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The Impact of Schemas on the Placement of Eyes While Drawing.

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Abstract. The impact schemas have on individuals engaged in drawing has not been researched much. Studies have been conducted with people drawing cylinders, parallelograms, or tables, but little research has been completed involving people drawing human faces. When individuals are asked to draw a geometric object, even when the object is in front of them, the drawing is distorted from the original shape. Can the average individual accurately depict the location of eyes on a face? Participants were asked to correctly place facial features on the outline of a face. As an independent variable, participants were given one of two conditions. Half the participants were required to move all facial features to a blank face. Another group was asked only add the eyes onto the blank face. The dependent variable was the placement of the eyes. The test only measured participants' ability to accurately place the eyes on the outline and not the other facial features. When placed accurately, the eyes should be placed half way between the top of the head and the bottom of the chin. Results showed that those in the only eyes condition performed better than those in the all facial features condition when it came to placing the eyes.

There are questions about how schemas distort the true perception of an object. A schema is defined as the way the mind categorizes and perceives information. For instance, a triangle, square, and cylinder define a schema of shapes. When perceiving a new object, like a circle, one uses a schema to categorize that circle as a shape. Gombrich (2004) defines a schema as a "memorized ideal" of an object. Schemas may make processing new information difficult. A "memorized ideal" might cause distortions when perceiving an object. A distortion is defined as any variation from the object's true form when perceived.

Cohen and Jones (2008) explained that causes of distortion happen while the object is being viewed and not during encoding. A series of experiments conducted in the study had participants look at a picture of a window and then select a rectangle or trapezoid with dimensions and angles that closest represented the window in the picture. The first experiment had the participants select a trapezoid while looking at the window. The results showed that participants were more likely to pick a view that was more rectangular than the true dimensions of the window. Most individuals had a schema of a window when being looked at straight on, which led to picking more rectangular representations of the window.

A second experiment tested the participants' observation of a window again, but with varying amounts of time before being tested. There were five levels of time delay: simultaneously, immediately, after 15 seconds, after 60 seconds, and after 150 seconds. The results showed that across all different time groups there was no difference in an individual's ability to pick a trapezoid with similar dimension to the window. All groups made the same error, picking out a more rectangular window than the correct outline, because their schemas were influencing their perception. In other words, participants should have been more accurate the less time they had to process the information because additional processing time would have made it possible for the cognitive system to integrate sensory input and stored schemas and produce more errors with more processing time. Because the amount of time had no influence in the distortion, these results suggest that when the window was initially viewed was when the perception error was made. From these results, Cohen and Jones concluded that distortions happen upon viewing an object.

Mitchell, Ropar, Ackroyd, and Rajendran (2005) had a series of experiments where they asked participants to depict a parallelogram or a table. The table was simply the parallelogram with legs added to it. In the first experiment, the participants were given a vertical table or parallelogram and asked to match the object when it was turned 90 degrees. Participants would move two sides of the object until they felt it was accurate. It was found that the table form was more likely to be distorted than the parallelogram. Mitchell et al. attributed this to the schema of a table that was activated by the addition of legs to the parallelograms. In a second experiment, the participants were asked to draw either a pair of tables or parallelograms from memory or from observation. They found that those that had to recall and draw a table from memory produced the most distorted drawings.

Matthews and Adams (2008) further tested the difference between drawings from memory and from observation. Matthews and Adams used drawings of cylinders to measure distortion caused by schemas. The participants were asked to draw a cylinder from memory. Once finished, they were asked to draw one from observation. When the two drawings and the observed cylinder were compared, it was found that the drawings were more similar than the observed cylinder. The drawing of a cylinder recalled from memory was distorted due to the idealized form participants already had in place when thinking of cylinders. The observable cylinder drawing distortions happened because the schema of a cylinder cannot be overcome. Because the schema of a cylinder interferes with drawing both from observation and from memory, the two drawings looked more similar than the true cylinder's form. Matthews and Adams' study suggests that when a schema is already in place, it is more difficult to draw from observation. Thouless (1931) observed the interaction between schemas and observation in a study asking participants to draw a circular disk based on the way it was perceived from where they were. Instead of the flat ellipse they should have drawn, the participants made a more circular form. Thouless concluded that previous stored knowledge interfered with the participants' ability to accurately depict the elliptical shape.

