7 female, were recruited from the Psychology 101 online subject pool at the Arizona State University Polytechnic Campus. The average age of participants were 19.5 years (*SD* = 2.73) and ranged from 18 to 33 years of age. The average years of driving experience were 5.3 years (*SD* = 1.78) and ranged from 1 to 8 years. All drivers had normal (20/20) or corrected to normal vision.

Apparatus

Driving simulator (Figure 1). The fixed-base driving simulator was composed of two main components: (a) a steering wheel mounted on a table top and pedals (Wingman Formula Force GP, Logitech™) and (b) three 19" Dell™ LCD monitors. The monitors were placed at a distance of approximately 60cm from the steering wheel. The three monitors were positioned side-by-side to create a driving scene that subtended a total of 130° H x 30° V of visual angle. The visual scene was rendered and updated by DriveSafety™ driving simulator software running on four PC's (Dell Optiplex GX270) and updated at a rate of 60 Hz. The DriveSafety™ software captured various driving performance elements at 60 Hz. This system was used for all two experiments to ensure consistency.

Procedure

Participants read an informed consent and then were given task instructions (*Appendix A*). Participants were randomly assigned to one of two conditions, the fast food or neutral prime condition. They were asked to rate either three diner and two fast food restaurant logos or five diner logos on their aesthetics (*Appendix B*). After that, participants were asked to navigate through a virtual rural road in a driving simulator. The participants were told in the instructions that they would be driving in a rural city at their regular driving speed. They were instructed to drive at a speed with which they were comfortable and were asked to obey all traffic signals and laws.

It was predicted that maximum driving speed, would be lower for drivers rating the five diner logos than for drivers rating the fast food and diner logos as shown by Zhong and De Voe (2010). A speedometer, which would likely minimize variance in driving speed, was omitted from this experiment. Each session took approximately 30 minutes to complete.

After the completion of the driving scenario, participants completed a post survey (*Appendix C*).

Results

The dependent variables were the average speed from the trigger of the yellow light to the point the participant stopped or the simulation ended, as well as the number of participants who hit the brake and stopped. In the fast food logo condition, 6 participants hit the break and stopped before the simulation ended and 10 ran the yellow light. In the neutral condition, 9 participants hit the break and stopped and 5 ran the yellow light. A chi-square test of independence was performed to examine the

relationship between the fast food and diner logos. The relationship between these variables was not significance at X^2 (2, N = 30) = 3.33, p = 0.068. Cohen's effect size value (d = .71) suggested a moderate to high practical significance. The participants in the fast food logo condition may be more likely to run the yellow light and not stop than the participants in the diner logo condition.

Contrary to our hypothesis, results from an independent samples *t*-test indicated that participants in the fast food condition (M = 45.42mph, SD = 25.96) did not drive faster than the neutral condition (M = 50.29mph SD = 34.98 t(28) = .437, p = .666, $CI_{.95}$ -17.98, 27.73; d = 0.16, $CI_{.95}$ -10.70, 10.37) (*Table 1*). Results from an independent groups display of sample means with *CI*'s with ESCI (Exploratory Software for Confidence Intervals by Geoff Cumming 2011) at a 95% confidence level, the fast condition had a margin of error of 13.84mph and the neutral condition had a margin of error of 20.20mph with a mean of 17.02mph and the confidence intervals overlap is 1.626 (*Figure 2*).

An independent samples *t*-test was performed comparing the mean brake scores of participants in the fast food and neutral conditions. The fast food logo condition (M = .28, SD = .26) did not significantly brake faster than those in the neutral condition (M = .27, SD = .23), t(28) = -.120, p = .906, $CI_{.95}$ -.195, .174; d = 0.05, $CI_{.95}$ -0.043, 0.127 *(Table 2)*. To further examine the brake score an additional independent samples *t*-test was ran excluding participants who had an average brake score of zero (n = 27). The fast food logo condition (M = .30, SD = .25) did not significantly brake faster than those in the neutral condition (M = .32, SD = .22), t(28) = .170, p = .867, $CI_{.95}$ -.175, .207; d =

0.08, $CI_{.95}$ -.169, -.006. Results from an independent groups display of sample means with *CI*'s with ESCI at a 95% confidence level, the fast condition had a margin of error of 0.141 and the neutral condition had a margin of error of 0.140 with a mean of 0.140 and the confidence intervals overlap is 1.887 (*Figure 3*).

The post questionnaire revealed that the majority of the participants (n = 18) thought the experiment was looking at driving behavior (e.g. staying in their lane or if they drove off the road) and number of years of experience driving (e.g. if people with more experience drive better than people with less experience). Seven of the participants thought the purpose was to drive the same speed throughout. This question explored if the participants were aware of the prime. Five participants thought the experiment was about examining if rating logos influenced driving behavior.

Discussion

The results of this experiment failed to replicate the impatience effect caused by fast food primes (Zhong and De Voe, 2010). A failure to replicate does not imply there was a flaw to the design of the study. This particular experiment tried extend the results from one priming experiment and apply them to a completely different environment, the driving simulator.

There is controversy surrounding priming research. One reason is pervasive bias, meaning there is a strong bias to publish only positive results. For example, 97% of studies, in four major psychology journals, reported statically significant positive results (Young 2012). These practices raise the question of misconduct.

A failure to replicate may be because of the subtle differences in protocols between the original study and the replication attempt, which may cause discrepant findings. It may not be due to the fault of the researcher, it may be because the experimental design details were not given. If the effects are real, the methods need to be clarified for replication. The classic experiment by Bargh et al. (1996), has been one example of priming research that has come under scrutiny. Bargh said that he "never wanted there to be some secret knowledge about how to make these effects happen…we should specify more detail about how to do these things" (Young 2012).

