15.301 study on the effects of robotic facial features on perceived teachability

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Abstract

As researchers in the area of Artificial Intelligence work to create humanoid robots that will interact with people, it is increasingly important to create these robots with faces that are friendly and teachable. Our study surveyed 188 individuals to determine which robotic facial features correspond to different personality types. We conclude that the presence of certain individual features as well as certain combinations of features are universally seen as both friendly and teachable no matter what an individual's sex or occupation. This research should help future projects in creating more friendly and teachable robots.

Acknowledgments

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1 Introduction

Robotics is an emerging field and is rapidly becoming more and more a part of our everyday lives. If people are to interact with robots on a personal basis, it is very important that the visual interface between robot and human provide the impression required for the function of the robot. For example, the face of a robot used for security patrol in a building would be very different than the face of a robot that might take your order in a restaurant.

This topic of research was born from the needs of researchers at the Massachusetts Institute of Technology Artificial Intelligence Lab. They found that in their experiments, the reaction of individuals to their robots varied widely with the appearance of the robot face. As robot-human interactions becomes more common in future research there will be a need to fully understand what people think and feel about robots, beyond the actual task the machines are performing. If we can begin to understand what people feel about a robot from its appearance, and why they feel that way, it will assist in the progress of robotic technology in our everyday lives.

The first step in the human-robot interface is the design of the robotic face. Our study allowed participants to associate certain robotic facial features with a variety of personalities. Using the technology provided by the web, we were able to provide an interactive web page that individuals could use to create robot faces. We correlated the facial features that people chose with the personalities presented. Since the survey was available on the web, our sample set could be fairly large and diverse. We extended this survey to members of the MIT community and friends and family outside the community. We felt that it was important to get a diverse sample set to ensure that there was no secondary effect of education or experience that could influence results.

We expect that the question of what features people find appealing for a given situation is not as subjective as it may seem. There are many influences on what we find appealing as humans and they vary greatly from one society to another. Since almost all of the individuals will have been exposed to American culture for a significant amount of time we can assume that they have the same general influences on their opinion. There is a good chance that influences from society that we may not be aware of (children's TV shows, subway ads, old sci-fi movies, etc.) have a distinct influence on opinions.

In the next section we will explain the current research from available literature followed by an explanation of our survey. We will then present our hypothesis. The section after that will describe in detail how the survey was implemented. Following that, we analyze the data, discuss the findings, and present our conclusions.

2 Theory and Hypothesis

2.1 Related work

Ongoing research in the Artificial Intelligence Lab at MIT involves designing and building robots that will look and act as much like humans as possible. Much of the design and construction has thus far focused on the mechanical constraints and movements necessary to communicate verbally and non-verbally (mainly through body language). The research is based on contemporary models of learning and development in infants and young children, and on normal social interaction between humans, particularly between two humans in a teacher-pupil relationship. [5]

Until recently, researchers at the lab had left largely unexplored the contribution of physical appearance to the social interactions between a human and a robot. Various research has brought to their attention the importance of appearance, specifically facial, to the way human beings interact with each other and with the inanimate objects around them. Facial expressions are important in conveying the "emotions" of the robot in order to evoke the appropriate response from the human caretaker. [1]

The object of this area of research at the lab is to create a humanoid robot that the average non-techie would find approachable and teachable. This task should be accomplished while simultaneously satisfying the mechanical constraints necessary for the robot to perform the desired functions. In their exploration of the relationship between appearance and perceived personality, the AI scientists are asking themselves two questions. First, how do we design faces for our existing robots? Cog, one of the first humanoid robots designed in the lab, is comparable in size to the largest human males. Researchers in the lab wanted Cog's human caretakers to interact with the robot as if it were a six or seven year old child. Because of this, they needed to compensate for this in the facial features of the robot. But the question remains, how to compensate? [3]

The second question is How do we design from scratch new robots that display the desired personality and still fit the necessary mechanical constraints? Now that they have begun to consider the importance of physical appearance, they can design the aesthetic and mechanical characteristics in conjunction with one another.

This leads to our project: Given a set of constraints similar to those the lab might face, what general types of facial features convey the desired (or undesired) personalities?

The ultimate goal of the humanoid robot project's interest in the link between facial features and perceived personality is to create robots that the average person would consider approachable, teachable and closely resembling an elementary-aged child needing to learn. In our project we attempt to examine a small subsection of the broader question of what types of faces evoke what types of responses from a human caretaker.

2.2 Nomological Net Features

We used predetermined "personalities" given to the respondents of our survey and observed which facial features they associated with each personality. The facial features were supplied to the respondents and consisted of three different faces, eyes, and mouths. We hypothesized that the features a participant chooses for a given personality will be consistent among respondents.

The survey was web-based and consisted of a "make your own robot" interactive format. Respondents were given three scenarios: a child that wants to learn and needs to learn; a child that does not want to learn, although he/she may need to learn; and a child that does not appear to need to learn. With these scenarios we attempted to "measure" the personality of the robot in terms that hopefully will be helpful to the researchers at the AI lab.

For each of the three personalities, the respondent was given a scenario and a palette containing eyes, mouths, and heads of various sizes and shapes. The respondent was then asked to choose from among the given sets to create the robot he or she felt displayed the desired personality. The choices were recorded as data and the respondent then repeated the process for all three scenarios. At the end of the survey, the respondent was asked to answer some basic personal information questions regarding age, gender, and occupation.