Cohen and Bennett (1997) completed a study that defined two major phenomena that would explain why errors occur in drawing. The first was illusion; they defined it as the way perception does not accurately depict the physical world. An example of an illusion can be when one is looking at the horizon, it may appear flat, but the horizon is actually curved. The second term was delusion; they defined this as the beliefs one holds about objects or space that is not true. Delusions can be changed through an act of will. Schemas and delusions both contribute to challenges in drawing and perception.

Mundy (2014) completed a study that primed participants to change the way they processed pictures of the Muller-Lyer illusion. The Muller-Lyer illusion is a set of two lines with arrows added to the ends that point opposite directions. The two lines are equal in length, but due to the direction the arrows are pointing one line looks longer than the other. Mundy primed three groups of individuals using different stimuli. The three groups were assigned to global, local, and control conditions. The global condition stimuli primed the participants to focus on the full length of the line including the arrows. The local condition stimuli primed the participants to focus on the body of the line and ignore the arrows. The control group was given no priming stimuli before the test. In the test, participants were asked whether or not the length of the two lines (not including the arrows) in a Muller-Lyer illusion were even. Global participants were more likely to state the two lines were not even in length, because they were primed to focus on the full length of the two stimuli, including the arrows. The local participants had less error in recognizing the length of the lines as even, because they were primed to see the lines and ignore the arrows of the stimuli. The control participants were wrong more often than the local participants, but more often right than the global participants. Mundy's study suggested that with the right priming before the stimuli, it is possible to overcome delusions.

Gregory (2008) explains that when expectations of an object are in place it is hard to convert our three-dimensional knowledge to a two-dimensional drawing, thereby causing distortion. When we view an object, we see the object three-dimensionally. While we may be viewing an object while standing slightly above it, we may still perceive that object as if we are standing at eye-level with it. When asked to draw a chair, an individual will likely have a previous memory interfere that will cause the individual's drawing to become distorted. Gregory's explanation assists Thouless' (1931) disk drawings, Matthews and Adams' (2008) cylinder drawings, and the study of Mitchell et al (2005) on tables and parallelograms. In those studies, there was an error in perception that led to distortion.

While there are some research studies that have been done on how schemas affect the way we can accurately perceive an object, and therefore draw it, there has been little research relating to how schemas could distort the ability to accurately depict a human face. Research conducted on perception of the human face by Mondloch, Le Grand, and Maurer (2002) provided insights on the ways adults and children process human faces. The stimulus of a female face was manipulated through three different methods: featural, spacing, or contour. Featural recognition is the ability to recognize a face based on facial features. Spatial recognition is based on the specific spacing in between facial features. Contour recognition is the outer edge of a face. Participants were asked to identify pictures of faces that seemed like sisters to the original female face. Their results suggest that children can only identify faces based on the contour of the face. Adults were able to pick similar faces based on all three types of information. Since the adults had more strategies for identifying faces than children do, these results suggest that children learn different types of strategies for identifying faces as they get older. This information is important when choosing an age to test a hypothesis about how the human face is perceived.

Balas and Sinha (2007) completed a similar study with identification of celebrities' faces. Participants were asked to move facial features of famous celebrities from the bottom of a computer screen to recreate the celebrities' faces with no outline in one test and then a second time with the outline of the celebrities' faces. They found that the first task, without an outline, had greater error than when the participants were able to use an outline to act as a guide. These results suggest that humans use the contour of an individual's face to help identify someone.

Young, de Haan and Bauer (2008) also tested the recollection of celebrities. They asked participants who were familiar with celebrities to identify them based on just one of their facial features. The results show that participants could not identify someone based on one facial feature alone. They found at least two features were required before a celebrity could be identified. This study suggests the viewing of faces to be more closely related to a gestalt process, which is why it is hard to identify someone from only one facial feature.

