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Exploratory Look Into the Impact of Race on Response Dynamics While Categorizing Stereotypical Black Names and Stereotypical White Names Via Mouse Movements

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EXPLORATORY LOOK INTO THE IMPACT OF RACE ON RESPONSE DYNAMICS WHILE CATEGORIZING STEREOTYPICAL BLACK NAMES AND STEREOTYPICAL WHITE NAMES VIA MOUSE MOVEMENTS

by

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Abstract

Racial bias (especially in the context of Black people) in society is as prevalent as ever. Because of this, scientists have developed various ways to measure racial bias against Black people. I propose that mouse tracking is a tool that can be used to predict racially biased behavior accurately. The overall purpose of this exploratory study was to use mouse tracking to investigate whether race impacts participants' mouse movements when categorizing stereotypically sounding Black and White names. As well as to see if participants consistently categorize “Black” and “White” names. This experiment showed a significant difference in the number of x flips for Black and White people categorizing stereotypically sounding Black and White names, with that difference being in the direction for Black people for both name types. However, there were confounds with some stimuli (Angel) and stereotype threat. There were no significant differences in maximum horizontal deviations, total area, and maximum speed. Thus, this experiment does not support the utility of mouse tracking in the context of racial attitudes evaluation.

Keywords: mouse tracking, response dynamics, mouse movements, black, white, race, categorization

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Chapter 1

Introduction

Mistreatment of Black people in the U.S. is as pressing an issue as ever and has led to people wondering about some of the underlying biases that lead to the materialization of heinous acts of violence, such as the tragic killing of George Floyd, Ahmuad Arbery, and Breonna Taylor. To mitigate such tragic events and the general mistreatment of Black people, accurately assessing racial differences and the implicit bias (unconscious associations people have towards a group of people) in a way that allows researchers to accurately predict behavior is of the utmost importance. There have been various attempts to complete this goal that use reaction times and mouse tracking.

Decision Conflict

For example, in a study by Correll et al., (2002), via a video game where they measured error and reaction times, the researchers found that people were more likely to shoot at an armed black man than at an armed white man. The most ubiquitous errors were made with participants shooting an unarmed black people and not shooting an armed white people. Unexpectedly, results showed participants shooting at unarmed white men more than unarmed black men. Although this finding is interesting, there is more to assess than the outcome and response time that the researchers measured. What needs to be known is what is going on between the moments where someone is deciding whether to shoot a Black person or not. This dilemma that I am speaking of is *decision conflict*. This conflict appears when someone must choose between two possible choices, which in this case is shoot or not shoot, and is at the heart of many prejudice studies (e.g., Stillman et al., 2018). This decision conflict phenomenon and the *resolution* of this conflict can accurately be captured via mouse tracking and has been shown to be able to predict behavior (e.g., Hehman et al., 2015; Stillman & Ferguson, 2019; Stillman et al., 2017). Overtly violent actions such as this and other acts of racism are sometimes not found to be correlated with self-report measures based on race (e.g., Verhaeghen et al., 2011; Wittenbrink, et al., 1997), which highlights a lack of a connection between the underlying cognitive processes and overt actions. This further supports the need to implement mouse tracking to indirectly study decision conflict and learn more about the underlying process of implicit bias. Implicit bias has been heavily studied under the context of the Implicit Association Test (IAT).

