The Charismatic Computer: 
Examining How Expressive Interfaces Influence Beliefs

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ABSTRACT
Recent research in applied psychology and management science suggests charismatic behavior can be learned. Furthermore, people who have undergone training to learn these behaviors are identified by observers as being charismatic. Other research suggests charismatic and expressive teaching interfaces improve learning outcomes in students. This adds support to “The Media Equation”, Reeves and Nass’ communication theory that states people often treat computers as though they were real people. This study attempts to further knowledge in these areas by investigating how charismatic behaviors can be leveraged in computer interfaces to influence beliefs and opinions. A virtual character was created and programmed with charismatic nonverbal behaviors. Results from evaluations indicate a promising approach to developing and evaluating charismatic computer interfaces.

Categories and Subject Descriptors
H.5.2 [Information interfaces and presentation]: User Interfaces – User-centered designs, miscellaneous.

General Terms
Human Factors.

Keywords
User interfaces, charisma, virtual characters.

1. INTRODUCTION
Charismatic figures throughout history have had the ability to induce passion and inspire action in followers. Bill Clinton, Steve Jobs, and the Dalai Lama are recent figures in history that have been cited as being charismatic. Such people are noted to have an ability to quickly connect with and induce positive feelings in others. It has long been assumed that charisma is an innate quality but recent research has suggested that anyone can learn to become more charismatic [1].

The inspiration for this study comes from the question: if it is possible to teach a person to be charismatic, then is it possible to develop a computer interface that is charismatic? Moreover, can such an interface affect a person similar to how a charismatic leader influences a follower?

This study aims to answer these questions by attempting to develop a charismatic virtual character capable of influencing people’s beliefs, with a focus on the effect of charismatic nonverbal behavior. This leverages the knowledge gained from Reeves and Nass’ work which showed how people tend to treat computers as though they were real people [2]. It is hoped that developing a charismatic computer will shed light on how best to develop interfaces that can improve lives through influencing people’s beliefs and behaviors, such as health habits.

The remainder of this paper will be as follows. In Section 2, related work in applied psychology, management science, and human computer interfaces will be reviewed. Section 3 will provide an overview of Rachel, our virtual character and a summary of its creation process. In Section 4, the evaluation methodology will be presented, as well as results and a discussion of the results. Sections 5 and 6 will provide direction for future work and conclude the paper, respectively.
2. RELATED WORK
This study builds upon research examining charisma in the fields of applied psychology, management science, and computer-aided teaching. Research in the field of management science has shown that the ability to behave charismatically can be taught [1]. This has inspired books on the subject that promise to guide readers towards becoming charismatic [3]. Earlier research on charisma demonstrated that leaders exhibiting charismatic nonverbal behaviors induced observers and listeners to imitate the leader’s nonverbal behavior [4]. Similar research found that leaders displaying positive emotional expressions were rated by followers as being more charismatic and that such leaders were able to induce positive moods in followers [5]. It has also been shown that subjects who are exposed to speakers who underwent charisma training performed better on knowledge tests over those who watched speakers without charisma training [6][7].

3. DESIGN
A virtual character giving a persuasive speech was created for the purposes of this study. Two versions were created (one with charismatic behavior, one without) as this study set out to examine the effect of charismatic nonverbal behavior on a listener’s beliefs. This section will describe how a virtual character was created.

3.1 The Virtual Human Toolkit
To investigate the effect of expressiveness and charisma on beliefs, a virtual human was created using the Virtual Human Toolkit, created by the University of Southern California’s Institute for Creative Technologies [8]. The Virtual Human Toolkit is a set of modules, tools, and libraries designed to give investigators the ability to create life-like virtual characters capable of engaging in conversations with human users. Specifically, the modules allow virtual characters to interact with human users through listening via a speech input module and speech via a text-to-speech engine. In addition, speech output can be enhanced with nonverbal communication such as facial expressions and body language defined manually or generated automatically.

The core modules and tools used for the purposes of this paper were the SmartBody module and VHBuilder and Character Customizer tools (speech input from the user was not needed for the purposes of this paper). The SmartBody module allows designers to create a virtual human and define physical features such as gender, skin colour, and clothing. For this investigation, a virtual human, Rachel, was created (Figure 1). This character was programmed to give two versions of the same speech. One version included nonverbal communication with expressive facial expressions and open body language/gestures, behaviors considered charismatic [3]. The other version was programmed to express no nonverbal behavior (except for lips, this version did not make facial expressions or hand gestures while speaking). Videos of both versions were recorded and edited with speech generated by the MARY Text-to-Speech System.

