

2011

Eyes, eyebrows and their effect on the facial perception of hostility

Bradford L. Schroeder
Tennessee Technological University

Follow this and additional works at: <https://scholar.utc.edu/mps>



Part of the [Psychology Commons](#)

Recommended Citation

Schroeder, Bradford L. (2011) "Eyes, eyebrows and their effect on the facial perception of hostility," *Modern Psychological Studies*: Vol. 16 : No. 2 , Article 4.
Available at: <https://scholar.utc.edu/mps/vol16/iss2/4>

This articles is brought to you for free and open access by the Journals, Magazines, and Newsletters at UTC Scholar. It has been accepted for inclusion in Modern Psychological Studies by an authorized editor of UTC Scholar. For more information, please contact scholar@utc.edu.

Eyes, Eyebrows, and their Effect on Facial Perception of Hostility

Bradford L. Schroeder

Tennessee Technological University

The purpose of the present study was to assess the effects of the eyebrows and the eyes on the perception of the emotion of hostility through facial expressions. Eighty-six participants were randomly selected as a convenience sample from Tennessee Technological University. Images of the eye and eyebrow region of the face were projected in front of the class and participants rated each image on hostility, friendliness, and happiness, scaled from 0-5. The specific dependent measures were only hostility ratings. Results supported each of the proposed hypotheses. It was found that inward eyebrows, less open eyes, and the combination of inward eyebrows and less open eyes were rated the most hostile at a significance level of .01. Related findings in previous research and potential future research are discussed.

Many empirical studies have been performed assessing entire faces with complete expressions and the emotions associated with them (Ekman et al., 1987; Hareli, Shomrat, & Hess, 2009; LeMoult, Joorman, Sherdell, Wright, & Gotlib, 2009); however, fewer studies actually focus on the individual effects of separate components of the face. Studies of facial expressions can discover how separate components of the face contribute to the emotional recognition and labeling of a facial expression. Since it is difficult to directly observe the overall effects of individual components of the face, research in this area is imperative to gain understanding.

Most researchers agree that the emotions communicated through facial expressions are universally recognized by people across cultures (Ekman et al., 1987; Izard, 1994). This implies that many people, regardless of cultural background, interpret specific manipulations of the face in similar ways. Also, in a study on differences in emotion identification between people with a history of depression and without a history of depression, there were little to no differences between the two groups identifying sad and angry faces (LeMoult et al., 2009). These minute differences suggest that anger is easily recognized, regardless of mood. . Essentially, in any case of a person's mood or

cultural background, anger and similar negative emotions are among the most commonly identifiable emotional expressions. In addition, an empirical study that focused separately on the brow region and the eye region of the face suggests that emotions can be identified accurately showing only portions of a human face (Boucher & Ekman, 1975), and a study that focused solely on the top region of the face also suggests that anger is one of the most easily identified emotions (Bassili, 1979).

Generally, angry facial expressions are perceived by downward movement of the brow in the upper portion of the face (Bassili, 1979). The eyebrows of angry faces are defined as “V-shaped”, describing the shape of the eyebrows on an angry face to be arched downward and inward, toward the nose (Lundqvist, Esteves, & Öhman, 1999; Tipples, Atkinson, & Young, 2002). A cross cultural study has also indicated that angry facial expressions are characterized by the eyebrows drawn together and down, with the eyes fixated and narrowed (Izard, 1971). Concerning the eyes, a negative, angry facial expression consists of eyes that are focused, narrow, and less open (Fox & Damjanovic, 2006). A study that manipulated eye size in angry and fearful expressions (using small eye size, unmanipulated eye size, and large eye size) found that participants most accurately identified faces with small eyes as being angry, and that unmanipulated eyes and large eyes lowered emotion identification accuracy (Sacco & Hugenberg, 2009). In contrast to neutral facial expressions, an empirical study on facial expressions and the perception of dominance and social power suggested that angry facial expressions are perceived as more socially dominant or socially powerful, implying a communication of threat or hostility (Hareli et al., 2009). Also, anger as an emotional expression has been

defined as synonymous with hostility, rage, and fury (Izard, 1971). With anger and hostility being so closely related, hostile faces consisted of inward shaped eyebrows with smaller eye size for this study’s purpose. The present study focused on these parts of the face to assess their contributions to the easily identifiable emotion of hostility.