Our hypothesis states that there will be specific features and combinations of features that will be very common for each profile. We also hypothesize that these features and combinations will be universal and not dependent on the individual observer.

Our construct is that specific facial features leads to specific perceived personalities. The variables we used were which faces were chosen for each personality and what the perceived personality was. The independent variables are the features chosen while the dependent variables are teachability and friendliness.

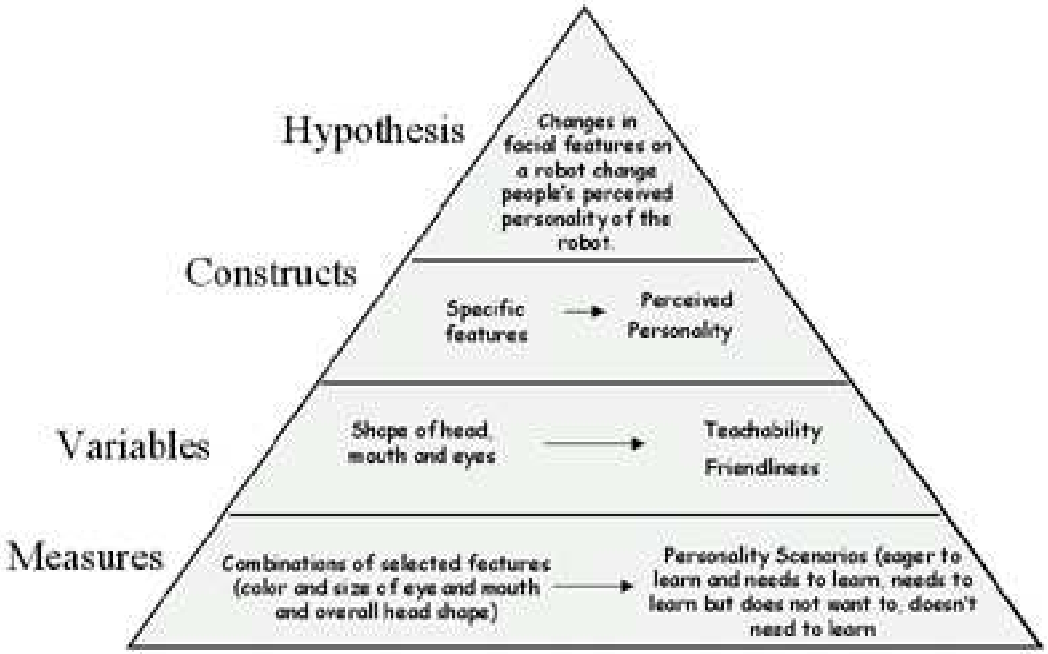


Figure 1: Nomological Net

3 Research Design

This survey was conducted entirely through the World Wide Web. The goal of the survey was to provide participants with a unique interface that would allow them to creatively express their particular preference for a face design with minimal constraints. We felt that giving them a set of faces to choose from would be too restrictive, so using web technology we created an interactive web page that allowed them to build a custom face given our controlled components.

3.1 Survey Technique

3.1.1 Front End

The entire front end of the survey was created using standard text editors. It is written entirely in HTML and over 250 lines of JavaScript. Many hours were spent debugging and generalizing the inner workings of the front end. The basics of HTML and JavaScript are beyond the scope of this