3.2 MARY Text-to-Speech System
The speech given by both versions of our virtual character was generated through the MARY Text-to-Speech System, an open source tool originally developed by the German Research Institute for Artificial Intelligence [9]. The system offers multiple voice options, some with varying tonality and others with a monotone. For the purposes of this study, two versions of the speech were generated. One version was generated using with a voice having a higher pitch quality as well varying in tone as the speech is delivered, a trait considered charismatic [3]. A second version of the speech was generated with a voice with a lower pitch and which does not vary in tone. The audio created with the MARY Text-to-Speech System was synchronized to a video recording of Rachel’s movements via iMovie.

3.3 TED Talk
The text from Graham Hill’s speech “Why I’m a Weekday Vegetarian”, given at TED 2010, was chosen for the text spoken by our virtual character [10]. A TED talk was chosen because the speeches are typically short, persuasive pieces. In addition, a TED talk is typically prepared by the speaker with a team from TED to ensure it is well written and appeals to a varied audience. This particular TED talk was chosen for its content. In it, Hill appeals to listeners to adopt a more sustainable diet by practicing vegetarianism five days a week. He cites health, financial, and environmental reasons to adopt a diet with less meat. Both versions of our virtual human spoke the same text.

4. EVALUATION
To examine how charismatic and expressive nonverbal behavior influences beliefs, subjects were shown one of two versions of our virtual character. Subjects were randomly assigned to either the video of the expressive version of our virtual human or the non-expressive version. Subjects were given questionnaires both before and after being shown a video to measure the effect our virtual character had on beliefs. The questionnaires contained questions related to the content of our virtual character’s speech.

A total of 12 subjects were recruited for this study. The subjects ranged in age from 25 to 38 and were evenly split between men and women.

4.1 Research Questions
This study aimed to answer to three main questions:

*RQ1) Can charismatic non-verbal behavior expressed by a computer interface influence how we intend to behave?*

*RQ2) Can charismatic non-verbal behavior expressed by a computer interface influence our beliefs and opinions?*

*RQ3) Is it possible to create a computer interface that people consider charismatic?*

4.2 Questionnaires
To answer the research questions presented in the previous section, questionnaires were given to subjects before and after viewing the video of our virtual human. They were three groups of questions, each consisting of Likert-style questions on a 7 point scale.

The first group of questions related to eating behaviors to answer RQ1. This group of questions was given both pre- and post-video to measure any changes in intended behaviors that are a result of viewing the video:

*Please rate your likeliness of adopting the following diets or eating habits over the next 6 months.*

(1 – Very unlikely; 2 – Unlikely; 3 – Somewhat unlikely; 4 – Neutral; 5 – Somewhat likely; 6 – Likely; 7 – Very likely)
A1) A vegan diet  
A2) A vegetarian diet (dairy and eggs OK)  
A3) A pescatarian diet (a vegetarian diet plus fish)  
A4) Eating a meat-free meal at every meal, every day  
A5) Eating a meat-free meal at every meal, 5 days a week  
A6) Eating a meat-free meal at every meal, 1 day a week  
A7) Eating at least 1 meat-free meal a day, every day  
A8) Eating at least 1 meat-free meal a day, 5 days a week  
A9) Eating at least 1 meat-free meal a day, 1 day a week

The second group of questions related to opinions about diet, to answer RQ2. As with the first group of questions, this set was administered both pre- and post-video:

Please rate your level of agreement with the following statements.

(1 – Strongly disagree; 2 – Disagree; 3 – Somewhat disagree; 4 – Neutral; 5 – Somewhat agree; 6 – Agree; 7 – Strongly Agree)

B1) I think vegetarianism is a good lifestyle choice  
B2) I think meat eating is a good lifestyle choice  
B3) I must have meat with every meal  
B4) I think a meal without meat is incomplete  
B5) I prefer having meals with less meat  
B6) I believe eating less meat will make me healthier  
B7) I believe eating less meat will make me feel better  
B8) I believe eating less meat is better for the environment

The third set of questions related to subjects’ opinions of our virtual character. These questions were asked to answer RQ3 and provide qualitative feedback about our virtual character. These questions were given only in the post-video questionnaire:

Please rate your level of agreement with the following statements about Rachel, our virtual human.

(1 – Strongly disagree; 2 – Disagree; 3 – Somewhat disagree; 4 – Neutral; 5 – Somewhat agree; 6 – Agree; 7 – Strongly Agree)

C1) Rachel was an expressive communicator  
C2) Rachel was an unnatural communicator  
C3) I think Rachel was charismatic  
C4) I think Rachel was charming  
C5) I think Rachel was persuasive  
C6) I think Rachel made good eye contact  
C7) I think Rachel had positive body language  
C8) I think Rachel had good facial expressions  
C9) I enjoyed the tone of Rachel’s voice  
C10) Rachel gave some facts about eating meat that I have not heard before

4.3 Results

For the three sets of questions described in the previous section, responses were compared between the group shown the video of our virtual character exhibiting no nonverbal behaviors (control group) and the group shown the video exhibiting elements of charismatic nonverbal behavior (treatment group).