This study’s objective was to measure the effects of the eyes and the eyebrows on the perception of hostility in facial expressions. Facial images were presented to the participants, containing varying degrees of eye openness and eyebrow shapes. The eyes were presented in three different ways: neutral, very open, and less open. The eyebrows were also presented in three different shapes: neutral, arched outward (“A-shaped”), and arched inward (“V-shaped”). Because the eyebrows frame and highlight the eyes in the face (Fox & Damjanovic, 2006), it is expected that there will be an interaction between the eyes and the eyebrows. The perception of hostility through facial expressions was rated by participants on a Likert-type scale, with zero meaning not at all hostile, and five meaning extremely hostile. For the purpose of this study, the emotion of hostility was considered a derivative of the emotion of anger. To keep the participants naïve to the purpose of the study, they were also required to rate the faces on dimensions of friendliness and happiness with scales similar to the one used for hostility ratings.

Since hostile faces have eyebrows that are arched inward and eyes that are less open, it was expected that there would be a significant main effect for eyebrow shape, such that facial stimuli with eyebrows that are arched inward would produce the highest hostility ratings from participants as opposed to facial stimuli with eyebrows that are arched outward and facial stimuli with eyebrows that are neutral.

It was also expected that there would be a significant main effect for eye openness, such that facial stimuli with eyes that are less open would produce the highest hostility ratings from participants as opposed to facial stimuli with eyes that are very open and facial stimuli with eyes that are neutral. In addition, facial stimuli with both eyebrows that are arched inward and eyes that are less open would produce the highest hostility ratings from participants than facial stimuli of any other comparable condition.

Method

Participants

Eighty-six Tennessee Technological University undergraduate students, ages 18 to 34 years, ($M=19.98$) participated in this study. The participants were comprised of 50 male students and 36 female students. Selected participants were a convenience sample of Tennessee Technological University students. All participants were treated ethically according to American Psychological Association guidelines.

Design

This study is considered a 3 (eyebrow shape) X 3 (eye openness) within-subjects factorial design. Eyebrow shape was the first independent variable, and has three levels: Arched outward (“A-shaped”), neutral, and arched inward (“V-shaped”). Eye openness was the second independent variable, and also has three levels: Very open, neutral, and less open. The dependent variable was participants’ ratings of hostility for each of the nine images. All participants rated each of the nine conditions.

Materials

Nine different color images created with FaceGen software by Singular Inversions were projected onto a screen in front of the classroom (see Appendix A). FaceGen was chosen for its statistically valid design for face modeling. The software’s different facial variables depend on

each other, such that any modification to one part of the face changes other facial variables to maintain a realistic appearance. To reduce bias, the images were created using gender and racially neutral attributes, and the facial structure was modified so that every image was physically average by the software’s standards. Each of these images was cropped to the same dimensions so that the only facial features showing were the eyes and eyebrows. Each of the images had a different combination of eye openness and eyebrow shape. The eye and eyebrow portions of the facial images were kept consistent across images such that every neutral eyebrow was the same on every image with neutral eyebrows and every less-open eye was the same on every image with less-open eyes. A ratings sheet with ratings for hostility, friendliness, and happiness on a scale of zero to five was used (see Appendix B). Above each projected image, there was a large number that corresponded to the number on the ratings sheet that the participants were currently rating.

Procedure

All participants received a ratings sheet and an informed consent form (see Appendix C). Participants were instructed to read the informed consent form, and to sign if they agreed to volunteer for the study. Participants were then instructed to complete the demographics box on the ratings sheet, containing information on age, gender, major, and class rank. Participants were instructed to view the projected image and circle the rating that they believed best described the emotions represented by the projected image. For the emotion scales, participants were instructed that a zero (0) on the scale corresponded to no emotion, while a five (5) on the scale corresponded to maximum emotion. Images containing both an eye openness and eyebrow shape stimulus were projected on the screen for

15 seconds before being replaced by the next image. Each of the images was chosen from a total of nine images, created from different combinations of eye openness and eyebrow shape. Each image had a number above it, corresponding to the number of the group of ratings on the sheet. Each of the nine images was presented consecutively, and neither eye openness nor eyebrow shape remained consistent from one image to the next, to ensure that the entire face changed in front of the participants. Between each image, there was also a blank screen to ensure that participants would notice that the image had changed. To counterbalance, the images were shown twice, in two differently ordered sets of nine. A total of 18 images were displayed in numerical order (see Appendix D).

