FACE RECOLLECTION: DEVELOPING A NOVEL TRAINING PROGRAM TO INCREASE RECOLLECTION RATES IN EYEWITNESS IDENTIFICATION

A Behavior Paper

Presented to

Lincoln University Regional Science Fair

Lincoln University

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August 18, 2008-February 9, 2009

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Eyewitness misidentification of criminals is a very prevalent problem that needs to be solved, as it is the leading cause of wrongful convictions and imprisonments in cases of DNA exoneration (Innocence Project, "Fact Sheet," February 6, 2009). Studies have found several trends in face recognition relating to eyewitness identification, including own-gender, own-age, and own-race biases. Several training methods have been developed in attempts to increase participants' accuracy in face recollection (e.g. Hills & Lewis, 2006; Malpass, Lavigueur, & Weldon, 1973). Though some of these studies have experienced positive immediate results, long-term training effects have yet to be achieved.

The purpose of this project was to create a novel computer program that would train participants to recollect faces more accurately and consistently. 168 participants, including teacher volunteers and high school students, watched several original videos with randomly generated faces superimposed over the actors' faces. The participants were then asked to reconstruct two of the faces from four multiple choice feature questions. The experimental group was then subjected to a training program, and using the method "**top-down, shape-width,**" participants were shown similarities and differences in eyes, noses, mouths, and chins. After the training portion, four more video clips were viewed followed by more reconstruction questions. The results were grouped into categories of race, gender, age, and overall improvement after training.

After examining the results of this study, it was concluded that this simple, novel training method is effective both in short- and long-term results, which is a potential breakthrough in the area of eyewitness training. Though race and gender correlations were not significant, the overall scores significantly increased ($P < .001$) after training, moving from a mean pre-training score of 42.8% to a mean post-training score of 46.676%. The mean follow-up score of 44.125% was not significantly different from the post-training mean, demonstrating the long-term effectiveness of this training method. Considering the results of this study, it is plausible that the use of this novel and systematic approach to increasing the accuracy of face recollection could be used by the general public as well as in law enforcement to reduce harmful errors in eyewitness identification.

Contents

Purposes

The purpose of this study was to determine the effects of the following on face recollection rates:

1. Race of the participant and of the suspect
2. Gender of the participant and of the suspect

From this research, in creating a novel face recollection training program, the purposes of this study were to:

1. Increase facial feature recollection rates
2. Decrease misidentification rates of other races' features
3. Decrease misidentification rates of other genders' features
4. Determine any long-term effects of the program

Hypotheses

It was hypothesized that when participants are subjected to a face recollection program that:

1. Face recollection rates of other race faces would be significantly lower than the rates of same race faces
2. Face recollection rates of other gender faces would be lower than the rates of the same gender faces

It was also hypothesized that after participants were subjected to a face recollection training program that:

1. Face recollection rates would significantly increase
2. Misidentification rates of other races would significantly decrease
3. Misidentification rates of other genders would significantly decrease
4. The effects of the program would still be apparent in the results of the follow-up program

Variables

1. The independent variable in this study is the novel training program, including race and gender of the faces in the program, developed to increase facial recollection rates.

2. The dependent variable in this study is the face recollection rates.

3. The control variables in this study included the consistent methods of design for each program version and the nine day gap between use of the training and follow-up programs.

Literature Review

On April 15, 1985, an eight-year-old girl was brutally raped and murdered in her own home. Fourteen days later, Frank Lee Smith was arrested based on shaky eyewitness testimony from neighbors. Relying upon identification by the victim's mother and Smith's previous criminal record, Smith was given the death sentence. In 1990, Smith earned a stay of execution while more hearings began. After a change in an eyewitness testimony, DNA testing was requested, showing Eddie Lee Mosley, not Frank Lee Smith, as the killer. However, this testing was not complete until December 2000, eleven months after Smith died of cancer in prison. He spent the last fourteen years of his life in prison for a crime he did not commit (Innocence Project, "Know the Cases: Frank Lee Smith," February 8, 2009).

Eyewitness Identification

According to the Innocence Project, eyewitness misidentification has played a role in 77% of wrongful convictions overturned by DNA testing in the US, yet eyewitness accounts are still heavily relied upon in many situations of today's courts. The many factors leading to eyewitness identification during the crime include length of time in which the perpetrator's face was viewed, eyewitness' distance from the perpetrator, visibility, stress, fear, and presence of a weapon (Tredoux, Meissner, Malpass, & Zimmerman, 2004). Studies have also demonstrated several other trends in eyewitness identification. Wright and Stroud (2002) established that an eyewitness will usually pick a perpetrator out of a line-up more accurately when the two are around the same age. Trends among similar genders are not concrete, but one study suggested that men and women remember and describe different characteristics, with women recalling characteristics judged to be more important in facial recognition (Yarmey, 1993). Lindholm and Christianson (1998) also demonstrated that, in an eyewitness situation, more than males, women may remember more features and have a better memory for events in general. The most researched eyewitness trend is race. A plethora of studies have found a cross-race effect (CRE) or own-race bias (ORB), meaning that a person is more likely to correctly identify a face of similar race than a face of another race. Several studies have demonstrated the reliability among experts of the CRE (e.g. Kassin, Ellsworth, & Smith, 1989; Kassin, Tubb, Hosch, & Memon, 2001), and a meta-analytic review found that the CRE accounts for 15% of the variance across 39 research articles from the past three decades (Meissner & Brigham, 2001).