The first two sets of questions were analyzed in a similar manner. For these questions, a change in response to the questions was measured by converting all responses to a corresponding numerical value and subtracting the value recorded pre-video from the value recorded post-video. For example, if a subject answered “Neutral” (a numerical value of 4) to a question before watching the video, then answered “Somewhat Likely” (a numerical value of 5) to the same question after watching the video, a change in response of 1 was recorded. A negative change in response indicates that a response went from a response with a higher numerical value to one with a lower value (ex. from “Neutral” to “Unlikely”). The response changes were then combined to produce an average for each question. The third set of questions related to subjects’ opinions about our virtual character were analyzed by converting the responses to a corresponding numerical value and then averaged.

4.3.1 Eating Behavior Questions

The change in response to the eating behavior questions (questions A1-A9) was analyzed and the results for the control and treatment groups are compared and presented in Figure 2.

For both the control and treatment group, no positive change in response was recorded for questions A1-A3 (likelihood of adopting a vegan, vegetarian, or pescatarian diet). For all questions, the control group showed a less than 0.5 average change in response. Four of the questions (A5-A7 and A9) elicited an average change in response of at least 0.5 in the treatment group. No average change in response was found for questions A1 or A8.

4.3.2 Diet Opinion Questions

An analysis similar to the one described in the previous subsection was performed on the responses to the opinion questions (B1-B8). The results are presented in Figure 3.

For all questions except B8, the average change in response received by the control group was between -0.17 and 0.17. In the treatment group, questions B2-B5 had average changes in
response that were similarly small. The final three questions, B6-B8, had change in responses of >0.66 in the treatment group.

4.3.3 Opinions About Rachel

The average response to questions in the third set of questions is presented in Figure 4.

For the control group, average response was “Neutral” or below for all questions except C2, C6, and C10. The majority of responses for the treatment group also on averaged recorded a “Neutral” response. Question C2 (“Rachel was an unnatural communicator”) on average recorded a response of “Somewhat Agree” or higher. Question C10 (“Rachel gave some facts about eating meat that I have not heard before”) recorded an average response between “Neutral” and “Somewhat Agree” for both control and treatment group.

4.4 Discussion

4.4.1 Opinions About Rachel

An examination of the results from the third set questions presented in Section 4.3.3 suggests that the findings of this study do not support RQ3 in the positive. That is, we were not able to create a computer interface that subjects recognized as charismatic. For example, responses from the treatment group to question C3 (“I think Rachel was charismatic”) were on average “Neutral” while simultaneously responses to question C2 (“Rachel was an unnatural communicator”) were on average between “Somewhat Agree” and “Agree”. In addition, treatment group responses to questions designed to measure the charismatic nonverbal actions (C6-C9) did not indicate a positive result. On average, none of these questions garnered a response to suggest subjects particularly enjoyed listening to the virtual character or believed the character was acting in a way that was charismatic.

There are a few reasons why this study received negative responses. One reason could be poorly formulated questions. Our definition of charisma and ability to recognize it may differ from person to person. If subjects were given objective methods for rating charisma and charismatic non-verbal behaviors, we may have received a more positive result. Another reason could be that the small subject sample size happened to contain only subjects that didn’t consider Rachel charismatic. A subject sample size of greater than 6 for the treatment group may contain subjects that are more representative of the population.

A more likely reason for our negative result is that charisma is nuanced and involves actions not implemented or poorly implemented in this study. For example, four subjects in the treatment group indicated that at times it was difficult to understand the words spoken by our virtual character. Clear speaking voice is a key characteristic of charismatic speakers [3].

4.4.2 Diet Behavior Questions

It is possible that while subjects did not consciously think that Rachel was charismatic, elements of charismatic behavior exhibited by our virtual character could subconsciously influence the behavior and opinions of our subjects. To explore this, we look at the results from the first set of questions about diet behavior.

For questions about eating behaviors, on average no one in either control or treatment group was convinced to change their diet to a strict vegan, vegetarian, or pescatarian diet (questions A1-A3). These questions were included to see if the persuasiveness of the nonverbal behavior in our treatment group was so strong it would compel subjects to go beyond the diet proposed in the speech. The results clearly show this is not the case. A reason for this negative result could be that the nonverbal behavior programmed into our virtual character did not add to the persuasiveness of the speech. Another reason could be that these diet changes are considerably more drastic than the one proposed in the speech (a flexible diet with an emphasis on reduced meat consumption on weekdays).