Results

A 3 (eyebrow shape) X 3 (eye openness) within-subjects ANOVA was performed on ratings of hostility, scaled from 0-5. A Dunn's multiple comparisons test was used for all planned comparisons between the means (see Table 1). There was a significant main effect for eyebrow shape, $F(2,158)=1096.30$, $MS_E=.66$, $p<.001$. Participants rated inward eyebrows as significantly more hostile than outward eyebrows, $t(158)=43.28$, $p<.01$, and neutral eyebrows, $t(158)=37.62$, $p<.01$. Also, participants rated neutral eyebrows as significantly more hostile than outward eyebrows, $t(158)=5.66$, $p<.01$. For eye openness, the variances for each level were found to differ greatly from each other. Mauchly's sphericity test was used to assess the equality of these variances. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2)=20.44$, $p<.001$, therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity, $\epsilon=0.81$. This correction was applied to improve the validity of the F -ratio's significance value.

After correction, the main effect of eye openness was found to be statistically significant, $F(1.63, 128.40)=112.36$, $MS_E=.62$, $p<.001$. Participants rated less open eyes as significantly more hostile than very open eyes, $t(158)=14.47$, $p<.01$, and neutral eyes, $t(158)=10.57$, $p<.01$. Participants also rated neutral eyes as significantly more hostile than very open eyes, $t(158)=3.90$, $p<.01$.

For the interaction between eyebrow shape and eye openness, the variances for each level were found to differ greatly from each other. Mauchly's sphericity test was used to assess the equality of these variances. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(9)=43.95$, $p<.001$, therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity, $\epsilon=0.78$. This correction was applied to improve the validity of the F -ratio's significance value. After correction, the interaction between eyebrow shape and eye openness was found to be statistically significant, $F(3.11, 245.42)=7.62$, $MS_E=.43$, $p<.001$ (see Figure 1). Participants rated inward eyebrows paired with less open eyes as significantly more hostile than inward eyebrows paired with very open eyes, $t(316)=8.10$, $p<.01$, inward eyebrows paired with neutral eyes, $t(316)=8.97$, $p<.01$, outward eyebrows paired with less open eyes, $t(316)=30.02$, $p<.01$, and neutral eyebrows paired with less open eyes, $t(316)=27.29$, $p<.01$. Participants also rated inward eyebrows paired with very open eyes as significantly more hostile than outward eyebrows paired with very open eyes, $t(316)=32.89$, $p<.01$, and neutral eyebrows paired with very open eyes, $t(316)=30.48$, $p<.01$. Participants' hostility ratings for inward eyebrows paired with neutral eyes were significantly higher than outward eyebrows with neutral eyes, $t(316)=29.80$, $p<.01$, and neutral eyebrows paired with neutral eyes,

$t(316)=22.95, p<.01$. Additionally, neutral eyebrows paired with less open eyes were rated as significantly more hostile than neutral eyebrows paired with very open eyes, $t(316)=11.28, p<.01$, and neutral eyebrows paired with neutral eyes, $t(316)=4.63, p<.01$. Outward eyebrows paired with less open eyes were rated as significantly more hostile than outward eyebrows paired with very open eyes, $t(316)=10.80, p<.01$, and outward eyebrows paired with neutral eyes, $t(316)=8.58, p<.01$. Furthermore, hostility ratings for neutral eyebrows paired with neutral eyes were significantly higher than outward eyebrows paired with neutral eyes, $t(316)=6.85, p<.01$.

It was found that hostility ratings for inward eyebrows paired with very open eyes as compared to inward eyebrows paired with neutral eyes was not statistically significant, $t(316)=.87, p>.01$, outward eyebrows paired with neutral eyes as compared to outward eyebrows paired with very open eyes was not statistically significant, $t(316)=2.22, p>.01$, neutral eyebrows paired with very open eyes as compared to outward eyebrows paired with very open eyes was not statistically significant, $t(316)=2.41, p>.01$, and neutral eyebrows paired with less open eyes as compared to outward eyebrows paired with less open eyes was not statistically significant, $t(316)=2.89, p>.01$. Six participants' data were excluded before analyses due to a failure to follow instructions.