Implicit Association Test

It is important to talk about the IAT since this paradigm is one of the most popular ways to study racial attitudes indirectly and employs the theory of decision conflict. Also, that in the seminal Wittenbrink et al., (1997) IAT study, one of the stated goals for the IAT was to get at the disconnect between people's positive explicit responses and physical actions indirectly, which aligns with the goal of this study. The IAT is a measuring instrument that quantifies an individual's implicit bias by measuring the amount of time an individual takes to categorize attributes (Unpleasant-Pleasant) into categories (Black-White) and vice versa. This process allows researchers to measure a person's associations tacitly while they categorize stimuli to the correct attributes and categories. Also, IATs have a score that is computed after someone takes the said test, and these scores have been used to explain a lot of various relationships, such as non-harmonious intergroup relations (Rudman & Ashmore, 2007), and holds up when controlling for familiarity with White pictures (Dasgupta et al., 2000). These tests have also been shown to manifest people's bias against Black people under multiple contexts (e.g., Greenwald et al.,1998; Judd & Wittenbrink 2001; Mitchell et al., 2003; Amodio & Devine, 2006). However, the IAT has been replicated hundreds of times under various contexts, and the internal validity of the IAT is questionable since the measuring instrument has low correlations with explicit questionnaires (Hofmann et al., 2005), and the effects are not long term (Blanton et al., 2013, p. 178). As well as the test-retest reliability being insufficient (Nosek et al., 2007, p. 274), and the IAT not predicting behavior (Forscher et al., 2019). Also, in the Forscher et al., (2019), meta-analysis, the authors' concluding statement was that the IAT and implicit measures as a whole can not be used for a single interpretation of IAT scores translating to people's behavior since it does not consistently predict behavior. While there are various reasons that cognitive processes and actions may be independent dimensions, mouse tracking can potentially give us more insight into participants' decision-making than just response times (Maldonado et al., 2019). This has led to scientists trying to find various ways to best study the bias against Black people and the answer resides in mouse tracking. A study that explored racial bias while using mouse tracking is Wojnowicz et al., (2019), and this experiment used a self-organization theoretical framework that underlies this study.

Racial Bias and Mouse Tracking

In Wojnowicz et al., (2009), they posited that explicit attitudes are the byproduct of a multitude of nuanced implicit attitudes that compete with one another that occur in milliseconds. Also, initial implicit mental representations give us small inaccurate snapshots of different information that is constantly changing with the acquisition of new information. As a result, in what the authors deemed a "self-organization framework," a potential attitude that appears earlier in the cognition process can be replaced by another later on in this process and become explicit—subsequently, this initiates subsystems such as language and memory. An example of this “self-organization framework”, would be someone who has stereotypical implicit attitudes of their manager being heartless or inconsiderate before meeting them. As the employee interacts with their manager daily, they start to learn more information about said manager, such as being friendly and thoughtful. These characteristics now override their previous implicit attitudes of their manager and are now explicitly positive. This example illustrates why it is essential to measure participants' ongoing thought process with mouse tracking since there is a lot of exciting information about the overall thought process of someone when they are developing attitudes about someone.

To test this theoretical framework, the researchers had participants classify stimuli that appeared in the middle of a computer screen into the categories of like or dislike with their mouse. Throughout experiment one, participants categorized distractor words, but the two stimuli of interest were "Black people" and "White people." The researchers only analyzed trials in which participants selected the category like for both. In analyzing the data, the researchers measured hand output via mouse tracking. The reason being is that since mental processing is ongoing, one's hand movements relay this process probabilistically, which gives insight into what is going on in a person's mind throughout a trial (Erlhagen & Schoner, 2002; Henis & Flash, 1995). This experiment found that participants' mouse movements showed a significant difference in the trajectory towards the dislike response for Black people and not White people when they reported explicit positive attitudes for Black and White people. Also, the maximum perpendicular deviation (maximum distance between actual trajectory and ideal trajectory) and the mean distance traveled to the like response were greater for the "Black people" response trajectories than for the "White people" trajectories. Additionally, "Black people" and "White people" did not significantly differ in their total reaction time. This study highlights the importance of analyzing mouse trajectories since Wojnowicz et al., (2009), were able to unearth an exciting finding in the incongruence of participants' mouse trajectories and their explicit like choice selection for both Black and White people. These results were recently corroborated by Melnikoff et al., (2020). Also, in the aforementioned paper, they found that participants MDb (maximum deviations conversion into an estimate of racial bias) were less likely to help out a graduate student with a stereotypically Black sounding name (DeAndre) than stereotypically White person name (Dustin). This further validates the use of mouse tracking with Black and White racial attitudes. Another study that examines response dynamics via mouse tracking is Mathur's and Reichling's (2019) study and is the paradigm that this research paper will use.