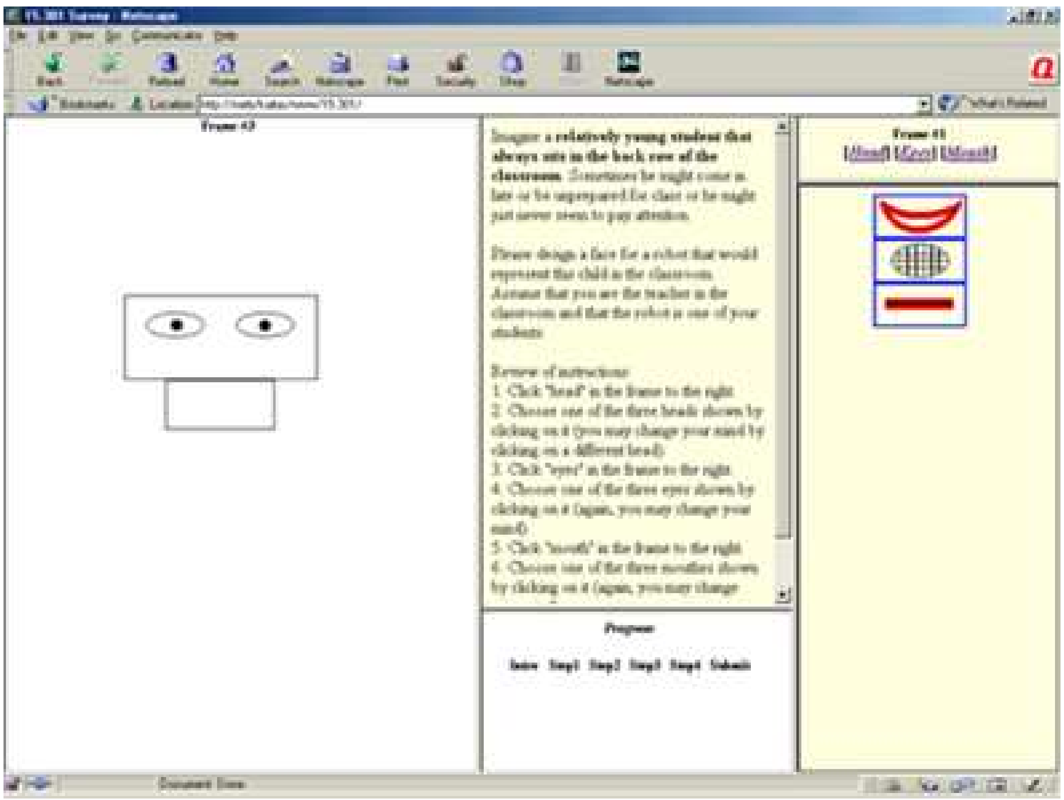


Figure 2: Survey Front End

paper; however, general design will be addressed. Full source for all documents can be found in the appendices. The HTML and JavaScript were hosted on the main MIT web server (`web.mit.edu`), running Apache.

The frameset for the index page sets one frame for each of face construction, data collection, instructions, selections and navigation (seen in Figure 2). The data collection frame also contains the progress monitor, and holds all information on face choices in a form that will ultimately be submitted to the server. The HTML is really a wraparound for the JavaScript that does the real work.

Faces are created by using layers in the face design frame. Each facial element goes on a separate layer. This allows individual positioning of facial elements, customizing the placement for each different head shape. Swapping the actual images is done with standard JavaScript. Between each set of instructions, or stage, the choices for the last constructed face are saved and the design pallet is cleared for the next stage. The functionality and implementation is straightforward. Perusal of the file `survey.js`, found in the appendix, will explain functionality. Attention was taken to carefully design the script to be easily scalable to many facial components if necessary. Arrays are defined to allow the administrator of the survey to define custom feature positioning for each head shape.

A participant takes the survey by going through the sequence of instruction pages. Initially, they are presented with general info about the survey, and other notices in accordance with the Committee on the Use of Humans as Experimental Subjects (COHUES). After that, they are prompted to select facial components and make a robot face that fits different personality types in a classroom setting. After they have created three faces, they are allowed to look at the three different faces and answer some questions about each one regarding their perception of its personality.

3.1.2 Back End

The back end for data collection was written entirely in VBScript using Active Server pages, hosted on Microsoft Personal Web server.

id	h1	m1	e1	h2	m2	e2	h3	m3	e3	age	oc	sex	11	12	13	14	21	22	23	24	31	32	33	34
18	1	1	0	2	0	1	1	2	0	20	5	0	4	5	6	5	0	1	0	2	4	4	4	4
19	-1	-1	-1	2	0	1	1	1	2	23	1	0	3	3	3	3	0	0	0	2	5	5	4	5

Table 1 - Sample data from response database

Data was collected into a Microsoft Access database (sample record shown in Table 1). Each response was given a unique ID to be used as the primary key in the database, and each unique selection in the survey was given a value. Each choice of facial feature had a value from 0 to 2 and each rating question was given a value from 0 to 6 (mapping to the range of 1 to 7 that the user was presented). A default value of -1 was entered if the user simply clicked through the survey without filling in any values. This is evident in Table 1, record 19. The user clicked through the first face without selecting any features, evidenced by the -1s.

The file `submit.asp` does the actual data insertion into the database. It uses a simple SQL insert and full source can be found in Appendix B.

3.1.3 Advertising, Response Rate and Sampling Population

The survey was advertised to a wide audience. The main targets were various mailing lists at MIT, totaling hundreds of students. One of the major lists was the course 6 general announcement list. In addition, the advertisement for the survey was posted to various USENET robotics interest groups. The USENET exposure reached thousands of individuals, although the actual population that read the announcement is impossible to judge.

In the end, we received a little over 200 responses. Many of those were completely invalid (all -1s). A small number were partially valid (-1s for one face), and the majority were entirely good data. Due to the technical nature of the survey and the non-standardized nature of the Internet browser market, we had numerous technical problems with the survey. The standard version of Netscape available on Athena worked with the survey (Communicator 4.7). Unfortunately, Internet Explorer could not handle the JavaScript in the survey. Also, it turned out that different builds of Communicator would handle the JavaScript differently, causing even more problems. We felt that a survey standardized to work on any Athena machine (the general MIT standard) was sufficient. We received a satisfactory number of responses from a somewhat diverse population (not all occupations were engineering), a fair amount of spread in age group, and a general gender spread leading to quality data.

3.2 Reliability and Biases

The main bias in this survey was that all the individuals that took the survey were Internet savvy. This, of course, is not the case of the entire population of the country and even less so for the population of the world. Our results, therefore, are only representative for a small subsection of the human population. We aimed to make the user interface as clear and easy to use as possible. It is not clear whether it was actually easy to use, since we did not have time to do extensive end user testing regarding the form of the survey. It is possible that people may have been confused by what data they were supposed to enter (evidenced by the numerous sets of all -1s for the first face). In addition, a small bug in the code resulted in gender information being lost for the first 80 individuals that took the survey. We did, complying with COHUES rules, allow people the option of skipping that question and therefore had to chalk those responses up as N/A.

4 Analysis

From those who responded to the survey, we received a total of 180 valid data sets. Of these 180, 167 had valid designs for Face 1, 179 had valid designs for Face 2, all had valid designs for Face 3 and 100 had a valid entry for gender.