Discussion

The results of this study support the hypotheses that inward eyebrows would produce the highest hostility ratings, less open eyes would produce the highest hostility ratings, and the combination of the two would produce the highest hostility ratings. Between eyes and eyebrows, the results showed that essentially, the eyebrows were the more important part of the

face, ultimately determining which emotion is communicated.

The more the eyebrows were arched inward, the more hostile they were perceived. This was seen when comparing eyebrow types; inward eyebrows were rated the most hostile, and neutral eyebrows were rated more hostile than outward eyebrows. The effect was not as substantial for the eyes, but the trend is similar. Eyes that were less open were rated as the most hostile, and neutral eyes were rated as more hostile than very open eyes. It is inconclusive whether neutral eyes are more hostile than very open eyes when paired with inward eyebrows; whether neutral eyebrows are more hostile than outward eyebrows when paired with less open eyes; whether neutral eyes are more hostile than very open eyes when paired with outward eyebrows; and whether neutral eyebrows are more hostile than outward eyebrows when paired with very open eyes.

One of the possible reasons the results were drastically significant is that the differences between each facial stimulus's hostility levels were obvious for some comparisons. For example, when comparing a face with inward eyebrows to a face with outward eyebrows, a significant difference in hostility ratings is almost guaranteed. However, the significance of some comparisons was not obvious, despite the previously mentioned factors. For example, neutral eyebrows were rated as significantly more hostile than eyebrows that were arched outward. While this certainly does not define a neutral facial expression as hostile, it does describe it as less friendly than a face with outward eyebrows. To lessen the effect of this factor and strengthen the overall design, future research could focus on the differences between different degrees of the arch on inward eyebrows and compare them to other inward eyebrows,

rather than comparing inward eyebrows to neutral and outward eyebrows.

Other research has found that bigger eyes make a face seem less angry (Sacco & Hugenberg, 2009). This finding is in line with the results of this study; neutral and very open eyes were perceived as less hostile than less-open eyes. Also, previous research has shown that “V-shaped” eyebrows are the key component to perceiving a face as threatening (Lundqvist et al., 1999). The results support this claim when considering a threatening facial expression as synonymous with one that is hostile; eyebrows influenced facial expression perceptions the greatest, and eyebrows that were arched inward had the highest hostility ratings.

Since the present study only focused on the eyes and the eyebrows, the results are limited in application to that region of the face. Another study has shown that the shape of the mouth has a significant effect on the perception of emotion in the face (Lundqvist et al., 1999). It is possible that including the mouth could define the effects of either the eyes or the eyebrows in a different way than what the present results portrayed. For the same reason, it is also possible that including all of the face’s features could redefine the overall effects of the eyes or eyebrows.

These results are important because they can help illustrate how humans perceive emotion, and what takes priority in the inner processes of judging facial expressions. Additionally, they can be generalized to common facial expression recognition. Between the eyes and the eyebrows, the results show that the eyebrows are the most important. However, this is limited only to the upper portion of the face. When the entire face is brought into consideration, the eyes and eyebrows may have a different effect on how a certain emotion may be processed. The results also imply that the individual parts of the face

have a different magnitude when judging facial expressions; the eyebrows were considerably more effective than the eyes in making a facial expression appear hostile. In contrast, the importance of specific facial features could be different for other emotions. Future studies could consider different parts of the face, or focus on different portions of the face. In essence, the next step to further this research is to expand and incorporate more parts of the face to evaluate which facial features have the greatest influence on perceived emotion through facial expressions.

References

- Bassili, J. N. (1979). Emotion recognition: The role of facial movement and the relative importance of upper and lower areas of the face. *Journal of Personality and Social Psychology*, 37, 2049-2058.
- Boucher, J. D., & Ekman, P. (1975). Facial areas and emotional information. *Journal of Communication*, 9, 21-29.
- Ekman, P., Friesen, W. V., O’Sullivan, M., Chan, A., Diacoyanni-Tarlatzis, I., Heider, K. . . Tzaravas, A. (1987). Universals and cultural differences in the judgments of facial expressions of emotions. *Journal of Personality and Social Psychology*, 53, 712-717.
- Fox, E., & Damjanovic, L. (2006). The eyes are sufficient to produce a threat superiority effect. *Emotion*, 6, 534-539.
- Hareli, S., Shomrat, N., & Hess, U. (2009). Emotional versus neutral expressions and perceptions of social dominance and submissiveness. *Emotion*, 9, 378-384.