In Mathur's and Reichling's (2019), the researchers implemented an online template for fellow scientists to measure mouse tracking in a category competition experiment. To empirically validate this, they ran a study in which participants categorized pictures of robots and humans. Some of these pictures were obviously humans or robots and some were ambiguous in what they were. Participants went through six practice trials to get acclimated to the experiment and then completed ten trials that were analyzed. During the ten trials, participants' reaction times, mouse movements in terms of x flips (number of times the mouse cursor reverses direction), maximum horizontal deviations (maximum distance between actual trajectory and ideal trajectory), maximum speed, and the area between the actual and ideal trajectory were analyzed. The results of this study showed that participants' mouse movements made significantly more x flips and took less direct paths for ambiguous trials than non-ambiguous trials. This is important since these measures show the degree of uncertainty and conflict that goes into people's decision-making than just relying on response times (Maldonado et al., 2019; Stillman et al., 2018). I will use this paradigm to see whether there are any significant differences in mouse trajectories in categorizing Black and White sounding names which delves into decision conflict theory.

Current Study

For the current study, I will be taking an exploratory look into racial differences and decision-making. Also, I am gauging what is a stereotypically Black and stereotypically White name by collecting participants' categorization data since there is no Thorndike-Lorge word frequency list (1944) for stereotypically Black and stereotypically White names. As I am compiling this data, I will also be looking into the relationship that race (Black and White) has on mouse movements and race of name (Black and White). I am only using Black and White participants due to me being able to obtain a representative sample with those demographics more so than others using the University of Memphis SONA research participant system. With this experiment, I hypothesize that there will be a difference in how participants categorize Black and White sounding names based on race. Also, I predict that White participants will display greater indecision toward categorizing Black sounding names than Black participants and that there will be no significant differences for White sounding names. I predict this since White participants tend to show indecision in their overall mouse trajectories when categorizing Black stimuli, e.g. (Melnikoff et al., 2020; Wojnowicz et al., 2009). This mouse trajectory indecision will be shown via comparing x flips, maximum horizontal deviation, maximum speed, and reaction time (secondary measure) between Black names and White names for Black and White participants.

Chapter 2

Methods

Participants

There were 83 participants for this experiment. However, 21 participants were dropped in total. Since the objective of this study was to analyze mouse tracking differences between White and Black people, two participants were dropped due to not being Black or White (Middle Eastern and Hispanic). As well as 18 participants were dropped due to not finishing the experiment, and one participant was dropped due to taking nine hours to complete the experiment. So, in total, there were 63 participants, with 29 being Black and 34 being White. Participants received course credit and were recruited from undergraduate Psychology courses.

Materials

I used Mathur's and Reichling's (2019) mouse tracking category response paradigm and mouse tracking analysis software for this experiment. In this model, there were six practice trials that were not used in the analysis. The utility of these trials is for participants to get used to moving the mouse or touchpad quickly so that the mouse tracking model can measure participants' mouse movements with less noise. Subsequently, ten trials were used in the experiment, which had five Black sounding names (two male and three female) and five White sounding names (three male and two female).

Procedure

Once participants read and agreed to the informed consent form, they went over a brief description of the experiment. In the description of the experiment, individuals read instructions telling them to classify stereotypically Black and White sounding names into Black or White categories and to do so as quickly as possible. After that, the participants were informed that they would be going through six practice trials and then they would be getting into the main portion of the experiment.

The categories (Black-White) occupied the upper left and right regions of the mouse-tracking screen always. Stimuli (Angel) appeared in the middle of the screen. As participants went through the experiment, they categorized the stimuli by moving their mouse to the appropriate selection. If participants took more than 700 ms from when a trial started to move their mouse, the message "started too late" appeared to notify them to move faster next time. Also, the message "took too long" would appear if participants took longer than 5000 ms to complete a trial. (Freeman et al., 2016).