The use of the driving simulator is intended to bring the environment into the laboratory and examine driving behavior related to a yellow light trigger at the dilemma zone. Some elements that add to the realism can reduce experimental control. This experiment removed ambient traffic from the simulation. This allows for isolation of the fast food logo variable. However, there may have been a few elements that may still have altered driving speeds. First, the primes were given prior to the drive task and could have worn off before the yellow light trigger, which was 4 minutes into the simulation. Second, the diner logos used from Zong et al. (2010) were Canadian diners and may not have been familiar to the U.S. participants. Implementing the food logos into the simulation design and having familiar fast food and diner logos will help to isolate the fast food logo variable.

Experiment 2

Method

Experimental design

The experiment was designed to further investigate the effects of fast food logos on driving speeds. The design was the same as the first experiment except for a few changes. Participants did not rate logos on their aesthetics. Instead, participants navigated through the same virtual rural road in a driving simulator which now included either 10 diner logos on billboards or 10 fast food logos on billboards. Each condition included 5 image logos, which were repeated twice for a stronger prime.

Participants

Thirty drivers with valid driver licenses, 23 males and 7 females, were recruited from the Psychology 101 online subject pool at the Arizona State University Polytechnic Campus. The average age of participants were 20 years (*SD* = 3.6) and ranged from 18 to 36 years of age. The average years of driving experience were 4.45 years (*SD* = 4.41) with a range from 1 to 24 years of age. The participants had a variety of majors (*Table 3*). All drivers had normal (20/20) or corrected to normal vision. Each session took approximately 30 minutes.

Materials

For familiarity, the logos for this experiment were chosen from restaurants in the local community. An online survey was conducted with 30 participants (13 male, 16 female, and 1 non-answer) to rate 10 diner logos and 10 fast food logos to obtain the top 5 most familiar logos for each condition *(Figure 4)*. The average age of participants were 21.28 years (*SD* = 6.98) and ranged from 18 to 47 years of age. A *t*-test from the online study results was run to ensure familiarity of the top 5 logos that were chosen for each condition (neutral logos *M* = 5.99, *SD* = .68 and fast food logos *M* = 5.82, *SD* = 1.51).

The 5 logos for each condition had approximately the same familiarity recognition ($t(27) = .414$, $p = .682$) (*Table 4*). There was high correlation between the 5 logo images for each condition (fast food $\alpha = .91$, neutral $\alpha = .66$).

Apparatus

The same driving simulator used in the first experiment was used to conduct this experiment.

Procedure

Participants read an informed consent and then were given the task instructions (*Appendix A*). Participants were randomly assigned to one of two conditions, the fast food or neutral prime condition. After, participants were asked to navigate through a virtual rural road in a driving simulator. The participants were told in the instructions that they would be driving in a rural city at their regular driving speed. They were instructed to drive at a speed with which they were comfortable and were asked to obey all traffic signals and laws.

As with the previous first experiment, it was predicted that maximum driving speed would be higher for drivers in the fast food logo condition than in the neutral condition.

After the completion of the driving scenario, participants completed the same post survey questionnaire as in the first experiment (*Appendix C*). Each session took approximately 30 minutes to complete.

Results

The dependent variable was the average speed from the beginning of the drive to the point the participant stopped or the simulation ended. Additionally, the number of participants who hit the brake and stopped at the yellow light was examined across each condition. In the fast food logo condition, 3 participants hit the break and stopped before the simulation ended and 12 ran the yellow light. In the neutral condition, 12 participants hit the break and stopped and 3 ran the yellow light. A chi-square test of independence was performed to examine the relationship between the fast food and diner logos. The relationship between these variables was significant, X^2 (2, N = 30) = 10.8, $p < .001$, d = 1.50. The participants in the fast food logo condition were more likely to run the yellow light and not stop than the participants in the neutral condition.

A baseline independent samples *t*-test was conducted from the start of the drive to the first billboard. The participants in the fast food condition did not drive faster (M = 27.53mph, SD = 4.83) than the neutral condition (M = 33.52mph, SD = 6.13), $t(28)$ = 2.03, p = .065.

An independent samples *t*-test indicated that participants in the fast food condition did not drive on average faster (M = 67.47mph, SD = 7.92) than the neutral condition (M = 66.23mph, SD = 10.51), $t(28)$ = -.250, p = .807; d = 0.14, $CI_{.95}$ -3.079, 3.355 (*table 6*). Results from an independent groups display of sample means with *CI*'s with ESCI at a 95% confidence level, the fast condition had a margin of error of 7.324mph and the neutral condition had a margin of error of 9.725mph with a mean of 8.524mph and the confidence intervals overlap is 1.718 (*Figure 5*).

An independent *t*-test indicated that participants in the fast food condition did not have higher maximum speed (*M* = 40.27, *SD* = 3.79) than those in the neutral condition (*M* = 34.11, *SD* = 8.42), *t*(28) = -1.635 *p* = .133, $CI_{.95}$ -14.558, 2.235 (*table 8*). Cohen's effect size value (*d* = 0.943, $CI_{.95}$ -1.281, 3.234) suggested a high practical significance. Results from an independent groups display of sample means with *CI*'s with ESCI at a 95% confidence level, the fast condition had a margin of error of 7.324mph and the neutral condition had a margin of error of 9.725mph with a mean of 8.524mph and the confidence intervals overlap is 1.718 (*Figure 6*).

A repeated measures test was performed to examine the speed at each of the 10 billboards across each condition. Speeds were analyzed with a 10 (billboard) X 2 (Condition) repeated-measures ANOVA with billboard as the repeated measure and condition as the between subjects factor. The fast food versus diner logo conditions were the independent variable.