Edwards (1979) notes how facial features cause error in drawings depicting proportions of the human skull correctly. She refers to this phenomenon as the "Cut-off Skull Syndrome." Edwards describes this phenomenon as the grouping of facial features, which she believes causes the forehead to be forgotten about and the skull flattened even when drawing from observation. She has observed over years of teaching that individuals are more likely to draw facial features closer together and more centered on a face than what is accurate. This drawing phenomenon is widespread. Most people who just begin drawing fall victim to this phenomenon. Famous artists, like Van Gogh, have also had this phenomenon happen to them. She states that mathematically, the eyes are a midway point vertically from the top of the skull to the bottom of the chin. The distance from the top of the skull to the eyes should be roughly the same distance as from the eyes to the chin. Edwards noticed that many people fall victim to the "Cut-off Skull Syndrome," but she never tested this.

This study tested participants' abilities to place eyes on a face. The study had one independent variable, the amount of facial features that needed to be placed on the face. One group was asked to just place eyes on a blank face. The other group was asked to place all facial features on the face (see Appendix A). The dependent variable was the distance, in pixels, from the top of the head to the eyes. The first hypothesis for this study tested the "Cut-off Skull Syndrome." It was predicted that participants who were asked to place only the eyes will place the eyes more accurately than the students asked to place all facial features.

The second prediction was that art major participants would more accurately place eyes, regardless of condition than the non-art major participants. Art students are taught to overcome delusions in perception. Many schools reference Edwards' "Cut-off Skull Syndrome" while teaching proportions in drawing classes. Therefore, art-major participants would be more likely to place the eyes more accurately than non-art major participants.

Method

Participants

Forty-six participants were recruited by volunteer sign-up boards in the Psychology department at Minnesota State University Moorhead. Participants were primarily undergraduates at Minnesota State University of Moorhead. The sample consisted of 25 women and 21 men. Participants recruited had a limited art background. Forty-four had taken no art classes in college and had limited experiences in high school with art. The remaining two students were identified as art majors in their fourth year of college. Students may have been given credit towards one of their classes for completing the study depending on their instructor. All participants were treated according to the ethical guidelines of the American Psychological Association.

Materials

The materials were similar to those used by Balas and Sinha (2007). Participants were asked to use Paint, a program invented by Microsoft, on a Sony VAIO laptop and to drag facial features from the right of the screen to the correct location on an outline of a face. The participants were given a mouse to make the process easier. The posters and mirrors within the room were removed so participants could not use as references.

Procedure

Before the study started, all participants were asked to read and sign an Informed Consent form. From this between-subjects design, participants were measured on their ability to accurately place eyes on a blank face. The independent variable was the number of facial features participants were asked to place on the outline. Half of the participants were given a blank face and asked to drag the eyes, mouth, nose, and ears to the location on the face; this group will be referred to as the "all facial features" group.

The other half of the participants were only asked to place the eyes where they think they should go; this group will be referred to as the "eyes only" group. This process was not timed, but most participants were finished within two minutes. When participants finished moving the facial features, the picture was saved to later use for data collection. The dependent variable was the distance the eyes are to the top of the head, measured in pixels. The participants were asked to rate their art background on a Likert scale. The participants' responses on the Likert scale were also coded to compare to the facial features exercise portion of the study to see if art background changes the participants' performance (see Appendix B for questionnaire given to participants). After the study, the participants were debriefed.

Results

The independent variable had two levels: placement of all facial features or only the eyes. The dependent variable was the distance in pixels from the top of the blank face outline to the corner of the eyes.

An independent-samples *t*-test was conducted to compare eye placement in pixels in the all facial features group to the only eyes condition. There was a significant difference in the scores for all facial features (M= 150.25, SD=19.31) and only eyes (M=164, SD=19.53) conditions, $t(45)=-2.43$, $p=.019$, Cohen's d=0.71. See Figure 1 for a bar graph comparing the conditions.

The individuals that were asked to place all facial features, on average, placed the eyes 14 pixels higher than those that only placed the eyes (see Figure 2). Furthermore, those placing all facial features placed the eyes 50 pixels, or 12.5%, higher than the correct location for the eyes. Those in the only eyes condition did not place the eyes as high as the individuals who had to place all facial features. They were still, on average, placing the eyes 36 pixels above where they should have been.