Once participants were finished with the experiment, they were debriefed about the content of the study. Afterward, they were asked whether they experienced any problems while taking the experiment and their gender, race, age, and education attainment. The study took around ten minutes to complete.

Chapter 3

Analysis

For the analyses, I will go into the repeated measures ANOVA results for the independent variables of participants' race (Black or White) and race of name (Black or White) for the dependent variables of x flips, maximum horizontal deviation, total area, maximum speed, and average reaction times for participants' mouse movements that I gathered via Mathur and Reichling's (2019) software package. As well as participant name categorization percentages.

Chapter 4

Results

There was a significant main effect for participant race with x flips F (1, 62) = 4.97, p = .029, η^2 = .074, 1-b =.592 and race of name F (1, 62) = 4.85, p = .031, η^2 = .073, 1-b =.582 with Black participants having more x flips for both White name trials (M= 2.35, SD=1.87) and Black name trials (M= 2.57, SD= 2.46) than White participants for both name groups (M= 1.47, SD= .67; M= 1.79, SD= .84). However, there was not a significant interaction for participant race and race of name F (1, 62) = .17, p = .684, η^2 = .003, 1-b =.069. Also, there was no significant main effect for participant race with maximum horizontal deviation F (1, 62) = .35, p = .559, η^2 = .006, 1-b =.089, race of name F (1, 62) = 2.03, p = .159, η^2 = .032, 1-b =.290, and no significant interaction between participant race and race of name F (1, 62) = 2.56, p = .115, η^2 = .040, 1-b =.350. Additionally, there was no significant main effect for participant race with area F (1, 62) = 1.19, p = .280, η^2 = .019, 1-b =.189, race of name F (1, 62) = 1.22, p = .274, η^2 = .019, 1-b =.192, and no significant interaction between participant race and race of name F (1, 62) = 1.23, p = .272, η^2 = .019, 1-b =.194. There was no significant main effect of participant race with maximum speed F (1, 62) = .35, p = .557, η^2 = .006, 1-b =.090, race of name F (1, 62) = .01, p = .917, η2 = .001, 1-b =.051, and no significant interaction between participant race and race of name F (1, 62) = .80, p = .375, η^2 = .013, 1-b =.142. Finally, there was a significant main effect for participant race with response time F (1, 62) = 11.63, p = .001, η^2 = .158, 1-b =.919, and race of name F (1, 62) = 5.09, p = .028, η^2 = .076, 1-b =.603 with Black participants having longer response times for both White name trials (M= 1,343.21 ms, SD=575.65 ms) and Black name trials (M= 1,662.95 ms, SD= 1,049.18 ms) than White participants for both name groups (M= 1,022.07 ms, SD= 281.74 ms; M= 1,382.27 ms, SD= 587.48 ms). However, there was not a significant interaction for participant race and race of names F (1, 62) = .04, p = .840, η^2 = .001, 1-b =.055. Refer to Table 1 to see all of the significant and non significant findings and Table 2 for the means and standard deviations for x flips, max deviations, area, maximum speed, and reaction times for Black names and White names. Additionally, all mouse tracking trajectories for Black participants (Figure 1) and White Participants (Figure 2) and the Black and White name categorization percentages can be seen in Table 3.