Effects of speed (mph) at each billboard (means of Billboards 1 -10 = 69.16, 68.18, 73.94, 78.79, 74.53, 73.53, 79.04, 82.39, 77.65 and 83.38 respectively; F(9, 252) = 21.638, p=.000) and condition (*M* neutral logo = 74.91, *M* fast food logo = 77.21, *F*(1,28) = .194, p=.668) was not statistically significant *(Figure 7).* The billboard by condition interaction was not significant, p= .507.

A repeated measures test was performed to examine the average between each of the 10 billboards across each condition. Mean speeds were analyzed with a 9 (billboard) X 2 (Condition) repeated-measures ANOVA with billboard as the repeated measure and

condition as the between subjects factor. The fast food versus diner logo conditions were the independent variable.

Effects of speed between each billboard (between Billboard means 1 -10 = 68.67,71.06, 76.37, 76.66, 74.03, 76.29, 80.71, 80.02, 80.52 respectively; F(9, 252) = 110.551, p=.000) and condition (*M* neutral logo = 74.854, *M* fast food logo = 77.218, *F*(1,28) = 6.114, p=.659 were not statistically significant *(Figure 8).* The billboard by condition interaction was not significant, p= .532.

An independent samples *t*-test was performed comparing the mean brake scores of participants in the fast food and neutral conditions. The fast food logo condition (*M* = .146 *SD* = .056) significantly hit the brakes faster than those in the neutral condition (*M* = .352, *SD* = .280), *t*(28) = -2.235, *p* = .034; *d* = 0.84 (*table 7*). Results from an independent groups display of sample means with *CI*'s with ESCI at a 95% confidence level, the fast condition had a margin of error of .120 and the neutral condition had a margin of error of .161 with a mean of .141 and the confidence intervals overlap is 0.531 (*Figure 7*). To further examine the brake score an additional independent samples *t*-test was ran excluding participants who had an average brake score of zero (*n* = 21). The fast food logo condition (*M* = .411, *SD* = .258) did not significantly brake faster than those in the neutral condition (*M* = .259, *SD* = .248), *t*(28) = 1.352, *p* = .192, $CI_{.95}$ -.083, .386. Cohen's effect size value (*d* = 0.631, $CI_{.95}$ .528, .734) suggested a moderate to high practical significance.

To further explore speed and condition, each of the 5 logos on the billboards by condition were examined. The two logos that were the same were examined by looking at

the speed difference between the billboards. An independent *t*-test indicated that participants in the fast food condition did not differ in speed with the first logo image (*M* = 4.49, *SD* = 5.72) than those in the neutral condition (*M* = 4.26, *SD* = 2.65), *t*(28) = -.100, *p* = .922. An independent *t*-test indicated that participants in the fast food condition did not differ in speed with the second logo image (*M* = 11.90, *SD* = 3.81) than those in the neutral condition (*M* = 9.83, *SD* = 1.49), *t*(28) = -1.331, *p* = .208. An independent *t*-test indicated that participants in the fast food condition did not differ in speed with the third logo image (*M* = 10.56, *SD* = 5.51) than those in the neutral condition (*M* = 6.33, *SD* = 5.11), *t*(28) = -1.487, *p* = .163. An independent *t*-test indicated that participants in the fast food condition did not differ in speed with the fourth logo image (*M* = 2.18, *SD* = 6.56) than those in the neutral condition (*M* = -4.45, *SD* = 11.03), *t*(28) = -1.367, *p* = .197. An independent *t*-test indicated that participants in the fast food condition did not differ in speed with the fifth logo image (*M* = 8.99, *SD* = 7.70) than those in the neutral condition (*M* = 8.70, *SD* = 2.52), *t*(28) = -.095, *p* = .926.

Through the post survey, an opened question revealed one participant may have been aware of the logo prime and had answered the question by stating that they thought the experiment was about "how billboards change our accuracy in driving, depending on how eye catching they are". Further, a forced-choice recognition question yielded that three participants thought the experiment was about examining if rating logos influenced driving behavior. The majority of the participants, forty-percent (*n* = 12), thought the experiment was looking at number years driving experience and driving patterns. Thirty-three percent (*n* = 10) thought the study was looking to if they maintained the same

speed throughout and seventeen percent (n = 5) thought it was looking at driving behaviors.

Discussion

This experiment aimed to isolate the fast food logo variable as much as possible and strengthen the prime by implementing familiar restaurant logos. Placing the image of the logos into the driving simulation was intended to strengthen and maintain the prime throughout the drive. Ambient traffic and speed limit signs were removed from the simulation and the speedometer was omitted.

Driving simulators are a useful way to obtain knowledge about driving behaviors. However, there are limitations to this experiment. First, the logos were chosen from the local community and the participants may have come from another state or country. Second, participants may not be a representative of all drivers. For example, the average age of participants was 20 years old and they had an average of 4 years driving experience. An older participant population may reveal different driving behaviors linked to years of driving experience and may have yielded a different result.

General Discussion

The concept of fast food may have underlying associations that could be mapped on to behaviors without the average person being aware. On any given day in the U.S., about one-quarter of adults visits a fast food restaurant (Schlosser 2001). In 2000, Americans spent more than $110 billion on fast food (Schlosser 2001). The current research helps to examine association effects of priming on behavior.

Using fast food logos and diner logos, the participants were primed similarly to Zhong and De Voe (2010). Results failed to replicate, in both experiments, a significantly higher mean speed score in the fast food logo condition. In experiment one, participants significantly hit the break faster and ran the yellow light more often when primed by the fast food logos than diner logos.