We received completed or partially completed surveys from 68 males, 36 females, and 76 who either did not wish to disclose their gender or for whom a bug in the initial version of the survey prevented their gender selected from being recorded. Three respondents (1.7%) were younger than 18, 126 (70.8%) were between the ages of 18 and 22, 21 (11.8%) were 23 to 25 years of age, 13 (7.3%) were 26-30; 8 (4.5%) were 31-40; 6 (3.4%) fell within the 41-50 range and one respondent (0.6%) was over the age of 50.

Although we had hoped to reach people from a broad range of backgrounds and occupations, the vast majority of our respondents were engineers (60%) or scientists (21.1%). The remaining occupations were teaching (4.4%), medicine (2.8%), financial (2.2%), labor (0%), service (1.7%), and other (7.8%) which received fewer responses than hoped for.

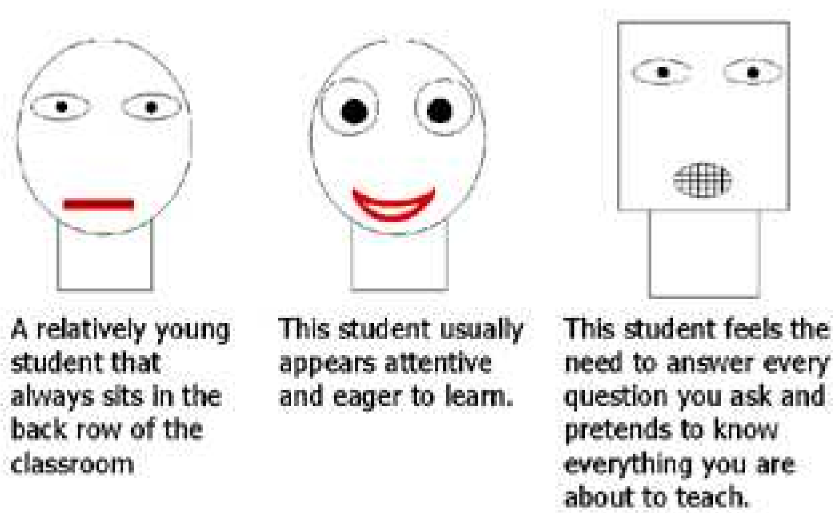


Figure 3: The most popular faces in our study

In comparing which features respondents picked to build their robot faces, we noticed some striking trends. Some features were more or less evenly split among a given face scenario and some features were definitely more favorable than others for a given face. In addition, certain combinations of heads, mouths, and eyes were more popular-with the most popular being the combination of each of the most popular features-while other combinations were hardly chosen at all. When asked to create the face of the young child uneager to learn, 46% chose the rounded face, 76% chose the straight red mouth, 47% chose the oblong black and white eyes, and 17% of respondents chose all three. For the eager and attentive robot face, 55% chose the round head, 77% the red smiling mouth, 64% the big round eyes, and 31% chose all three. In the case of the know-it-all robot, 41% chose the large square head, 53% the oval grid-shaped mouth, and the choice of eyes was split between the oblong eyes and the round ones at 35%. The most popular combination for the third robot included the oblong eyes, and 11% of respondents chose this combination. Perhaps surprisingly, the red beady eyes were the least popular in every face, even in those with the less-than-favorable descriptions.

Next we looked at whether or not a respondent's gender or occupation had any bearing on the features chosen. Regressions showed no correlation, although for our variables, the numbers assigned were more or less random. An occupation of 4 (labor) was no "higher" than one of 1 (engineering) or "lower" than 7 (other). Neither was the round head "greater" in any sense than the large square one. Such numerical distinctions were convenient for collecting data, but more or less useful for running regressions. In an effort to compensate for this, we broke down the data columns by individual occupation selections and computed the choice percentages for each feature within each of the seven fields of occupation. In doing so, we found no apparent distinction between occupations. We repeated the same breakdowns by gender, and among those who chose to respond, we found even less of a distinction between the females' choices and the males' choices.

An exercise in greater accuracy would be to rerun the survey and attempt to collect more data from non-technical fields.

We then computed a correlation matrix for all variables collected. The matrix elements indicated a strong correlation between a robot's teachability and its eagerness to learn (0.8), as expected. These results supported our original hypothesis that people tend to associate friendliness with teachability. If you were to make a robot that people considered friendly, you would be making a robot people would want to teach.

Finally, we looked at respondents' answers to the final questions regarding teachability, friendliness, and degree of aggressiveness/passivity. We separated those faces that respondents had placed at one extreme of the scale or the other and compared which feature combinations they corresponded to. The table in Appendix B shows the results of this breakdown.

5 Discussion

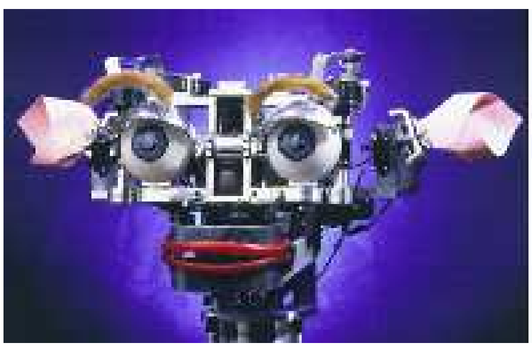
5.1 Support of our Hypothesis

We found that our findings strongly supported our hypothesis. For each scenario, certain facial features were more popular to a majority of participants. Also, certain combinations of features were shown to be more popular for each scenario. This is important because researchers are working to create a robot that can be accepted by the majority of people as teachable. Our results indicate that this is certainly possible. In all features and faces, the differences in percentages of people that chose one face or feature over another was independent of sex or occupation. No difference exceeded 15 percent. This shows that people's perceptions of friendly and teachable robotic faces is universal.