Training Studies

As a result of these trends and their harmful effects, some research has also experimented with training eyewitnesses to more effectively recollect faces. Hills & Lewis (2006) demonstrated that the CRE could be lowered in Caucasians by training participants to shift attention to diagnostically African-American features. Malpass, Lavigueur, & Weldon (1973) found that verbal description training has no significant effect on face recognition accuracy, but training in visual recognition does, at least in short term. Though many of these studies have demonstrated short-term success rates, long-term memory still remains a problem. Though long-term training effects are not often studied, one experiment showed that the positive effects in face recognition ability were found to diminish after one week (Malpass, Susa, Meissner, 2008). One conclusion that is often drawn to account for this tendency is that these experimental training programs' methods are unable to override a lifetime of face recognition by a different process (e.g. Hills & Lewis, 2006). Police officers, however, are trained to scrutinize faces with a systematic method going from the top to the bottom of the face (W. L. Kost, personal communication, January 8, 2009). The repetition and requirement of this level of attentiveness may account for the reason police officers are generally more observant to details, specifically in a crime scene situation (Christianson, Karlsson, Persson, 1998), which suggests that, in order to be truly effective, face recognition training must become second-nature through repetition.

Method

Design

Based on the literature review, it was decided that several experts should be contacted for further information. Tracy Robinett, a detective of the Osage Beach Department of Public Safety; Rick Buttram, an area sergeant, Wendy Kost, a criminal intelligence analyst, and Jean Curtit, a criminalist of the Crime Lab, all of Missouri Highway Patrol; and Dr. Christian Meissner, an expert in the field of face recognition, of the University of Texas, El Paso Psychology Department were contacted. Based on the information gathered, it was determined that a face recollection training program should be created.

Three different versions of the program were produced. Two were created for the initial testing, one as a variable with the training portion of the program, and one as a control without the training portion of the program. The third version was created as a follow-up program without further training. Each version then had two versions of its own (i.e. training, version 1 and training, version 2), creating a total of six different program versions.

The training version of the program consisted of three sections: the first was a research gathering section, the second was the training program, and the third was another research gathering section. The control version consisted of three sections as well: the first was the research gathering section, the second was a link to a crossword puzzle (used to factor out a ‘practice effect’) which the participant completed for ten minutes before returning to the program, and the third was the other research gathering section. The follow-up version consisted of only a single section of research gathering.

Research Gathering Portion

Each research section consisted of four original, prerecorded videos created for the purposes of this study. Each video contained four characters receiving approximately equal screen time. The first video was approximately two minutes in length, and each video thereafter was approximately thirty seconds shorter than the one before it. In each video, one character was an African American male, one was an African American female, one was a Caucasian male, and the other was a Caucasian female. A randomly generated face created on the FACES™ (Interquest™) composite drawing program (Attachment 1) was superimposed onto the face of each character, according to his or her race and gender, with a total of forty-eight faces (Attachment 2). Every research section had the same four video clips, with only the faces changing each time (Attachment 4). After viewing each clip, the participant was asked to reconstruct two of the faces that were in the video, based on select features he or she was given. For example, if asked to reconstruct the face of the Caucasian female, the participant would see four types of eyes, noses, mouths, and chins (Attachment 5). The participant was asked to pick which of each feature he or she saw on the face of the Caucasian male, recording his or her multiple choice answers on a provided answer sheet. The participant then went on to follow this same procedure after each of the four videos of every research gathering section he or she went through.

Each face generated on the FACES™ program is made up of several different features. Within each set of features, every variant of that feature is labeled by a number and grouped into categories with similar variants. In this numbering system, the first variant of the first category is labeled 100, and then every new hundreds value indicates the beginning of a new category.

The number system was used to determine which features to present as possibilities in the reconstruction questions. For every generated face used in the video clips, the codes of each feature were recorded. For each feature, the number 200, or a value of two categories, was subtracted, added, and then added again to the original code to produce three more variant options for the reconstruction questions (Attachment 3). If there was no corresponding variant number in another category, then the next highest number in that category was used. Also, for the purposes of this study, the lowest and highest categories were considered to be one category apart to create circular, rather than linear, number values.