To see if our virtual character could compel diet changes more in line with the theme of the speech, we asked if subjects would consider reducing meat consumption on certain days of the week (A4-A9). In particular, responses to Question A5 (the likelihood of adopting a diet of eating a meat-free meal at every meal, 5 days a week) indicated that on average those in the treatment group were persuaded to change their opinion towards adopting a diet that was more in line with the weekday vegetarianism diet proposed in the speech. The control group showed no such change. This would seem to suggest that our treatment of including charismatic nonverbal behavior had a positive persuasive effect.

There are, however, a few threats to the validity of this conclusion. The first is that it is possible the persuasiveness of the speech was solely due to the content and was not affected by the nonverbal behavior expressed by the speaker. Such a threat is supported by the results discussed in Section 4.4.1. The counter-argument to this is that if that were true, then the average response
in the control group would be similar to the treatment group. It may be more accurate to say that watching a virtual character that does not use expressive nonverbal behaviors reduces the persuasiveness of the speech given. In other words, the charismatic behaviors programmed into Rachel may be necessary but not sufficient for persuasion, and that other factors may need to be included.

Another threat to the validity of this conclusion could be bias induced by the wording of question A5. It is clear that this question is asking something directly related to the theme of the speech and so subjects may have been compelled to answer in the positive after watching the video. Again, the counter argument is if this were the case then a similar change in response post-video would have been observed in the control group. It could be that those in the control group were not paying close attention to the speech in the video to know the overall theme. Indeed, some respondents in the control group mentioned how boring watching the video was.

Overall, the results are not strong enough to support RQ1 in the positive. That is, the results reported here do not support the hypothesis that charismatic non-verbal behavior in a computer interface can influence how people behave.

4.4.3 Diet Opinion Questions

An examination of the responses to questions about opinions regarding diet provides another perspective for evaluating this study. Stating opinions about diet requires less commitment from subjects than statements pledging diet changes, thus responses may be less susceptible to bias from such pressures.

The responses for questions B6-B8 (“I believe eating less meat will make me healthier/make me feel better/is better for the environment”) show a difference between the control and treatment groups. The difference in average response change between the control group and the treatment group suggests that subjects that viewed the version of Rachel programmed with charismatic behaviors were more persuaded to change their opinions about meat eating. However, the threats to the validity of this conclusion are similar to those mentioned in the previous section. It is possible that the content of the speech itself persuaded subjects to change their response to the questions. For example, responses to B8 (“I believe eating less meat is better for the environment”) could be a result of hearing new facts about the environmental impact of meat production. This is supported by the response to C10 (“Rachel gave some facts about eating meat that I have not heard before”), where the average response for both groups was “Somewhat Agree”. Changes in responses to questions B1-B5 were on average small for both groups, indicating no effect of charismatic behavior on subjects’ opinions.

Overall the results here suggest there may be some support for RQ3, that is, charismatic non-verbal behavior in a computer interface can influence how people’s beliefs. Evidence from further studies would give more support (discussed in the next section).

5. Future Work

Future directions for investigating whether charisma in computer interfaces can influence beliefs should focus on improving the implementation of the interface and method of evaluation.

This study could be replicated and improved by enhancing the virtual character used for this study. This study created a virtual character from scratch, but for the purposes of this study this is not required. As subject feedback indicated, the virtual character created for this study was lacking in charismatic qualities. One way this could be improved is to convert to a virtual character a video of a real speaker that is universally considered charismatic or judged to be charismatic. Such an approach could reduce the communication deficiencies such as those in this study’s virtual character. The virtual character could also be modified in such a way that subjects do not recognize the original speaker (thus avoiding bias) and the voice could be an actual voice recording to avoid inaccurate text-to-speech synthesis.

Future studies can also build on the evaluation methods presented in this paper. One option could be to improve the questions asked to remove bias and avoid leading questions. An improvement could be that in addition to presenting statements and asking subjects to respond with their level of agreement, subjects would be presented with hypothetical scenarios and asked to choose amongst a number of potential responses.

Another option could be to choose different speech content. The text chosen for this study contains facts and logical arguments that make it very persuasive. Using text without these logical elements could do a better job of isolating the persuasiveness of the speech to nonverbal communication. Other similar studies could use text that attempted to persuade subjects to believe something clearly untrue (ex. the existence of telepathy).

6. Conclusion

Despite failing to produce a computer interface that subjects recognized to be charismatic, the study presented here is a good starting point for future work. Some of the results support the idea that charismatic nonverbal behavior in computer interfaces plays a role in influencing a person’s beliefs. It is clear that producing a charismatic computer interface is challenging and more work is needed to create a charismatic interface that is capable of strongly influencing a person’s beliefs. Continued work in this area will provide better knowledge in creating interfaces that compel humans to change their beliefs and behaviors, which can be used in applications like fitness training and improving eating habits. Ultimately, what is learned in this area has the potential to help people live happier and healthier lives.

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8. References