Taking ambient traffic out of the simulations allowed priming to have a greater effect, but it was not consistent with real world driving scenarios. Additionally, the use of a higher fidelity driving simulation or performing field testing in real driving situations would advance understanding of priming in real world applications. Real driving situations may require the combined influence of cognitive factors and environment cues that were not examined or measured in the current research.

The controversy on the goal priming research has come under scrutiny. Bargh et al. (2001) paper has been cited over 1100 times and seemed warranted to replicate (Harris et al. 2013). Many labs tried to replicate Bargh and his colleague's results and failed. Bargh came under scrutiny for not openly providing his materials and exact procedure. Bargh said that is was the fault of the researchers and they were not conducting the experiment correctly. If the effects are real, the methods need to be clarified so other researchers and labs can replicate the results. If the effects are not real, the field needs to better understand how errors could enter the literature and how to prevent this from happening in the future (Harris et al. 2013).

The current research shows there are subtle priming effects and if replicated with a larger sample may show positive results. The use of the driving simulator has less

variance and is sensitive in the collection of data. One example of the driving simulator being sensitive, is being able to program to collect data every 60 Hz along the course of the drive. This allows examination along any point of the course and can be helpful in examining if the prime took place and if so when.

Future research should recruit diverse ages of adults. Furthermore, fast food and diner logos could be examined to include cross-cultural primes to counterbalance for foreign participants. For example, it would be useful to include logos on billboards that are familiar to Americans and other cultures in the same driving simulation. The present research provides a platform for future research to continue to examine driving behavior and cultural associations with food concepts.

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APPENDIX A

PARTICIPANT MATERIALS

Experiment 1 and Experiment 2
Participant Consent:

Driving Performance

Dear Participants

I am a graduate student under the direction of Dr. Hyunjin Song in the College of Technology and Innovation at Arizona State University. I am conducting a research study to test the effects of driver performance.

I am inviting your participation, which will involve using a driving simulator to navigate through a city environment. You will first rate logos on the dimension of esthetics and then drive in a rural city environment. You have the right not to answer any question, and to stop at any time. The study should require about 30 minutes to complete. After, completion of the study you will be given a brief survey to fill out.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty, (for example, it will not affect your grade). You must be 18 or older to participate in the study.

There are no foreseeable risks or discomforts to your participation.

Your responses will be confidential. The results of this study may be used in reports, presentations, or publications but your name will not be known. If applicable, results will only be shared in the aggregate form.

If you have any questions concerning the research study, please contact Mistey Taggart at mwoodru1@asu.edu. If there are any complaints or concerns please contact Dr. Song at Hyunjin.Song@asu.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

Experiment 1
Participant Instructions:

This study is composed of two different tasks. First, you will evaluate some logos. Second, you will drive a virtual road in a driving simulator for about 5 minutes. In this study you will be asked to rate logos on their aesthetics. Here is your first task of logo questionnaire. You can ask questions at any time during the study (including while you are driving).

<participants fill out the questionnaire>

Your second task is to drive in the simulator. Please drive as you normally drive and keep driving until the simulation ends.

After completing the drive you will be asked to complete a short survey given by the experimenter.

Please do not disclose the details of this study to others. This will help ensure consistent and accurate results.

Thank you for your participation!

Experiment 2
Participant Instructions:

This study is composed of one task. You will drive a virtual road in a driving simulator for about 5 minutes. You can ask questions at any time during the study (including while you are driving).

For this task you are to drive in the simulator. Please drive as you normally drive and keep driving until the simulation ends.

After completing the drive you will be asked to complete a short survey given by the experimenter.

Please do not disclose the details of this study to others. This will help ensure consistent and accurate results.

Thank you for your participation!

APPENDIX B

SURVEY AND PRIMING LOGOS

Experiment 1 Predriving Survey

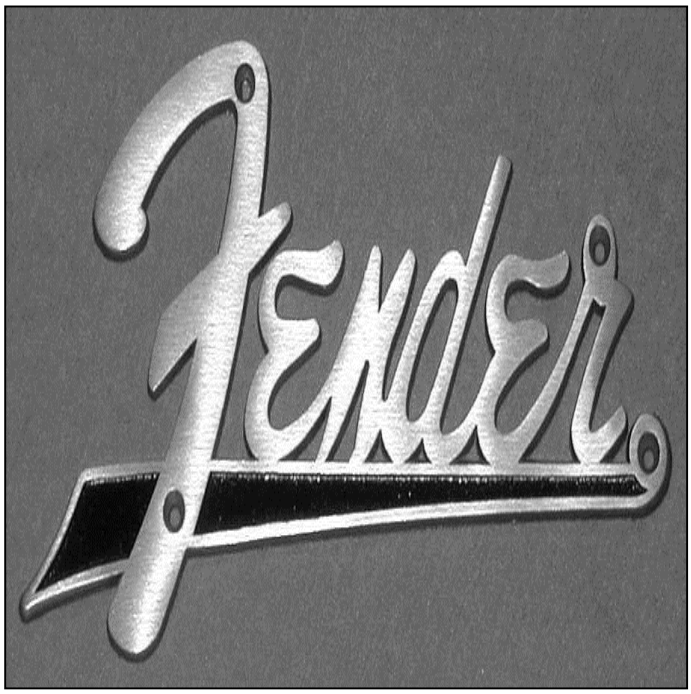
Fast Food Condition

The marketing department is interested in consumer's reactions to commerce logos. Please rate the following logo on the dimension of esthetics.