After being selected, each feature was inserted into the PowerPoint program using Snagit™, a screen capture program. Each type of feature was consistently captured using a specific size: eyes—242 x 92 pixels, noses—222 x 111 pixels, mouths—180 x 130 pixels, and chins—322 x 139 pixels. The features were placed into the program based on random answer keys which were created for each program version, with the correct feature being placed next to the corresponding correct answer, and the other three being randomly placed by the other three answer possibilities. The correct answer was designated to be the exact feature seen on the face in the video. However, because of an error in calculating corresponding features, many feature reference numbers ended up being slightly different than the correct feature. As a result of this error, a follow-up study was conducted to validate the results of this experiment.

The training version and the control version had the same faces in each video clip, and the follow-up version had a separate set of faces. Following each video clip, the training, version 1 participants would reconstruct a random two of the four faces while the training, version 2 participants would reconstruct the other two faces, ensuring that all necessary data was gathered without placing a larger burden on the subject. The reconstructed faces varied with each video, so the participant was never aware of which faces he or she would be asked to recreate. This structure also created the difference between control, version 1 and control, version 2 and follow-up, version 1 and follow-up, version 2.

For the purposes of data correlation, the training and control version subjects were asked to complete a five-question demographics survey after viewing the brief introduction to the program. The introduction overviewed the purpose of the program and directed participants to go through the program in its entirety in only one uninterrupted session, follow all instructions exactly and completely, watch each video only once and not to talk during the program, return or skip ahead to other slides or questions, or use the program if their vision was not normal or corrected. Non-adults were also strictly instructed not to write their name or any other information, other than a given code, on the answer sheet. The survey asked for subjects' gender, age, race, marital status, and level of diversity in their hometown.

The only non-adult group that needed to identify their answer sheets in some way was the training, version 1 group. This was the subgroup which also used the follow-up program. In order to do this, each participant, according to instruction, created his or her own code consisting of the row and desk number in which he or she sat. This allowed each subject to find their answer sheet again when taking the follow-up program in order to keep their data together for later comparison.

Training Portion

The training section of the program, found only in the training version of the program, consisted of some basic facial recollection tips, a method for more accurate face analysis, applications of this method with each individual feature, and a practice face.

The introduction included discussion of the repercussions of eyewitness misidentification, mention of the CRE, and instruction to focus on the features that will not change (e.g. eyes, not hair).

The method was created to be very easy to remember. It simply consisted of the phrases, "**top-down, shape-width**." This method instructs to begin analysis at the top of the head, with the eyes, and then move down, to nose, mouth, and chin. With each feature, first the shape is studied, then the width.

The next segment of training went through each feature, beginning with eyes, and pointed out details in several different variations that correlated with the method. For example, six variations of eyes were shown, and elements such as width, shape, angle, color, and distance apart were pointed out to the participant (Attachment 6). This helped the participant understand some terminology and specifically what to look for in faces.

The final aspect of the training portion was a practice face. A generated face was shown on the screen for a pre-set time of fifteen seconds before advancing to the reconstruction slides. The participant was then asked to recall the eyes, nose, mouth, and chin of the face, just like the previous research gathering questions.

Participants

The human subject group was made up of 168 teachers and high school students, and each version of the program was used by a different group of subjects. Three teachers had all of their classes use a version of the program. One teacher's classes used the training, version 1; one teacher's classes used the training, version 2; and one teacher's classes split into two groups, with one group using control, version 1, and the other one using control, version 2. The classes that used training, version 1 also used the follow-up, with each half of the group using a different version. An IRB-approved parent permission form was required from every underage participant before using the program. Teachers who volunteered to participate in the research were alphabetically assigned a version of the program to use, with the first half of the alphabet using training, version 1, and the second half using training, version 2.

Statistical Analysis

All data were subjected to analysis. Data involving race, gender, and age were subjected to correlation analysis through Microsoft Excel while pre- and post-training program data and post-training and follow-up data were subjected to Analysis of Variance (ANOVA). An alpha level of 0.05 was used to determine significance.

Discussion of Results

Pre-training vs. Post-training

The mean pre-training score for a training version participant was 42.8%. After training, that mean increased to 46.676%, making the increase in scores significant ($P < .001$). The control version participants had a pre-activity mean score of 42.125%, with an insignificant change to the post-activity mean score of 37.375%. Theoretically, by itself the significant increase in pre- and post-training scores could be accounted for by the participants' repetition. However, when placed in combination with the control scores, this 'practice-effect' was factored out of the results. In essence, the training program was solely responsible for the significant increase in facial recollection rates.

Follow-up

Compared to the mean pre-training score of 42.8%, the mean follow-up score increased significantly ($P = .006$) to 44.125%. The mean post-training score of 46.676% remained significantly greater when compared to pre-training results but was not significantly different from the mean follow-up score. This suggests that the training program has long-term value, though the extent of this value is unknown.