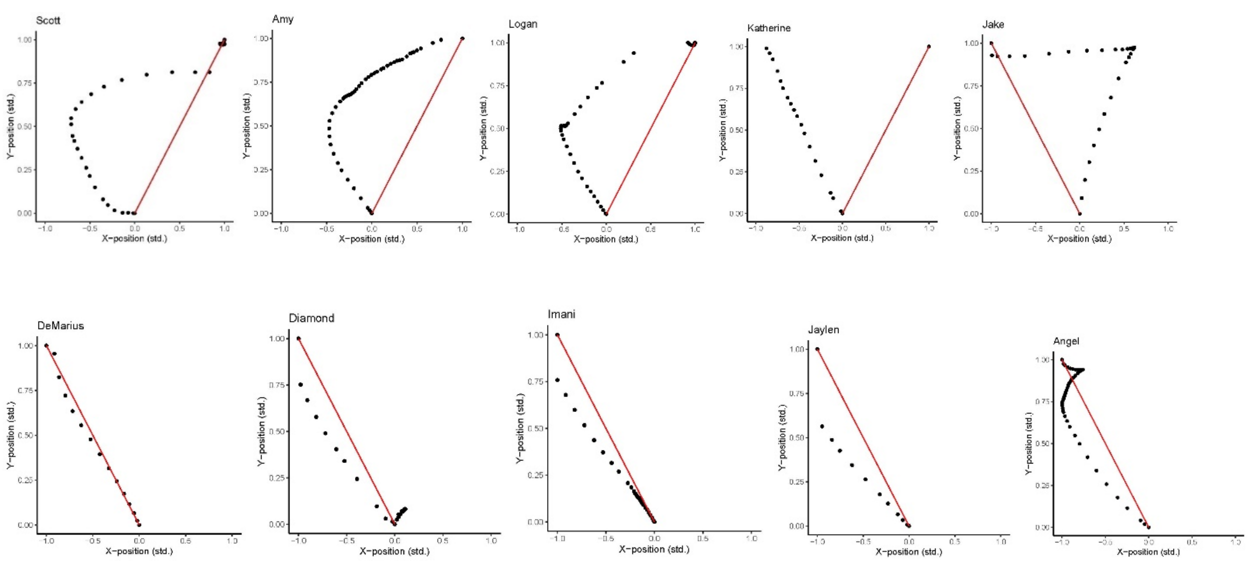

Figure 1. Black participant mouse trajectories

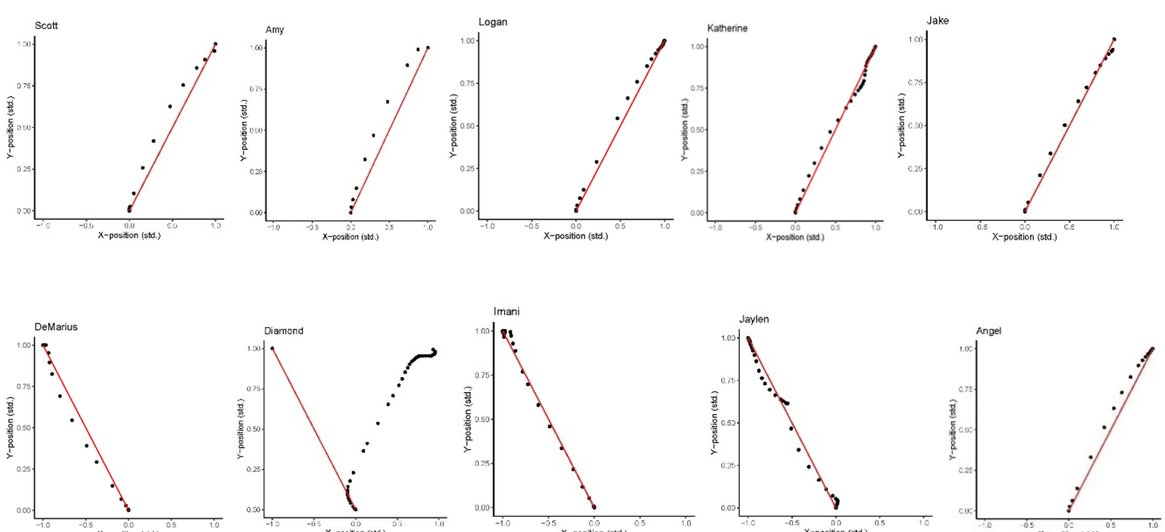

Figure 2. White participant mouse trajectories

Chapter 5

Discussion

With this experiment, I hypothesized that there would be a difference in how participants categorize Black and White sounding names based on race. Also, I predicted that White participants would display greater indecision toward categorizing Black sounding names than Black participants and that there would be no significant differences for White sounding names. This experiment showed that there was a significant difference in the number of x flips for Black and White people categorizing stereotypically sounding names, which is a sign of there being initial confusion, and is shown to be predictive of behavior (e.g., Stillman et al., 2018). However, this happened for White sounding names more often, and there were no significant differences in maximum horizontal deviations, total area, and maximum speed. As well as there being alternative explanations for the significant x flips and reaction time results. These results do not support our hypothesis of White participants displaying greater indecision toward categorizing Black sounding names than Black participants and that there would be no significant differences for White sounding names between Black and White participants.

The direction of these results was surprising since Black people had more x flips and there were no significant differences in categorizing stereotypically Black sounding names. This could have been due to stereotype threat which could have led to Black participants being more cautious and taking longer in their classification of the Black and White names (Steele & Aronson, J, 1995 & Logel et al., 2008). Also, the fact that White participants did not show a significant difference in the other mouse trajectory measurements of maximum deviations, area between ideal and actual trajectory, and maximum speed than Black people was perplexing. This may be due to this experiment being a categorization study of names and not combining the naming with an attribute evaluation (good or bad) and a confound of the word Angel that could be construed as White due to associations with Heaven (white clouds). Also, the fact that there were no distractor words and trials may have led to participants knowing the intention of the experiment, which may have had an impact on the results (Wojnowicz et al., 2019). Additionally, an inculcation of racial stereotypes explicitly and implicitly in society may have made it so that people know what a "Black" and "White" name is generally, which explains the lack of max deviations and total area.