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing



1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

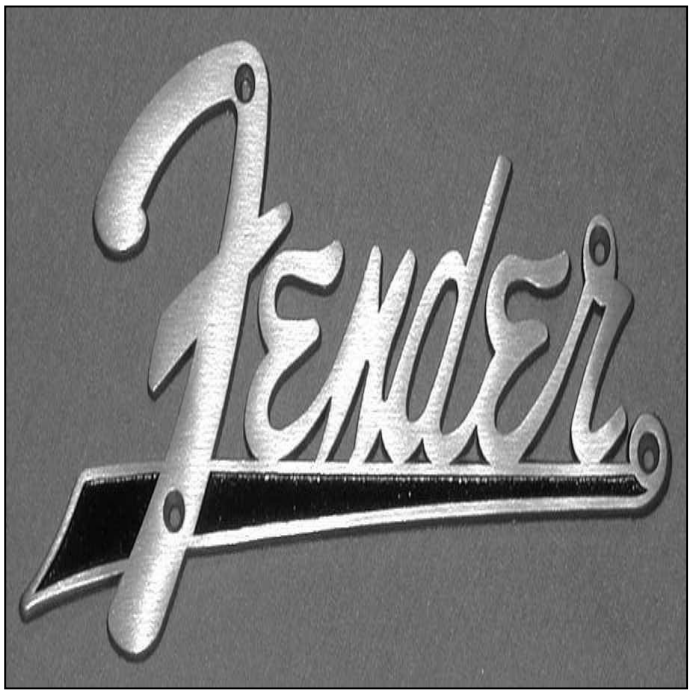
Neutral Condition

The marketing department is interested in consumer's reactions to commerce logos. Please rate the following logo on the dimension of esthetics.

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing



1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

1	2	3	4	5	6	7	8	9
Not at all Esthetically Pleasing								Very Esthetically Pleasing

APPENDIX C

PARTICIPANT POST SURVEY

Experiment 1 Post Survey

1.) How do you feel right now right at this very moment?

-4 -3 -2 -1 0 1 2 3 4
Very negative Very positive

2.) How fast do you think you drove on average?
( ) miles/hr

3.) How old are you?
( )

4.) Gender (M/F)

5.) How many years of driving experience do you have?
( ) years

6.) What is your major?
( )

What do you think the purpose of the study is? (please write a sentence or few to explain)

(Flip Survey Over to Answer Last Question)

Which one do you think is the possible purpose of the study? Please check one

_____ Examining if you maintained the same speed throughout the drive.
_____ Looking at year's experience of driving and driving patterns; if people with more experience drive better than people with less experience.
_____ Examining if rating logos influence driving behavior.
_____ Looking at driving behavior; for example if you stayed in your lane or if you drove off the road.

Thanks again for participating in my study and please keep the details of the study to yourself.

Experiment 2 Post Survey

1.) How do you feel right now right at this very moment?

-4 -3 -2 -1 0 1 2 3 4
Very negative Very positive

2.) How fast do you think you drove on average?
( ) miles/hr

3.) How old are you?
( )

4.) Gender (M/F)

5.) How many years of driving experience do you have?
( ) years

6.) What is your major?
( )

What do you think the purpose of the study is? (please write a sentence or few to explain)

(Flip Survey Over to Answer Last Question)

Which one do you think is the possible purpose of the study? Please check one

_____ Examining if you maintained the same speed throughout the drive.
_____ Looking at year's experience of driving and driving patterns; if people with more experience drive better than people with less experience.
_____ Examining if logos influence driving behavior.
_____ Looking at driving behavior; for example if you stayed in your lane or if you drove off the road.

Thanks again for participating in my study and please keep the details of the study to yourself.

APPENDIX D

FIGURES

Figure 1. Driving simulator.

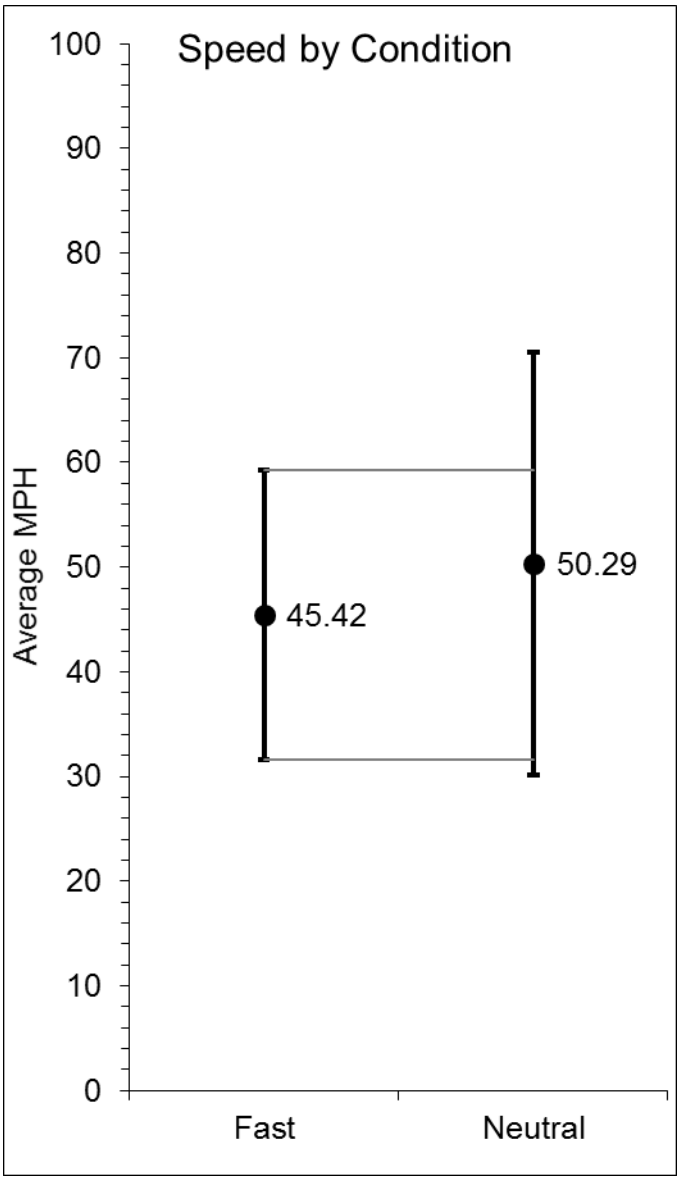


Figure 2. Experiment 1 mean error bar graph depicts 95% confidence intervals. The horizontal lines help estimation of proportion overlap; *CI*'s overlap is 1.626.