Due to the limited art major participants, the difference between art major participants' performance and non-art major participants was unable to be tested.

Discussion

The first hypothesis tested if the eyes only group would more accurately place the eyes than the all facial features group. The expected results, based on Edwards' (1979) observations that the grouping of facial features causes distortion, were that the group that was asked to place all features placed the eyes even higher than the group asked only to place the eyes. This hypothesis is supported with the data gathered in this study. These results suggest that the more facial features that are present the more likely an individual is to place the eyes too high.

The eyes only group was more accurate at placing the eyes than the all facial features group. However, the eyes only participants were still placing the eyes closer to the top of the head than they should have been. The remaining difference between where the eyes were placed by the group and the accurate placement of the eyes can be explained by interference with schemas. In the process of debriefing the participants, many noted how, in their minds, eyes were higher on the face than where they should have placed them to be accurate.

The distortions caused by memory in placing eyes are consistent with other studies where schemas interfered with perceptions while drawing (Matthews and Adams, 2008; Mitchell et al., 2005; Thouless, 1931; Gombrich, 2004). The present study used different stimuli than the previous studies. Thouless (1931) used a simple flat disc; Matthew and Adams (2008) used a cylinder; Mitchel et al. (2005) used a table. This study expanded our understanding of objects that schemas can distort while drawing.

A potential confound in this study could have been the difficulty some participants may have experienced in using Paint. I made sure to clearly explain the instructions and was close by if they needed help, but that does not mean they felt comfortable with the program or asking for help.

The second expected result was that art major participants would be more accurate in their placement of eyes than the non-art major participants. This hypothesis was unable to be tested. While running participants, their artistic background was noted to test for an impact of experience on the results. This portion of the study had limitations because the sample group used had no art experience in college, with the exception of two participants. Ideally, it would have been best to obtain large groups of individuals from all artistic backgrounds to split amongst the two levels of the independent variable to determine how the level of drawing experience could have effected eye placement. Further studies could look into the difference between art majors and non-art major participants.

From the current study, there is support to Edwards' (1979) "Cut-off Skull Syndrome." The data gathered in this study can be used when teaching individual's how to draw faces. If an individual was to start by drawing the location of the eyes on a face and then adding in the other facial features, the individual may find his drawing to be more accurate than those that do not start with the eyes.

It also explains yet another way schemas can affect our memories. This study displayed new objects that become distorted through memories. This information could be useful when it comes to the process of making police sketches to catch criminals. With further research, there may be a way to minimize distortion that happens when drawing a human face from memory. Most importantly, through this study, many new questions may be asked and addressed in further research on the topic.

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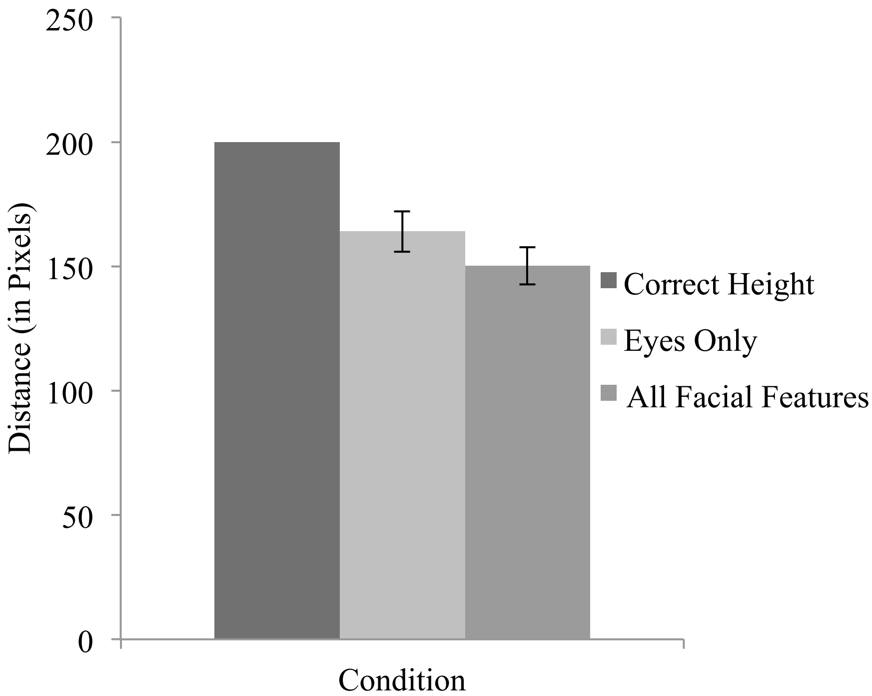