Our results are stronger than if we had shown participants fixed faces and had them rate each on different factors, because each participant in our study had to creatively construct each face from their own personal ideas of teachability and personality. We believe that getting very consistent results using this creative approach clearly shows that perceived personality results from specific physical characteristics.

5.2 Relation to other research

Current research in the area of humanoid robotics is very limited. The Cog and Kismet projects at the Massachusetts Institute of Technology's Artificial Intelligence Lab (MIT AI Lab) are the most well known of current research projects. These groups are attempting to create human-looking robots that are teachable by humans. To achieve these goals, both projects have created life-size robots with distinct faces. [5]



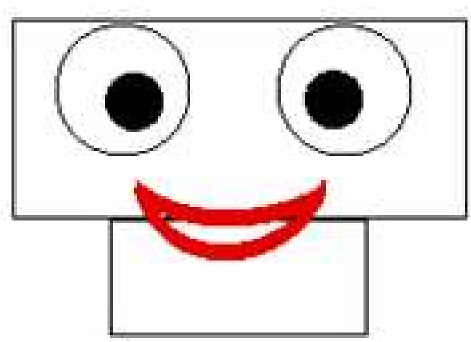


Figure 4: The Kismet robot from the MIT AI lab's Humaniod Robotics group and our representation of a Kismet-like robot. Kismet has a rectangular face, large eyes, and lips that can smile. **http://www.ai.mit.edu/projects/sociable/menzel-interest.web.JPG**

Kismet is a robot that would be represented in our survey by a long, rectangular head, big eyes, and smiling mouth. This was chosen by only 2 out of the 179 respondents for the teachable robot scenario (although 94 people chose the corresponding eyes and mouth). Our results show that an oblong, human shaped head would create a friendlier, more teachable robot. Other than head shape, the Kismet robot is in agreement with our results. The big eyes and red, smiling mouth in the survey were patterned after Kismet in an effort to see if Kismet's design really was the most teachable and friendly out of all of our combinations.

Other humanoid research is occurring in 3D graphics where actual human physical representations are drawn to create virtual characters that users can interact with through a computer screen or projector. We find no studies similar to ours in this area of research. Bates discusses creating animated "robots" for human interaction with expressive personality, much in the way that Disney makes its animated characters come to life. [2] Since computer graphics can be much more complex than a mechanical robot, these researchers have a greater degree of flexibility in choosing their representations. But even with this flexibility, all seem to prefer the most human form (round head, big eyes, and mouths with lips) when creating an agent for a user to interact with.

Breazeal argues that for communication it is more important for a robot to have emotional reactions that to have "superficial" facial features. [4] However, we find that it is important that a human wants to make the initial contact with a robot. We have shown that appearance plays a large role in a human's perceptions of a robot's personality. We do not deny the importance of emotion in the communication proces; however, emotion still has to be expressed through certain basic facial features. Our study shows that certain facial features are more appropriate when creating a teachable robot.

Because no similar studies on robotic facial features have been performed, it is difficult to compare our findings with current research. It is possible that many researchers assume the hypothesis that we proved in our study. It seems rational to believe that smiling faces, round heads, and big eyes create a robot that is both friendly and easy to teach. However, robots such as Kismet and Cog do not have the features shown by our study to be the most friendly and teachable.

5.3 Issues in conducting research

Although we were able to reach a large audience with this survey, due to the limitations of our web page, we were only able to reach people using Netscape 4.7. Since this browser is used by less than 20 percent of Internet users (although accessable to 100% of MIT students for certificates) we were not able to reach many people that fit into occupations other than engineering or science. Using a more robust web page that could function in many different browsers and actively seeking people in other professions would allow us to receive more data about non-technical backgrounds.

Despite these limitations, our data showed surprisingly well that no matter how many people fit into a certain category (sex or occupation) they tended to form the same distribution of answers. The percentages of people of distinct sexes or occupations that chose each feature for each scenario differed by less than 15 percent for all features and scenarios. This was true for the highly represented engineering group as well as others that only had a handful of representative data. Testing with larger data sets is reccomended to validate these results.

6 Conclusion

In this study we found that specific features were more commonly associated to specific personalities. These associations were independent of features such as gender and occupation. We also learned that our survey format is appropriate for this form of research. The more traditional methods of analysis involve showing a participant many premade faces and asking them questions about each one. This method becomes tedious for the participant and does not allow each user to express his own ideas of certain personality. We believe our interactive format was more successful at determining what features should be used for a robot design.

The major shortcoming of our design was that it only worked on Netscape. That caused us to lose data from a lot of people who were willing to take the survey but who had installed a different browser. In addition, our features were extremely abstract. Future work could create images of features exactly as they would appear on the robot using CAD drawings. Results from such surveys could be immediately applied to a robot's design. However, we can apply our results to determining the major facial features that should be present in future robots.

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A Survey screen shots and HTML files

A.1 Survey Text

Instructions

Hi, thanks for taking the time to do our survey. It should take only 5 minutes and is very simple to do.