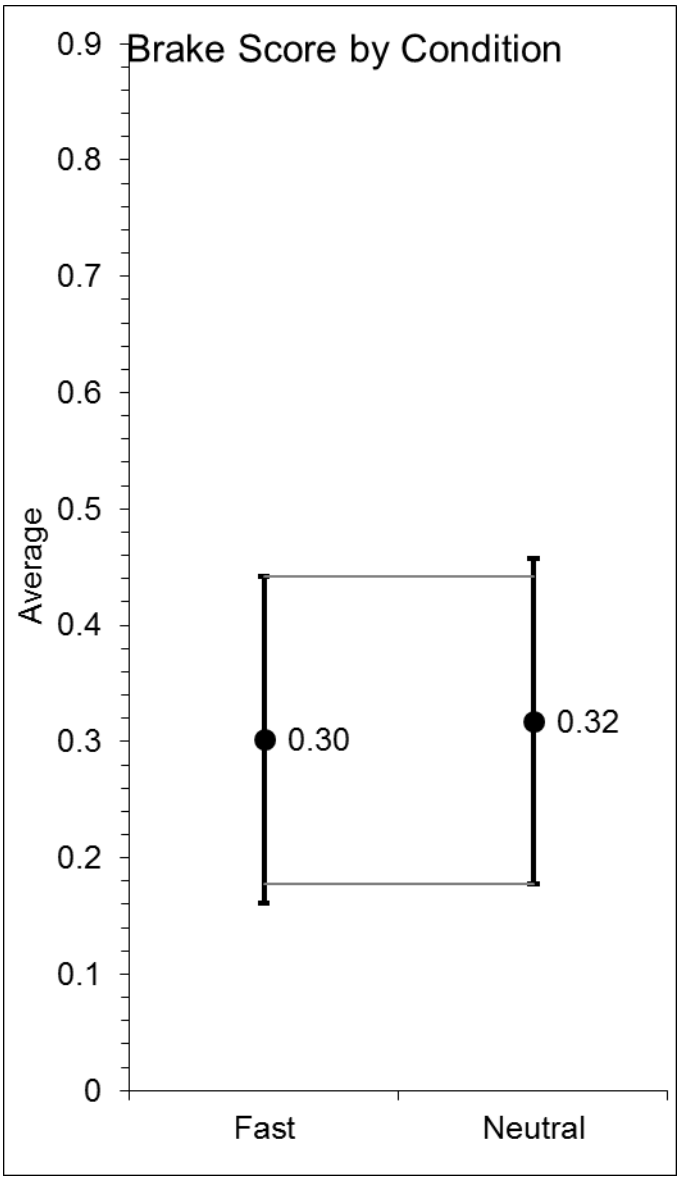


Figure 3. Experiment 1 mean error bar graph depicts 95% confidence intervals. The horizontal lines help estimation of proportion overlap; *CI*'s overlap is 1.887.

Experiment 2 Billboard Logos	
Neutral Diner Logos	Fast Food Logos
	
	
	
	
	

Figure 4. Experiment 2 diner and fast food logos used on billboards in simulation.

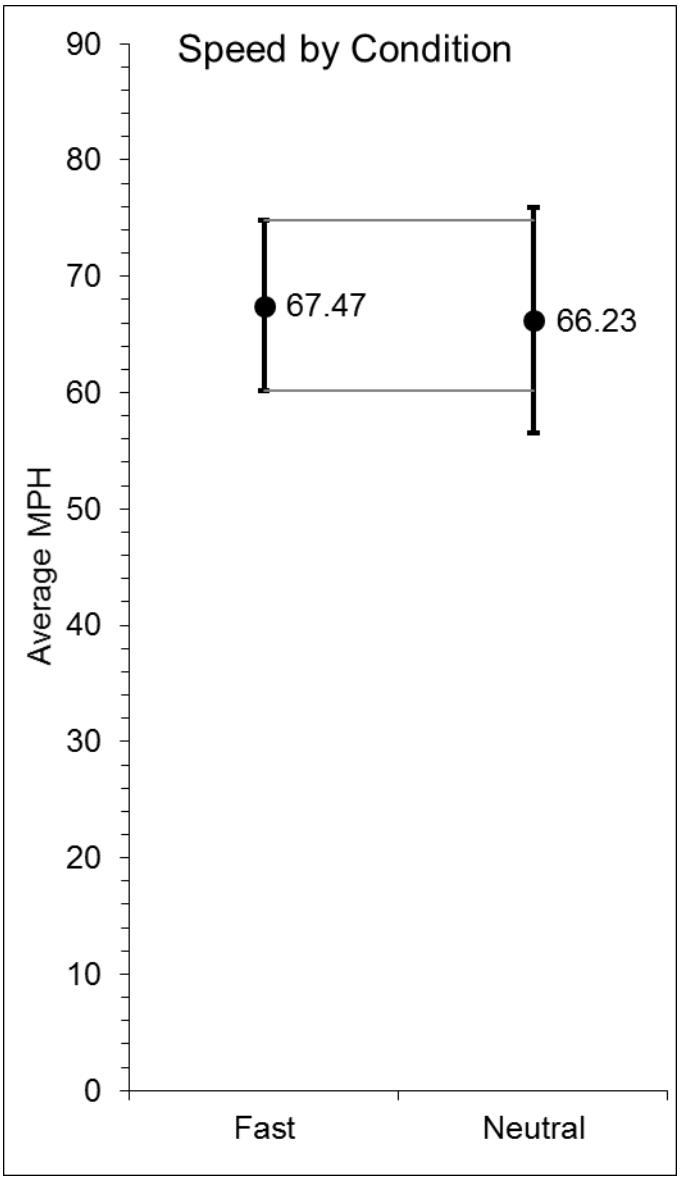


Figure 5. Experiment 2 mean error bar graph depicts 95% confidence intervals. The horizontal lines help estimation of proportion overlap; *CI*'s overlap is 1.718.