Gender and Race

Correlations of gender of the participant versus gender of the identified face were not significant. Correlations of race of the participant versus race of the identified face were also not significant, which is considered to be abnormal in a cross-race effect study of this kind. These results may be explained by the fact that the faces created on the FACES® program were not constructed based on pre-existing faces. Instead, the faces were composed of individual features deemed to be either diagnostically African-American or Caucasian.

Error Correction

Because of the numbering error in the multiple choice feature selection process, a follow-up study was conducted to validate the results of the original experiment. Another group of high school students used the training version of the program in order to gather pre-training and post-training data. The results were found to be even more significant than that of the original study ($P< .0001$), with the difference in scores before and after training being much greater as well (Pre-training: 25.88% and post-training; 62.77%). These results served to further support the findings of the original study.

Summary

Data from this study suggest that this simple, novel training method is effective, both in short- and long-term results. Though the extent of the long-term effects is not yet known, the fact that some long-term results were achieved is a potential breakthrough in the area of eyewitness training. One possible flaw in these data, however, is the low rate of diversity that to which this study was restricted. Overall, the mean scores in every test were low, but the increase after training was significant. In combination the police observance study mentioned in the Literature Review, this could indicate that more installments of training would further increase face recollection accuracy.

Conclusion

Considering the results of this study, it is plausible that the use of this novel and systematic approach to increasing the accuracy of face recollection, once perfected, could be used by the general public as well as law enforcement to reduce harmful errors in eyewitness identification.

Statistical Analysis

Table 1. Statistical analysis for pre-training accuracy versus post-training accuracy from the training version of the program

Pre-Training vs. Post-Training

t-Test: Paired Two Sample for Means

	Pre-training	*Post-training*	
Mean	42.8	46.676	
Variance	61.93674395	49.39367	
Observations	125	125	
Pearson Correlation	#N/A		
Hypothesized Mean Difference	0		
df	124		
t Stat	-4.248962607		
P(T<=t) one-tail	2.09044E-05		
t Critical one-tail	1.657235771		
P(T<=t) two-tail	4.18088E-05		***p< 0.001***
t Critical two-tail	1.97927875		

n=168

Table 2. Statistical analysis for pre-activity accuracy versus post-activity accuracy from the control version of the program

Pre-activity vs. Post-activity in Control Group

t-Test: Paired Two Sample for Means ***(Control Group)***

	Pre-activity	*Post-activity*
Mean	42.125	37.375
Variance	88.8020833	86.65365
Observations	25	25
Pearson Correlation	0.00686508	
Hypothesized Mean Difference	0	
df	24	
t Stat	1.79918407	
P(T<=t) one-tail	0.04228863	
t Critical one-tail	1.71088232	
P(T<=t) two-tail	0.08457725	
t Critical two-tail	2.06389814	

n=168

Table 3. Statistical analysis for pre-training accuracy versus follow-up accuracy from the training and follow-up versions of the program

Pre-Training vs. Follow-up

t-Test: Two-Sample Assuming Equal Variances

	Pre-training	*Follow-up*
Mean	42.8	44.125
Variance	61.93674395	38.059411
Observations	125	32
Pooled Variance	57.16127732	
Hypothesized Mean Difference	0	
df	155	
t Stat	-2.809387182	
P(T<=t) one-tail	0.002801745	
t Critical one-tail	1.654743755	
P(T<=t) two-tail	**0.006**	
t Critical two-tail	1.975386112	

n=168

Table 4. Statistical analysis for post-training accuracy versus follow-up accuracy from the training and follow-up versions of the program