Participation in the survey is completely voluntary. You may choose to leave any questions blank by pressing the “next” button to move forward in the survey. This survey is confidential and no information will be collected besides the information that you enter in the blanks of this survey.

Click here to continue

When you click on an option, it will be displayed on the robot face in frame #3. You may switch options as many times as you wish. After you are satisfied with your result, press the buttons specified in the instructions.

Click here to continue

Imagine a relatively young student that always sits in the back row of the classroom. Sometimes he might come in late or be unprepared for class or he might just never seem to pay attention.

Please design a face for a robot that would represent this child in the classroom. Assume that you are the teacher in the classroom and that the robot is one of your students.

Review of instructions:

1. Click ”head” in the frame to the right.

2. Choose one of the three heads shown by clicking on it (you may change your mind by clicking on a different head).

3. Click ”eyes” in the frame to the right.

4. Choose one of the three eyes shown by clicking on it (again, you may change your mind).

5. Click ”mouth” in the frame to the right.

6. Choose one of the three mouths shown by clicking on it (again, you may change your mind)

7. Click here to move to the next face.

Imagine a different relatively young student that always sits in the first row of your classroom. This student usually appears attentive and eager to learn.

Please design a face for a robot that would represent this child in the classroom. Assume that you are the teacher in the classroom and that the robot is one of your students.

Review of instructions:

1. Click "head" in the frame to the right.

2. Choose one of the three heads shown by clicking on it (you may change your mind by clicking on a different head).

3. Click "eyes" in the frame to the right.

4. Choose one of the three eyes shown by clicking on it (again, you may change your mind).

5. Click "mouth" in the frame to the right.

6. Choose one of the three mouths shown by clicking on it (again, you may change your mind)

7. Click here to move to the next face

Imagine another relatively young student that always sits in the first row of your classroom. This student feels the need to answer every question you ask and pretends to know everything you are about to teach.

Please design a face for a robot that would represent this child in the classroom. Assume that you are the teacher in the classroom and that the robot is one of your students.

Review of instructions:

1. Click "head" in the frame to the right.

2. Choose one of the three heads shown by clicking on it (you may change your mind by clicking on a different head).

3. Click "eyes" in the frame to the right.

4. Choose one of the three eyes shown by clicking on it (again, you may change your mind).

5. Click "mouth" in the frame to the right.

6. Choose one of the three mouths shown by clicking on it (again, you may change your mind)

7. Click here to move to a set of questions about your faces.

You're almost done.

We'd now like you to review your choices, and answer the set of questions in the frame to the lower right.

Simply click on each of the buttons below in sequence and the face you chose will be shown to you. Rank the face on each of the criteria on the RH frame on the scale of 1-7.

Eager to learn / Doesn't Want to learn

1 2 3 4 5 6 7

Easy to teach / Difficult to teach

1 2 3 4 5 6 7

Friendly / Mean

1 2 3 4 5 6 7

Passive / Aggressive

1 2 3 4 5 6 7

7. Click here to finish this survey.

The last step!

Now, we just need some demographic information from you

Age

Sex

Field of study/profession

Click here to submit your results.

Thanks for taking our survey!

B Data

The following data tables show which faces corresponded to the choices of 0 and 1 and 5 and 6 for the questions 1-4 in the survey. Face numbers are from 10-36 where the numbers are determined by the following table.

ID	Head	Mouth	Eyes
10	0	0	0
11	0	0	1
12	0	0	2
13	0	1	0
14	0	1	1
15	0	1	2
16	0	2	0
17	0	2	1
18	0	2	2
19	1	0	0
20	1	0	1
21	1	0	2
22	1	1	0
23	1	1	1
24	1	1	2
25	1	2	0
26	1	2	1
27	1	2	2
28	2	0	0
29	2	0	1
30	2	0	2
31	2	1	0
32	2	1	1
33	2	1	2
34	2	2	0
35	2	2	1
36	2	2	2

Q1 - Eager to learn / Doesn't Want to learn

	0	1	5	6
10	2	7	0	0
11	25	13	0	0
12	6	4	0	0
13	0	5	2	0
14	4	4	1	1
15	4	4	2	1
16	0	1	0	1
17	2	0	0	1
18	2	0	4	2
19	0	2	1	0
20	3	2	0	0
21	3	4	0	0
22	1	0	2	1
23	0	2	0	2
24	2	0	5	5
25	3	1	10	6
26	1	1	4	0
27	1	2	9	1
28	12	9	1	0
29	38	20	0	0
30	10	1	0	0
31	0	2	1	0
32	1	0	3	1
33	0	3	2	1
34	1	1	16	5
35	0	2	6	1
36	0	1	4	2

Q2 - Easy to teach / Difficult to teach

	0	1	5	6
10	2	7	0	1
11	18	17	1	1
12	1	2	0	0
13	0	1	5	0
14	3	3	4	2
15	1	1	0	2
16	0	3	0	1
17	0	0	0	0
18	0	0	4	2
19	2	2	1	0
20	3	0	0	0
21	0	0	1	0
22	0	0	4	2
23	0	0	1	2
24	1	0	5	6
25	0	0	6	4
26	0	1	2	0
27	1	2	4	3
28	7	11	1	0
29	24	28	1	0
30	3	3	1	0
31	0	0	4	0
32	0	1	3	1
33	0	1	7	0
34	1	0	15	4
35	0	1	4	0
36	0	1	3	2