Limitations

A limitation in this study is Mathur's and Reichling's (2019) mouse tracking paradigm itself. The fact that a researcher is limited to the number of blocks they can use with this model is restrictive, especially if a researcher wanted to change the upper left and upper right category names throughout their experiment. However, this might be a sacrifice to increase the number of people who can successfully use this mouse tracking paradigm and keep the overall functionality of said paradigm at its highest. Ultimately, this paradigm is a streamlined way to measure mouse tracking online, especially with the Qualtrics platform.

Another limitation in this study is that this experiment was exclusively conducted online. Although this increases the number of people that can access the study and was necessary due to Covid-19, participants may not have been as attentive to the task as they would have been otherwise. Therefore, for a future mouse tracking study, half of the participants should complete the experiment in person and the other half online to see if there is a possible effect. Also, a researcher could have varying reward levels that are either compensation or extra credit since compensation has been shown to improve effort in web surveys (e.g., Porter & Whitcomb, 2003).

Future Directions

To improve this study, researchers could develop a way to control for word frequency for stereotypically Black and stereotypically White names by coming up with a modern Thorndike-Lorge word frequency list (1944). That way, they can control for various word characteristics since it has been shown that these aspects can impact participants' categorization and response times (e.g., Ottaway et al., 2001). Also, researchers could obtain a more diversified set of participants in terms of education and race. In this experiment, participants were exclusively from the University of Memphis, and because of demographics, the sample was restricted to only White and Black people. Expanding the subject pool can increase the generalizability of a researcher's findings.

This study is an initial step to use mouse tracking to help better understand decision conflict and conflict resolution to the various intricacies of stereotype formation against Black people. These stereotypes inflict harm to Black people in subtle and not so subtle ways, and with mouse tracking research and other changes in this world, we can mitigate the amount of damage done to Black people and make life better for everyone.