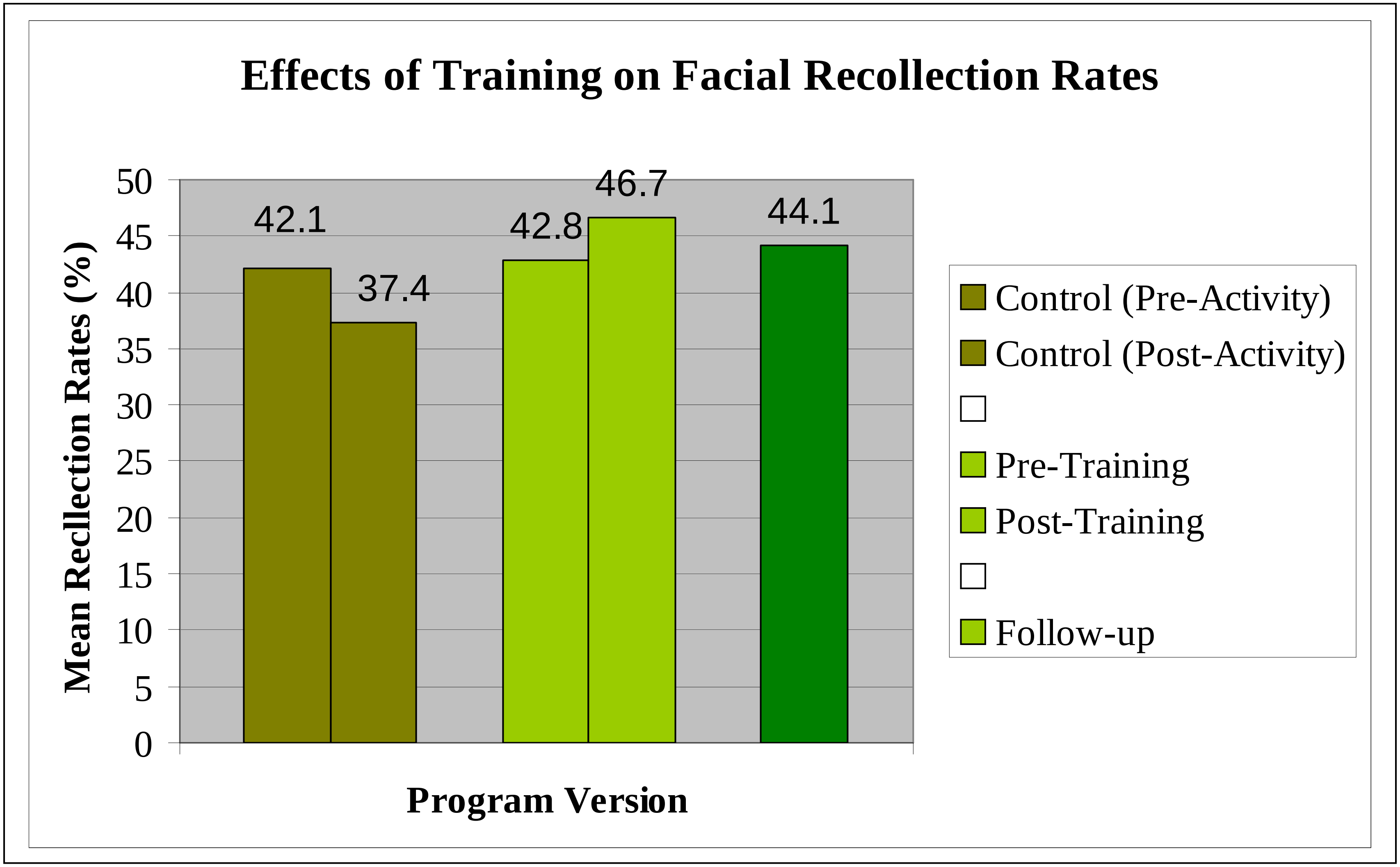
Post-Training vs. Follow-up

t-Test: Paired Two Sample for Means

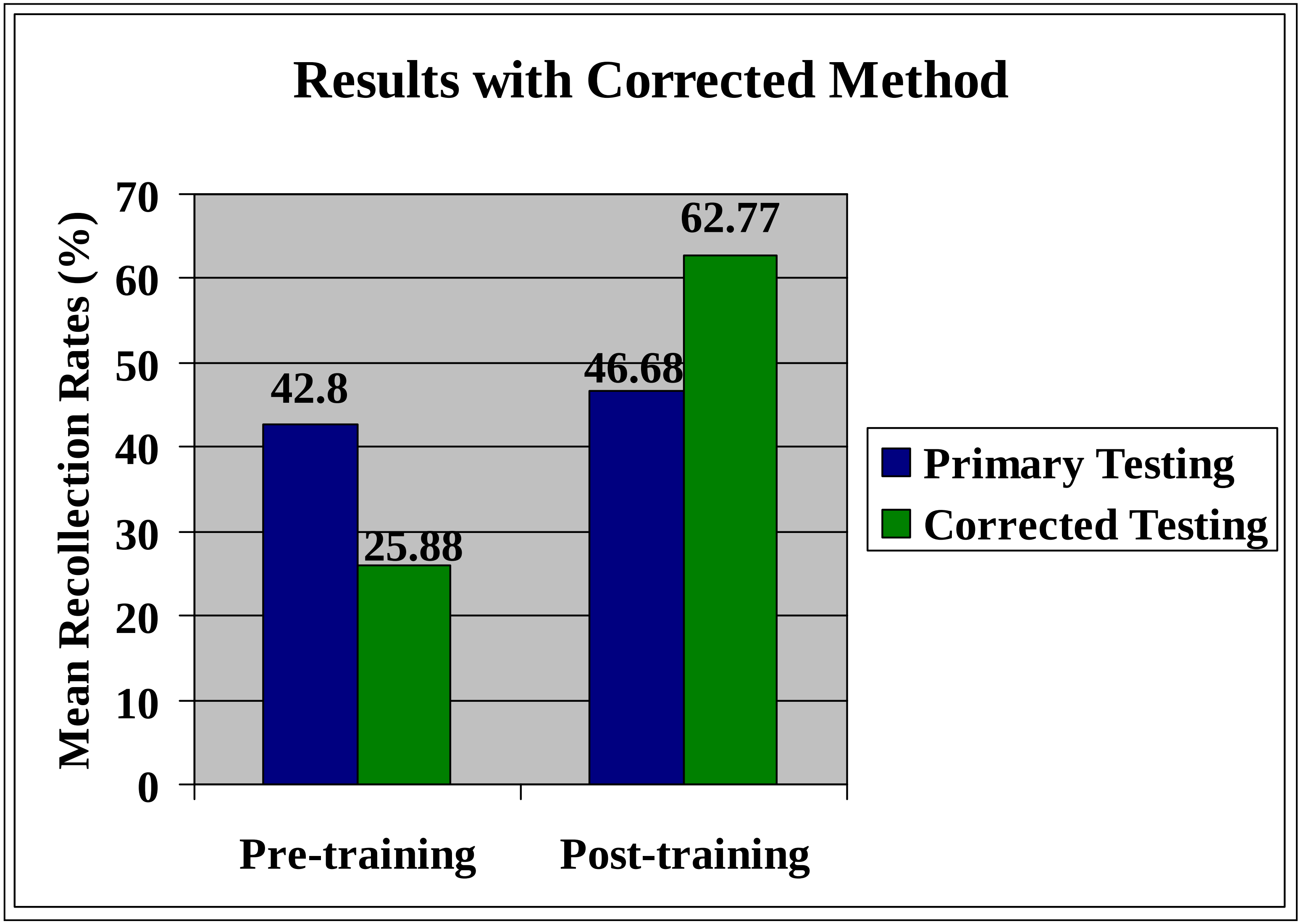
	Post-training	*Follow-up*
Mean	46.676	44.125
Variance	49.39367	38.059411
Observations	32	32
Pearson Correlation	-0.12013	
Hypothesized Mean Difference	0	
df	30	
t Stat	0.738365	
P(T<=t) one-tail	0.233015	
t Critical one-tail	1.69726	
P(T<=t) two-tail	0.46603	
t Critical two-tail	2.04227	

n=168

<u>Graphical Analysis</u>



n=168 **P< .001**


Results with Corrected Method
Mean Recollection Rates (%)
70
60
50
40
30
20
10
0
42.8
25.88
46.68
62.77
Pre-training
Post-training
Primary Testing
Corrected Testing

n=235 **P< .0001**

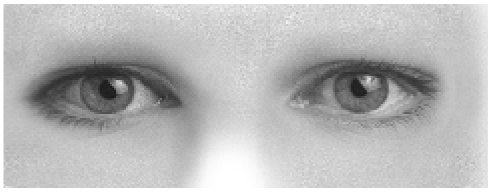
Attachment 1

Attachment 1. Screen capture of the FACES™ (Interquest™) composite drawing program

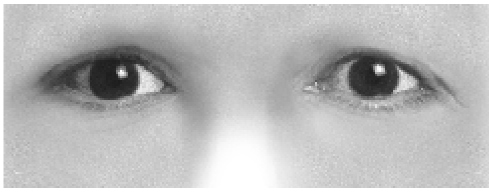
Attachment 2

Attachment 2. Caucasian female face generated on the FACES™ program, used to superimpose onto one actor's face