Q3 - Friendly / Mean

	0	1	5	6
10	1	9	0	0
11	23	17	0	0
12	1	3	0	1
13	0	0	6	1
14	3	6	0	0
15	0	0	5	0
16	1	3	1	1
17	0	1	0	0
18	0	0	3	0
19	0	2	0	0
20	3	1	0	0
21	2	1	0	0
22	0	1	3	1
23	1	0	0	1
24	0	2	4	4
25	0	0	7	2
26	1	2	0	0
27	0	1	2	1
28	12	10	0	1
29	37	24	0	0
30	5	2	1	0
31	0	0	1	1
32	1	2	0	1
33	0	1	3	1
34	1	0	4	2
35	0	6	0	1
36	0	3	0	1

Q4 - Passive / Aggressive

	0	1	5	6
10	0	1	0	1
11	5	7	4	4
12	1	1	1	1
13	0	1	10	2
14	1	5	4	3
15	1	0	5	2
16	0	5	1	2
17	1	0	0	0
18	2	3	2	0
19	0	0	3	1
20	0	0	2	3
21	0	0	0	0
22	1	0	6	1
23	0	2	1	1
24	0	0	8	3
25	4	7	4	1
26	2	5	1	0
27	4	3	2	0
28	3	3	1	3
29	4	7	4	4
30	0	2	2	1
31	1	0	4	1
32	2	2	3	1
33	0	0	5	3
34	4	10	1	0
35	3	11	0	0
36	5	3	0	0

face 1

34 picked head 0	9 picked mouth 0	79 picked eyes 0
58 picked head 1	32 picked mouth 1	47 picked eyes 1
78 picked head 2	128 picked mouth 2	43 picked eyes 2

face 2

66 picked head 0	139 picked mouth 0	44 picked eyes 0
15 picked head 1	24 picked mouth 1	114 picked eyes 1
98 picked head 2	16 picked mouth 2	21 picked eyes 2

face 3

73 picked head 0	65 picked mouth 0	63 picked eyes 0
57 picked head 1	95 picked mouth 1	64 picked eyes 1
50 picked head 2	21 picked mouth 2	53 picked eyes 2

More data is available upon request but is omitted for brevity of this document.

C Code

Submit.asp

```
<html>
<%

h1=request.form("head1")

h2=request.form("head2")

h3=request.form("head3")

e1=request.form("eyes1")
e2=request.form("eyes2")
e3=request.form("eyes3")

m1=request.form("mouth1")
m2=request.form("mouth2")
m3=request.form("mouth3")

age=request.form("age")
occupation=request.form("occupation")

q11=request.form("q11")
q12=request.form("q12")
q13=request.form("q13")
q14=request.form("q14")

q21=request.form("q21")
q22=request.form("q22")
q23=request.form("q23")
q24=request.form("q24")

q31=request.form("q31")
q32=request.form("q32")
q33=request.form("q33")
q34=request.form("q34")

sex=request.form("sex")

Set pwver = Server.CreateObject("ADODB.Connection")

pwver.open "15301","",""
pwdverstmt = "insert into results(h1,h2,h3,e1,e2,e3,m1,m2,m3,age,occupation,q11,q12,q13,q14,
q21,q22,q23,q24,q31,q32,q33,q34,sex)"
```

```
pwdverstmt = pwdverstmt & " values( " & h1 & "," & h2 & "," & h3 & "," & e1 & "," & e2 & "," & e3 & "," & m1 & ","
& m2 & "," & m3 & "," & age & "," & occupation & "," & q11 & "," & q12 & "," & q13 & "," & q14 & "," & q21 & ","
& q22 & "," & q23 & "," & q24 & "," & q31 & "," & q32 & "," & q33 & "," & q34 & "," & sex & ")"

Set pw = pwver.Execute(pwdverstmt)
pwver.Close

%>

thanks for your contribution to our survey!
</body>
</html>
```