- Izard, C. E. (1971). *The face of emotion*. New York, NY: Appleton-Century-Crofts.
- Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin*, *115*, 288-299.
- LeMoult, J., Joorman, J., Sherdell, L., Wright, Y., & Gotlib, I. H. (2009). Identification of emotional facial expressions following recovery from depression. *Journal of Abnormal Psychology*, *118*, 828-833.
- Lundqvist, D., Esteves, F., & Öhman, A. (1999). The face of wrath: Critical features for conveying facial threat. *Cognition and Emotion*, *13*, 691-711.
- Sacco, D. F., & Hugenberg, K. (2009). The look of fear and anger: Facial maturity modulates recognition of fearful and angry expressions. *Emotion*, *9*, 39-49.
- Tipples, J., Atkinson, A. P., & Young, A. W. (2002). The eyebrow frown: A salient social signal. *Emotion*, *2*, 288-296.

Table 1

Mean Hostility Ratings and Standard Deviations for Each Facial Stimulus

	<i>M</i>	<i>SD</i>
Eyebrow Shape		
Arched Outward	0.81	0.62
Neutral	1.23	0.70
Arched Inward	4.02	0.56
Eye Openness		
Very Open	1.58	0.52
Neutral	1.86	0.59
Less Open	2.62	0.72
Interactions		
Eyebrow Shape / Eye Openness		
Outward / Very Open	0.36	0.57
Outward / Neutral	0.59	0.82
Outward / Less Open	1.48	1.12
Neutral / Very Open	0.61	0.79
Neutral / Neutral	1.30	0.87
Neutral / Less Open	1.78	1.13
Inward / Very Open	3.77	0.77
Inward / Neutral	3.68	0.82
Inward / Less Open	4.61	0.56

Eye openness by eyebrow shape

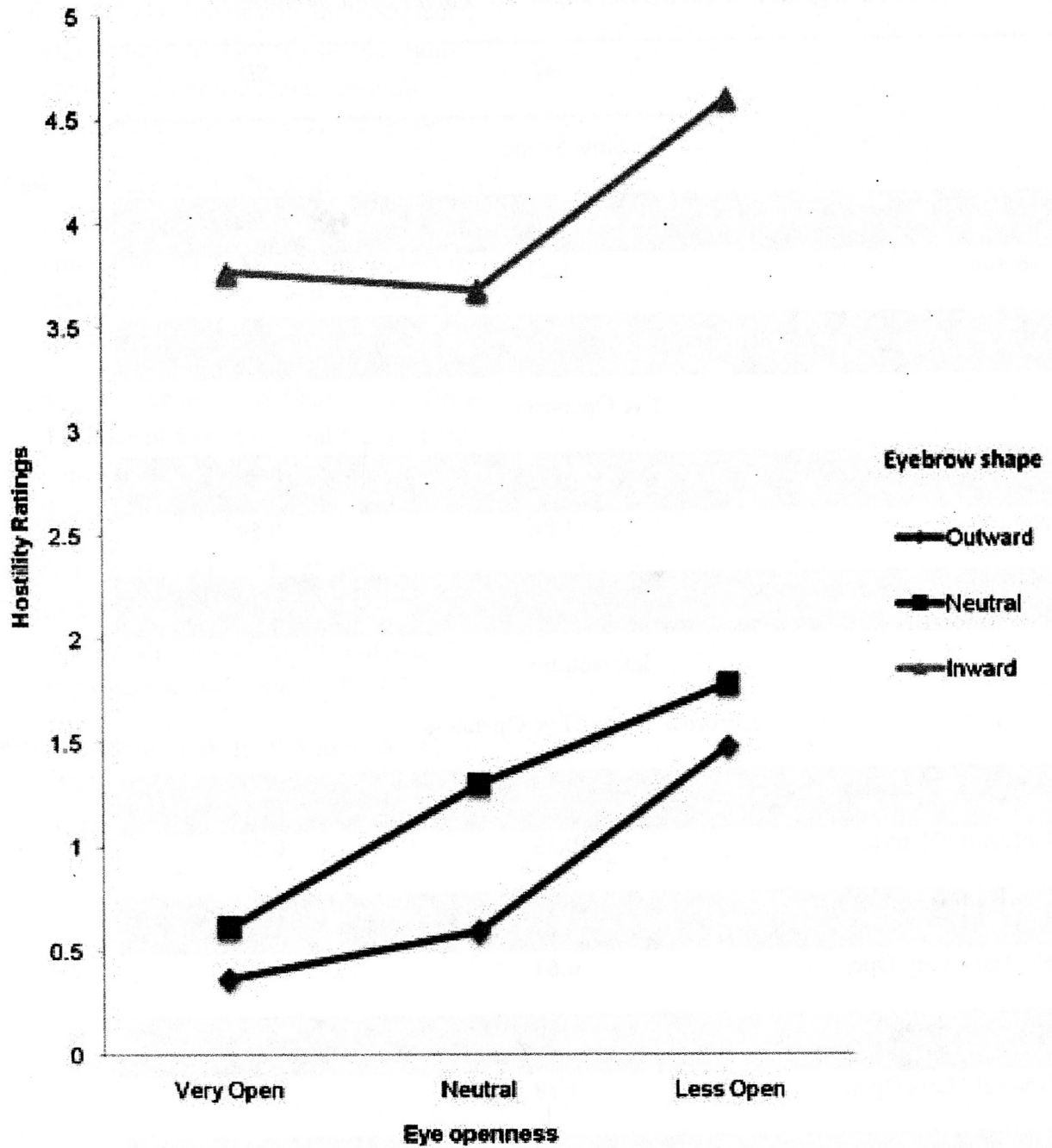
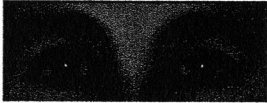
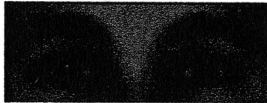