Attachment 3

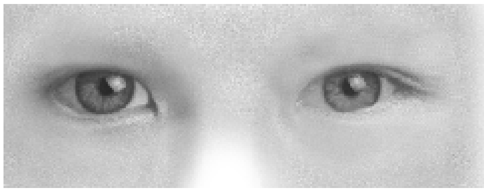


Correct eyes
Code: 944



Incorrect eyes
Code: 744

Incorrect eyes
Code: 133



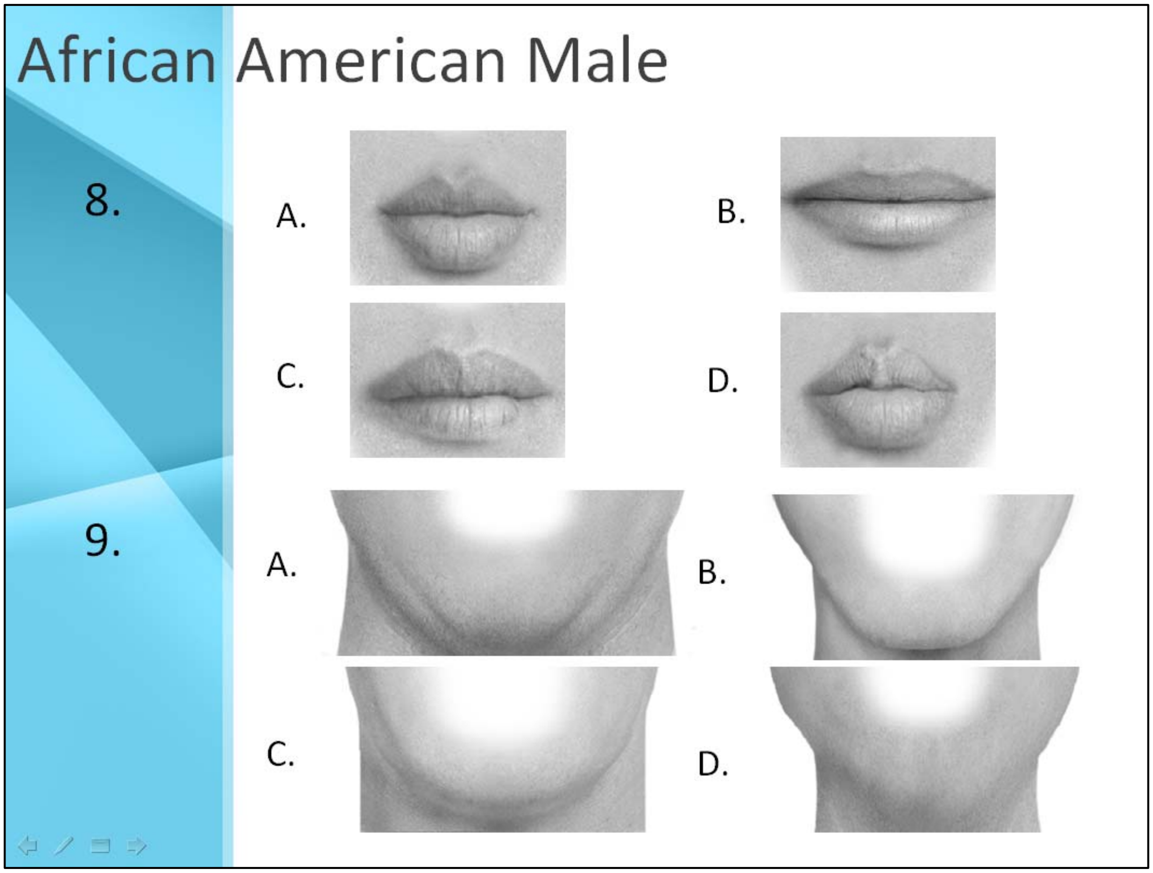
Incorrect eyes
Code: 344

Attachment 3. Caucasian female eye variant options captured from the FACES™ program, used in multiple choice research questions

Attachment 4

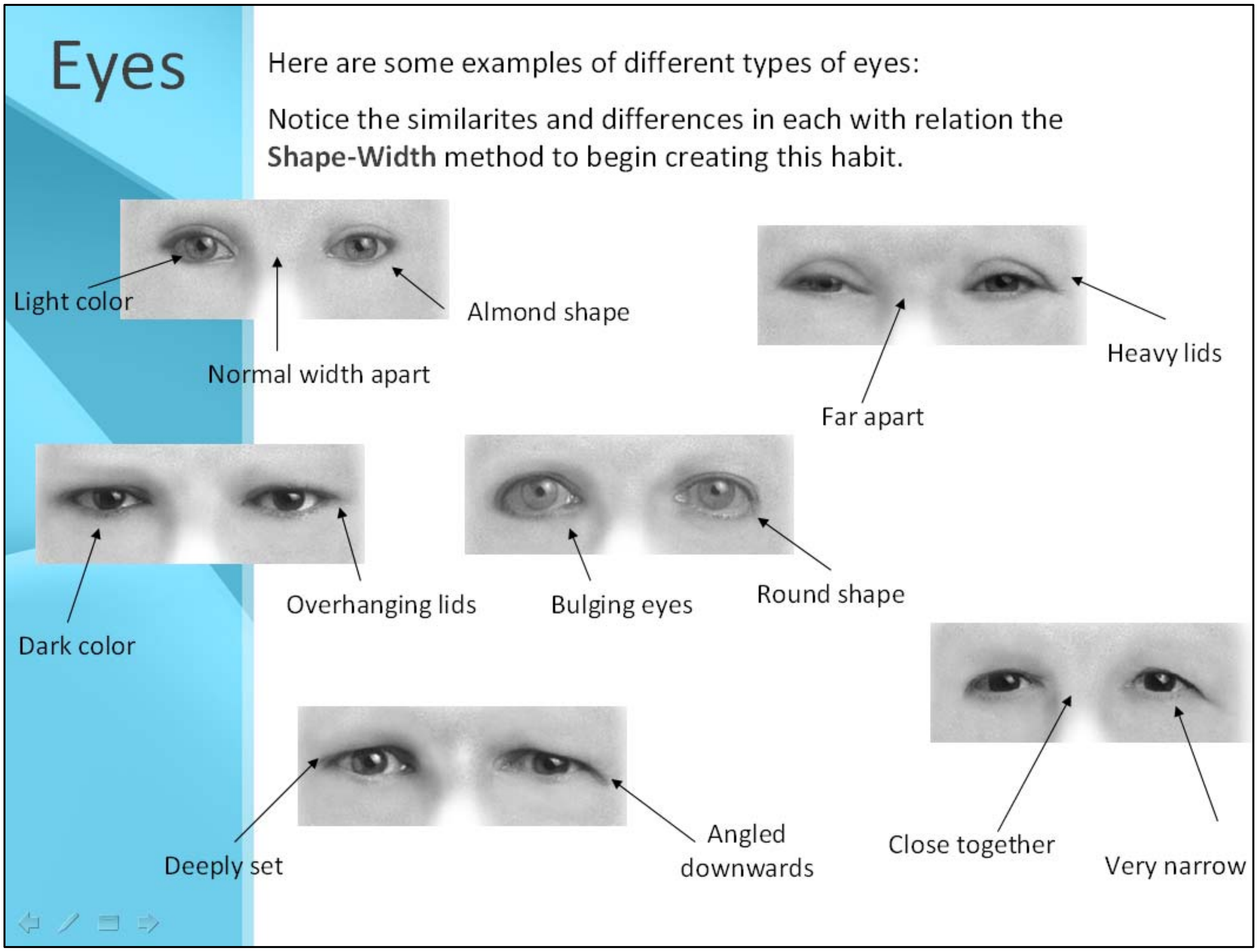
Attachment 4. Caucasian female eye variant options captured from the FACES™ program, used in multiple choice research questions