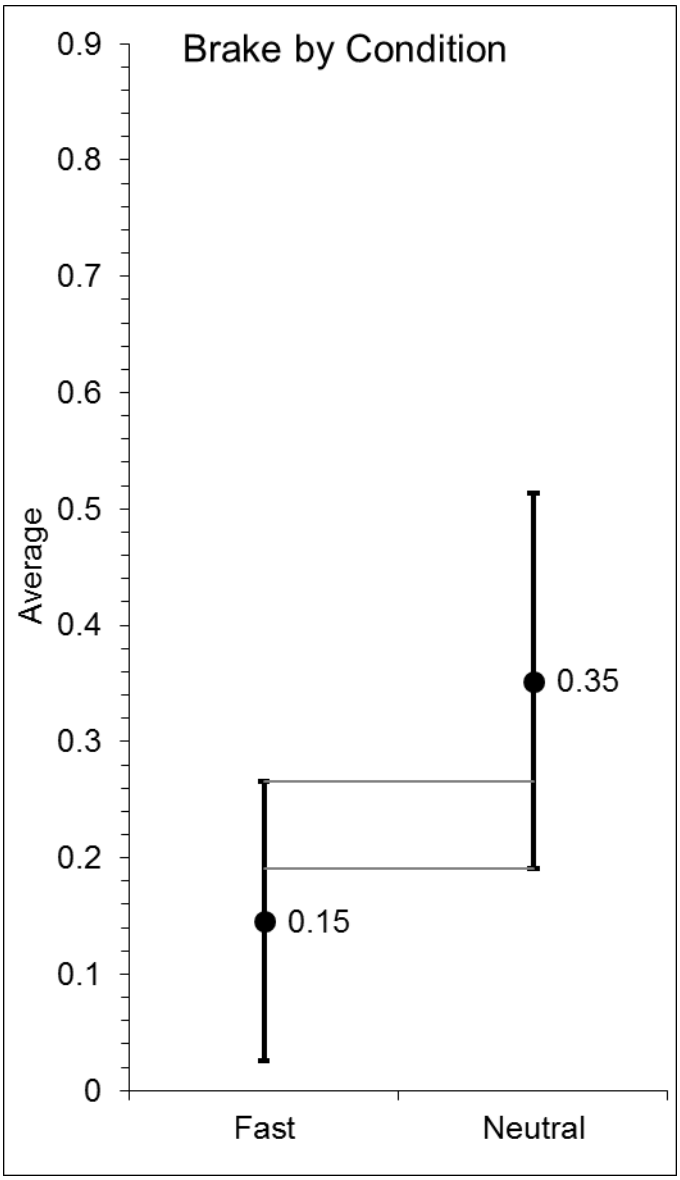
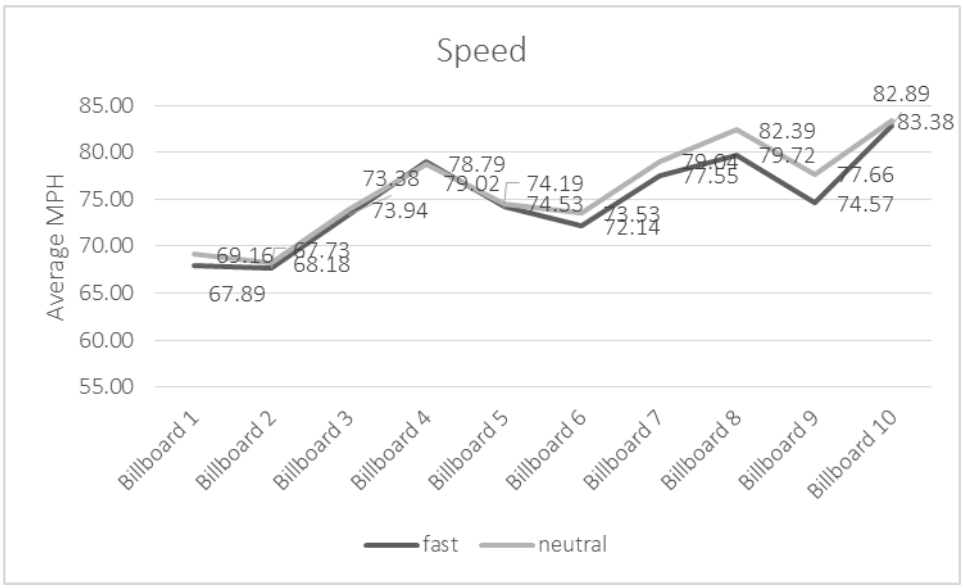
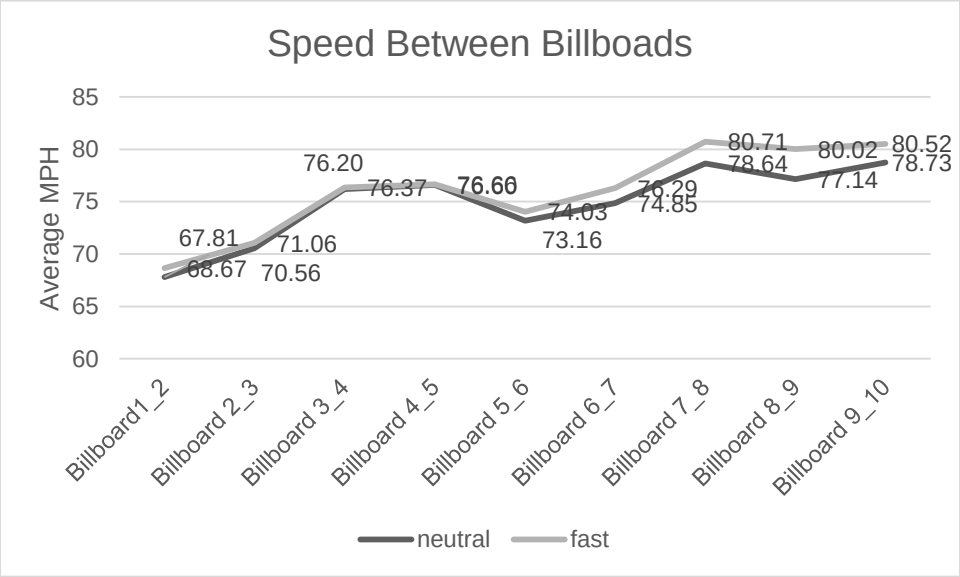