survey.js

```
// survey javascript

h=new Array();
hx=new Array();
hy=new Array();
ex=new Array();
ey=new Array();
mx=new Array();
my=new Array();

// head xy coords
hx[0]=100;
hy[0]=100;
hx[1]=100;
hy[1]=100;
hx[2]=100;
hy[2]=100;

// eye xy coords
ex[0]=125;
ey[0]=120;
ex[1]=125;
ey[1]=170;
ex[2]=127;
ey[2]=145;

// mouth xy coords
mx[0]=160;
my[0]=235;
mx[1]=160;
my[1]=235;
mx[2]=160;
```

```
my[2]=250;

h[0]=new Image();
h[0].src="head0.jpg";
h[1]=new Image();
h[1].src="head1.jpg";
h[2]=new Image();
h[2].src="head2.jpg";

/////////

e=new Array();
e[0]=new Image();
e[0].src="eyes0.gif";
e[1]=new Image();
e[1].src="eyes1.gif";
e[2]=new Image();
e[2].src="eyes2.gif";

m=new Array();
m[0]=new Image();
m[0].src="mouth0.gif";
m[1]=new Image();
m[1].src="mouth1.gif";
m[2]=new Image();
m[2].src="mouth2.gif";

im=new Image();
im.src="done.jpg";
bl=new Image();
bl.src="blank.jpg";

function change_face_category(i)
{
// save whatever category we're in now
savecategoriescurrent();
// readface
readface(i);

// and set the values in it
setcategoriescurrent();
}

function submitme(frm)
{
frm.submit();
}
```

```
function finalsubmit()
{
if(parent.frames["instructions"].document.forms[0].elements["age"].value=="")

parent.frames["instructions"].document.forms[0].elements["age"].value=-1;
parent.frames["collector"].document.forms[0].elements["age"].value=
parent.frames["instructions"].document.forms[0].elements["age"].value;
parent.frames["collector"].document.forms[0].elements["occupation"].
value=parent.frames["instructions"].document.forms[0].elements["study"].
selectedIndex;
parent.frames["collector"].document.forms[0].elements["sex"].value=
parent.frames["instructions"].document.forms[0].elements["sex"].selectedIndex;

parent.frames["collector"].document.forms[0].submit();
//parent.frames["collector"].document.forms[0].elements["subflag"].value=1;

}

function setcategoriescurrent()

{ setcategories(parent.frames["instructions"].document.forms[0].
elements["current"].value);
}

function savecategoriescurrent()
{
savecategories(parent.frames["instructions"].document.forms[0].
elements["current"].value);
}

function setcategories(i)
// copies all the saved answers for q[i][*] to q1-4
// in the category window
{
if(i>0)
{
for(j=1;j<5;j++) {

setchecked(parent.frames["choices"].document.forms[0].elements["q"+j],
parent.frames["collector"].document.forms[0].elements["q"+i+j].value);
}
}// if

}

function findchecked(a,max)
```

```
// returns the checked index of a radiobutton array
{
for(i=0;i<max;i++)
if(a[i].checked)
return(i);
}

function setchecked(a,i)
// sets the checked value for a radiobutton array
// for the index i
{
a[i].checked=true;
}

function savecategories(i)
{
if(i>0)
{

parent.frames["collector"].document.forms[0].elements["q"+i+1].
value=findchecked(parent.frames["choices"].document.forms[0].q1,7);

parent.frames["collector"].document.forms[0].elements["q"+i+2].value=
findchecked(parent.frames["choices"].document.forms[0].q2,7);

parent.frames["collector"].document.forms[0].elements["q"+i+3].value=
findchecked(parent.frames["choices"].document.forms[0].q3,7);

parent.frames["collector"].document.forms[0].elements["q"+i+4].value=
findchecked(parent.frames["choices"].document.forms[0].q4,7);
}// if

}

function readface(i)
// loads head, eyes and mouth data for face with index i & sets the current value
{

showface(parent.frames["collector"].document.forms[0].elements["head"+i].value,
parent.frames["collector"].document.forms[0].elements["eyes"+i].value,

parent.frames["collector"].document.forms[0].elements["mouth"+i].value);

parent.frames["instructions"].document.forms[0].elements["current"].value=i;
}

function showface(hi,ei,mi)
```

```
// hi - head index
// ei - eye index
// mi - mouth index
{
if(hi>=0)
headsetit(hi);
if(ei>=0)
setit(ei,'eyes',e);
if(mi>=0)
setit(mi,'mouth',m);
}

function headsetit(index)
{
parent.frames["selected"].document.layers["head"].document.images[0].
src=h[index].src;
parent.frames["collector"].document.forms[0].elements["head"].value=index;

parent.frames["selected"].document.layers["head"].top=hy[index];
parent.frames["selected"].document.layers["head"].left=hx[index];

parent.frames["selected"].document.layers["eyes"].top=ey[index];
parent.frames["selected"].document.layers["eyes"].left=ex[index];

parent.frames["selected"].document.layers["mouth"].top=my[index];
parent.frames["selected"].document.layers["mouth"].left=mx[index];
}


function setit(index,frame,array)
{
parent.frames["selected"].document.layers[frame].document.images[0].src=
array[index].src;
parent.frames["collector"].document.forms[0].elements[frame].value=index;
}

function movetonextstage()
{
movestage(getstage(),1);
}

function movestage(stage,sstate)
{

setdone("step"+stage);

// if we want to save the state, do it
```

```
if(sstate)
savestate(stage);

s=new Number(stage);

setstage(s+1);

resetface();
}

function version()
{
alert("v 1.4 - this survey requires netscape 4.7 or later");
}

function setdone(stage)
{
parent.frames["collector"].document.images[stage].src=im.src;
}

function setstage(next)
// sets the stage state
{

parent.frames["collector"].document.forms[0].elements["set"].value=next;
}

function getstage()
// returns string value of stage we're on.
{
return
(parent.frames["collector"].document.forms[0].elements["set"].value);
}

function resetface()
{
parent.frames["selected"].document.layers["eyes"].document.images[0].src=bl.src;
parent.frames["selected"].document.layers["mouth"].document.images[0].src=bl.src;
parent.frames["selected"].document.layers["head"].document.images[0].src=bl.src;
}

function savestate(number)
{
parent.frames["collector"].document.forms[0].elements["head"+number].value=
parent.frames["collector"].document.forms[0].elements["head"].value;
parent.frames["collector"].document.forms[0].elements["eyes"+number].value=
parent.frames["collector"].document.forms[0].elements["eyes"].value;
```

```
parent.frames["collector"].document.forms[0].elements["mouth"+number].value=
parent.frames["collector"].document.forms[0].elements["mouth"].value;
}
```