Attachment 5



Attachment 5. Screen shot of an example question requiring participants to choose the appropriate feature

Attachment 6



Attachment 6. Screen shot of example training slide pointing out differences in eye variants

Conclusions

Based on this study, the following conclusions may be drawn:

1. The initial hypothesis that face recollection rates would significantly increase was supported ($P < .001$).
2. The initial hypothesis that face recollection rates of other race faces would be significantly lower than the rates of same race faces was not supported.
3. The initial hypothesis that face recollection rates of other gender faces would be lower than the rates of the same gender faces was not supported.
4. The initial hypothesis that misidentification rates of other races would significantly decrease after training was not supported.
5. The initial hypothesis that misidentification rates of other genders would significantly decrease after training was not supported.
6. The initial hypothesis that the effects of the program would still be apparent in the results of the follow-up program was supported. The difference in mean post-training scores and mean follow-up scores was not significant.

Future Studies

Future studies could attempt to:

1. Find the extent of the long-term value of this method.
2. Create a facial recollection training program developed specifically for long-term memory, including multiple installments of training.

Acknowledgements

Interquest™
-Allowed me to use faces, features, and screen shots from the FACES™ program

Dr. Christian Meissner, Department of Psychology, University of Texas, El Paso
-Critiqued my method and served as my Qualified Scientist

Ms. Wendy L. Kost, Criminal Intelligence Analyst, Missouri State Highway Patrol
-Gave valuable input and assistance for my project

Ms. Jean L. Curtit, Criminalist/Latent Print Section, Sketch Artist, Missouri State Hwy Patrol
-Gave valuable input and assistance for my project

Detective Tracy Robinett, Osage Beach Department of Public Safety
-Helped in determining my method

Area Sergeant Rick Buttram, Missouri State Highway Patrol
-Put me in contact with various people

Dr. Brian Henry, Principal, Camdenton High School
-Served as chair of my Internal Review Board

Ms. Kim Lapeyre, RN, School Nurse, Dogwood Elementary
-Served on my IRB

Mrs. Jaimie Foulk, Chemistry Teacher, Camdenton High School
-Served on my IRB, volunteered her classes for subjects, and gave much moral support

Ms. Tammy Green, Librarian, Ellis Library, University of Missouri-Columbia
-Graciously rechecked invaluable sources on multiple occasions

Mr. Chris Reeves, Science Research Instructor
-Assisted with every aspect of my study, solved many problems, and was always ready to help

Mr. and Mrs. Tom Schlatter, Parents
-Assisted with some incredibly tedious aspects of my research and help me through very stressful times with moral support and occasionally brownies

Miss Kayla Foulk, fellow science research student and friend
-Assisted with several aspects of my research and helped me get through this year

Mrs. Kim Griggs, Mr. Bob Foster, and Mr. Chris Reeves, Teachers, Camdenton High School
-Allowed me to use their classes for my program participants

All teacher volunteers and student participants

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