Figure 1 A table comparing the distance from the top of the head to the corner of the eyes for the two conditions and the correct placement.

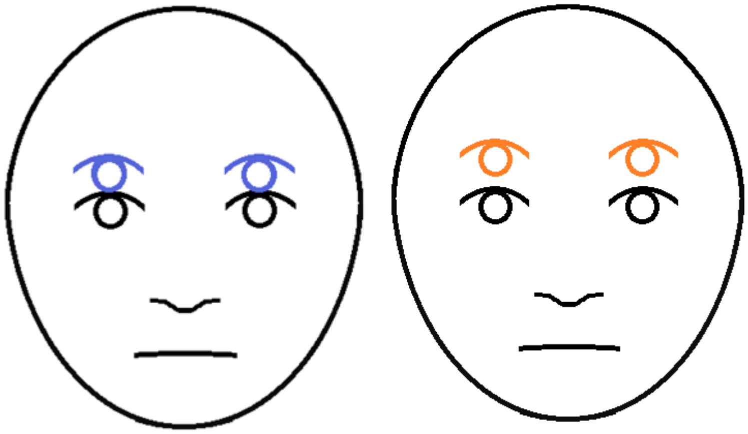

Figure 2.A completed face with a comparison (in blue) where those in the only eyes condition, on average, placed the eyes. A completed face with a comparison (in orange) where those in the all facial features condition, on average, placed the eyes.

Appendix A

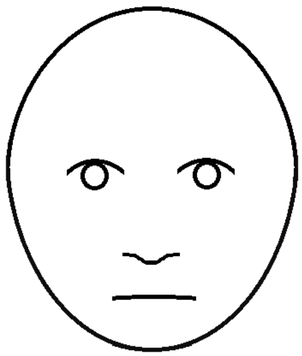

Figure A The sample face to be used for the experiment.

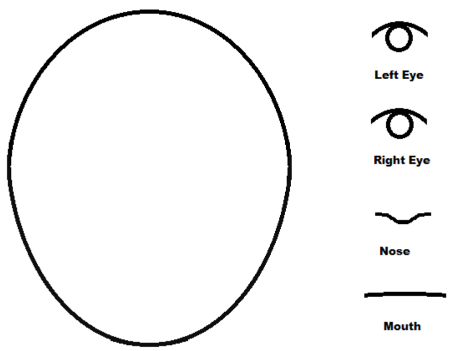

Figure B A face outline used by the all facial features group.

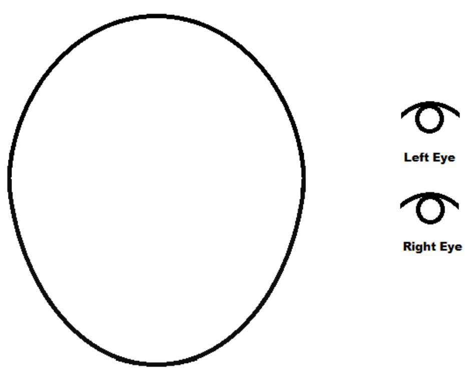

Figure C A face outline used by the only eyes group.

Appendix B

The questionnaire to be filled out by participants.

Participant Code: ________
Condition: ______
What previous art experience have you had? Please respond based on the scale below.
0 – No previous art experience.
1 – Some art in high school
2 – Some art in high school and draws for fun
3 - Some art in college
4 - Art Major in college