Figure 6. Experiment 2 mean error bar graph depicts 95% confidence intervals. The horizontal lines help estimation of proportion overlap; *CI*'s overlap is 1.718.



Condiiton	Billboard 1	Billboard 2	Billboard 3	Billboard 4	Billboard 5	Billboard 6	Billboard 7	Billboard 8	Billboard 9	Billboard 10
fast	67.89	67.73	73.38	79.02	74.19	72.14	77.55	79.72	74.57	82.89
neutral	69.16	68.18	73.94	78.79	74.53	73.53	79.04	82.39	77.66	83.38

Figure 7. Experiment 2 Line Chart illustrates the speed by condition at each of the ten billboards.



Condition	Billboard1	Billboard 2	Billboard 3	Billboard 4	Billboard 5	Billboard 6	Billboard 7	Billboard 8	Billboard 9
neutral	67.8072	70.556	76.20128	76.60176	73.16448	74.84912	78.63616	77.14112	78.72608
fast	68.66648	71.05976	76.36648	76.66224	74.03152	76.28584	80.71416	80.02056	80.51736

Figure 8. Experiment 2 Line Chart illustrates average speed between billboards by condition.

APPENDIX E

TABLES

Table 1. Experiment 1 participant average speed.

Speed MPH	Fast Food Logo		Diner Logo	
	M	SD	M	SD
	45.34	11.59	50.22	15.61

Table 2. Experiment 1 participant average break scores.

Break Score	Fast Food Logo		Diner Logo	
	M	SD	M	SD
	0.28	0.26	0.27	0.23

Table 3. Experiment 2 participant college majors.

Major
Supply Chain Management
GIT
Engineering Robotics
Civil Engineering
BA
Finance
Information Tech
MET
ATC
AMT
ABS
Food Industry Management
Air Traffic Management
Professional Flight
Business and Sports Medicine
Nursing
TIEM
Applied Biology
Sports and Media Business
Aviation Management & Professional First
Business Entrepreneurship
BA Communication
Pre-Vet
Marketing
Business/Sports Media
Applied Biology

Table 4. Experiment 2 logo familiarity ratings.

Logos	Fast Food		Diner	
	M	SD	M	SD
	5.99	0.68	5.82	1.51

Table 5. Experiment 2 participant responses to open-ended post survey question.

Purpose of Study
To study people's reaction time and decisions based on driving
To possible study how people's personality affect their driving
To see how the driving environment effects driving speed
How years of driving experience has an effect on driving safety
To determine driving habits and average speed
To see what are the things that attracted me on the road
Attention and speed limit
For safety purposes
To observe drivers while having distractions such as billboards
To see different reactions from different people
To see how people drive in different situations
How fast people drive, what could distract drivers
How drivers might get distracted or how driving tendencies are similar
To observe if people have good driving skills
Inventing a new car
To see how well people drive on a virtual course so that one day licenses may be obtained through virtual simulation vs. real world drivers ed.
To see how well people drive and know the rules of the road
To test how fast I would drive in a driving situation
To observe driving habits including speed and hand-eye coordination
Observe driving behavior/transition from highway to city speed; whether people stopped or went through the yellow light
To see if there is a correlation btw age and driving speed
To see how people drive, for instance, how reckless or safe a person is
How the driver responds to changes, drivers become more focused on what is around them
To see how different people drive
To see how most people drive in their daily lives
could help to view if person is qualified to drive in the real world
To see how fast people drive with different road types, straight roads, curves, hills; to see if people will try and rush a yellow light
How billboards change our accuracy in driving, depending on how eye catching they are
To see how people drive
To see if people are aware of how fast they are going when alone on the road

Table 6. Experiment 2 participant average speed.

Speed MPH	Fast Food Logo		Diner Logo	
	M	SD	M	SD
	67.47	7.92	66.23	10.51

Table 7. Experiment 2 participant break scores.

Break Score	Fast Food Logo		Diner Logo	
	M	SD	M	SD
	0.146	0.056	0.352	0.280

Table 8. Experiment 2 participant maximum speed.

Speed MPH	Fast Food Logo		Diner Logo	
	M	SD	M	SD
	40.27	3.79	34.11	8.42