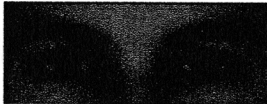
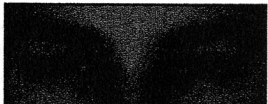
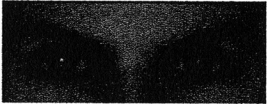
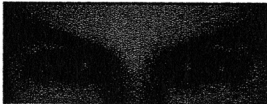



Figure 1. Mean hostility ratings for each interaction.

Appendix A

Facial Stimulus Images

		Eye Openness		
		Very Open	Neutral	Less Open
Eyebrow Shape	Eyebrows Arched Outward			
	Neutral			
	Eyebrows Arched Inward			

Appendix B

Participant Ratings Sheet

Instructions: Rate each face based on the following scales.

Circle One for each emotion.

Hostility	Friendliness	Happiness
0 - Not at all hostile	0 - Not at all friendly	0 - Not at all happy
1 - Slightly hostile	1 - Slightly friendly	1 - Slightly happy
2 - Somewhat hostile	2 - Somewhat friendly	2 - Somewhat happy
3 - Moderately hostile	3 - Moderately friendly	3 - Moderately happy
4 - Very hostile	4 - Very friendly	4 - Very happy
5 - Extremely Hostile	5 - Extremely friendly	5 - Extremely happy

<p>1 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>2 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>3 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>
<p>4 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>5 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>6 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>
<p>7 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>8 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>9 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>
<p>10 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>11 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>12 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>
<p>13 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>14 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>15 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>
<p>16 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>17 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>	<p>18 Hostility 0 1 2 3 4 5 Friendliness 0 1 2 3 4 5 Happiness 0 1 2 3 4 5</p>

Demographics

Age _____

Gender: M F

Major: _____

Year in School (Check one)

Freshman

Sophomore

Junior

Senior

Graduate Student

Appendix C

Informed Consent

You must be 18 years or older to participate in this study. If you are not, please stop now.

This study is being conducted by Bradford Schroeder, a Tennessee Technological University student, as a requirement for a research methods course. The purpose of this study is to research the effects of facial features and emotional perception. Your participation will involve rating 18 faces for three different emotions. The study will take about five minutes to complete. Your participation is strictly voluntary, and at any time you may quit the study without any penalty. Your responses will be held confidential. By signing this form, you are volunteering to participate in this study. If you have any questions or would like to learn about the results of the study, please email blschroede42@tntech.edu.

Participant Name (PRINT)

Participant Signature

Date

Bradford Schroeder

3/22/2010

Appendix D
Image Projection Sequence