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Appendix

Table 1

Results of Repeated Measures ANOVA

Mouse Tracking Analysis	F	df	p	η^2	β
Xflips					
Participant Race	4.97	1,62	.029	.074	.592
Race of Name	4.85	1,62	.031	.073	.582
Race of Name* Participant Race	.17	1,62	.684	.003	.069
Max Horizontal Deviation					
Participant Race	.35	1,62	.559	.006	.089
Race of Name	2.03	1,62	.159	.032	.290
Race of Name* Participant Race	2.56	1,62	.115	.040	.350
Area					
Participant Race	1.19	1,62	.280	.019	.189
Race of Name	1.22	1,62	.274	.019	.192
Race of Name* Participant Race	1.23	1,62	.272	.019	.194
Max Speed					
Participant Race	.35	1,62	.557	.006	.090
Race of Name	.01	1,62	.917	.001	.051
Race of Name* Participant Race	.80	1,62	.375	.013	.142
Response Time					
Participant Race	11.63	1,62	.001	.158	.919
Race of Name	5.09	1,62	.028	.076	.603
Race of Name* Participant Race	.04	1,62	.840	.001	.055

Note. *means interaction, and for the t-test Name trials, the p-value required for significance is .005 due to a Bonferroni Correction of running ten analyses.

Table 2:

Means and standard deviations for Mouse Tracking Statistics for Black and White Participants for Black and White Names

race		White xflips	Black x flips	White max x dev	Black max x dev	White area	Black area	White max speed	Black max speed	White rt	Black rt
Black/African American	Mean	2.345	2.566	0.91460393310	0.78852561586	20.19087015055	0.45240704545	0.01461874090	0.01439461841	1343.207	1662.952
	Std. Deviation	1.8662	2.4554	1.355644427855	0.380306124573	106.510455912667	0.249439952459	0.004569960007	0.005120987008	575.6539	1049.1781
Caucasian	Mean	1.469	1.789	0.52825493646	0.80100723686	0.30603773480	0.48274198854	0.01406165720	0.01515789803	1022.069	1382.269
	Std. Deviation	0.6738	0.8443	0.354488770108	0.367559950964	0.211468497365	0.307916243383	0.004981944559	0.004919521609	281.7434	587.4842
Total	Mean	1.866	2.141	0.70331932556	0.79535150234	9.31635242319	0.46899646745	0.01431408575	0.01481203695	1167.584	1509.453
	Std. Deviation	1.4093	1.7933	0.960302423412	0.370448001993	71.704617137148	0.281164926256	0.004770213521	0.004986304075	464.8441	833.8648

Table 3

Results of Name Categorization

Name	Black	White
White Names		
Scott	1 (1.6%)	63 (98.4%)
Amy	3 (4.7%)	61 (95.3%)
Logan	2 (3.1%)	62 (96.9%)
Katherine	1 (1.6%)	63 (98.4%)
Jake	1 (1.6%)	63 (98.4%)
Black Names		
DeMarius	61 (95.3%)	3 (4.7%)
Diamond	57 (89.1%)	7 (10.9%)
Imani	62 (96.9%)	2 (3.1%)
Jaylen	58 (90.6%)	6 (9.4%)
Angel	43 (67.2%)	21 (32.8%)

Black Names

1. Aaliyah (F)
2. Angel (F)

3. Destiny (F)

4. Diamond (F)

5. Imani (F)

6. Elijah (M)

7. Jaylen (M)

8. DeMarius (M)

9. Darius (M)

https://www.babycenter.com/0_popular-african-american-names_10329236.bc

Note. The names Aaliyah, Destiny, Elijah, and Darius were used in the practice trials, and all of the other names were used in the experimental trials. Also, 8 and 9 are names I came up with

White Names

1. Katherine (F)

2. Amy (F)

3. Jake (M)

4. Connor (M)

5. Dustin (M)

6. Scott (M)

7. Logan (M)

http://abcnews.go.com/2020/top-20-whitest-blackest-names/story?id=2470131

Note. The names Connor and Dustin were used in the practice trials, and all of the other names were used in the experimental trials.