

# Anthropomorphic Visualization: A New Approach for Depicting Participants in Online Spaces

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## ABSTRACT

Anthropomorphic visualization is a new approach to presenting historical information about participants in online spaces using the human form as the basis for the visualization. Various data about an individual's online behavior are mapped to different parts of a "body", resulting in an abstract yet humanoid representation of a person. We explain the details of the approach and make some initial observations about the visualization in use. We also discuss broader issues relating to presenting data that has been mined from individuals' messages, using the human form to depict this data, and evaluating visualizations used for social purposes.

## Author Keywords

Information visualization, social visualization, visual design, Usenet.

## ACM Classification Keywords

H.5.3 Group and Organization Interfaces, H.5.3.a Asynchronous interaction, H.5.3.b Collaborative computing, H.5.1 Multimedia Information Systems

## INTRODUCTION

Anthropomorphic visualization is a new approach that depicts information about individuals' behavior online using the human form. Various historical data about an individual is mapped to different parts of a representation of their "body", resulting in an abstract yet humanoid depiction of a person (called an "Anthropomorph") [see fig. 1]. We have created a test bed application using Usenet newsgroups that is allowing us to explore the advantages and disadvantages of using this type of visualization to present information about participants.

The human form is an intriguing yet problematic format for representing information about people. Creating a visualization of a group in which each member is represented with an Anthropomorph has the advantage of giving users an immediate feel for how the group is populated. It also provides a sense of the different character of each of the

participants' past behavior. However, the limited information used to generate the visualization may result in a representation that would be considered a caricature of their true identity, and the depiction may be considered misleading, irrelevant and unacceptable to the person being represented. By creating different representations of individuals and evaluating responses to them, we can begin to assess whether using the human form is a good idea in general and better understand the potential uses for this type of visualization.

In this paper, we will discuss our design approach, including related work and some details of our test bed application. We will present some initial observations about the approach, and discuss several questions that merit further investigation.

## DESIGN APPROACH

While a number of different visual approaches have been used to visualize historical information about individuals in online spaces [3][10], the human form has rarely been used. In our research, we wanted to use a compact format that would obviously refer to a particular person and allow for the easy comparison of information about multiple people. The human form seemed a natural choice for these purposes, despite the potential issues with this approach. A similar visualization technique is the approach known as Chernoff faces[1], which will be discussed later in this paper.

There are many ways information about people could be mapped to features or "body parts" in a visualization format consisting of the human form. In this section, we will first describe an example visualization – including the data we use and the way it is visually represented. We will then discuss the rationale for the choices we made.

## Description of example visualizations

For a more concrete example of how we can represent historical data using a humanoid form, refer to Figure 1 for three example visualizations that were computationally generated. Each part of the person's body indicates a particular piece of information about the person:

- The expression on the person's face indicates the average emotional tone of their messages.
- The color of the circle in their body also represents the average emotional tone.

- How open their eyes are indicates what percentage of their messages are responses to other messages as opposed to initial messages posted to start a new thread.
- The more messages they have written, the higher their arms are raised.
- Each box on their body represents a message they've written. Messages with thick outlines are initial posts in a thread, while messages without outlines are responses. The height of the box represents how long the message was. The color of the box represents the average emotional tone of the message.
- When their legs are spread apart and larger, this means that many people have responded to their messages and they play a central role in the group (i.e. they are planted in the group). When their legs are small and close together, this means that they've received few responses from others.
- When they have written a message recently, they appear dark and crisp. As days go by without a message, they appear more and more faded.

#### Data used in the visualization

Past research has identified *activity level* and *responsiveness* as two key parameters that can be used to differentiate individuals participating in Usenet, where activity level refers to the number and frequency of messages people write and responsiveness refers to how many messages people write that are replies to others rather than initial posts in a thread [4][7]. It is also useful to examine the structure of the social network that emerges within a particular group. By identifying each reply from one participant to another in the group as a social tie between the two participants, we can use techniques from social network analysis to calculate attributes of the participant in relation to the group. *Centrality* in a group is a useful indicator that the participant plays a key role in the group [9]. Activity level, responsiveness, and centrality are all used as parameters in the current version of the Anthropomorph visualization.

Using Natural Language processing to analyze message content is a potentially rich source of data about participants. By looking for the use of particular words or phrases, we can assume that the message and poster have certain interests or characteristics. For instance, a poster who uses happy words might be assumed to be happy. Various algorithms have been developed in the natural language processing and information retrieval research communities to summarize and characterize text to varying degrees of success. For the purpose of this visualization, we are using a third-party library that categorizes some of the words used in text messages to rate the messages'

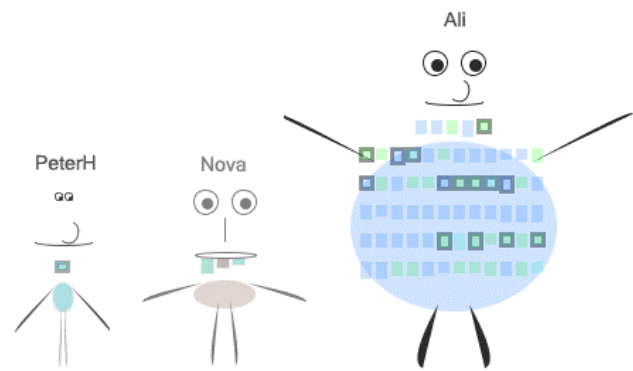


Figure 1:

These computationally generated “Anthropomorphs” depict a range of characteristics. PeterH has written a single message and has received no responses. Nova has posted 3 messages that have an anxious tone on average and has received a couple of responses. Ali is a more central figure in the group with several dozen messages and a variety of replies and responses.

emotional tone [6]. While not always precisely accurate in this subjective type of assessment, this natural language analysis nonetheless provides useful cues about a person’s writing.

#### Visualizing data using the human form

Our intent with this series of designs is to present a visualization that looks sufficiently humanoid to evoke a desired social response, while still providing a format that is sufficiently abstract and legible to clearly communicate the information about the participant’s history. For our example visualization approach, we identified a number of possible mappings between data and particular features of the body. Some of these mappings are intended to make sense metaphorically:

- The facial expression of the Anthropomorph is based on the average emotional tone of the messages.
- An individual’s central role in a group is indicated by their legs being spread out, planting them more firmly in the group.
- The more recently individuals have written a message, the darker and crisper they appear so people fading from participation in the group fade visually as well.

Other visual conventions are used to clearly communicate quantitative information. For example, a box is drawn on a person’s body for each message they have written in the last month, making it easy to count the messages and gauge a person’s level of participation in the group.

We believe the most similar prior approach to visualization using the human form is the format known as Chernoff faces which maps multiple pieces of data to the appearance of various facial features composed into a face [1]. Our approach attempts to learn from past critiques of Chernoff

faces. For example, if the data values that change the expression of the face are arbitrarily mapped to the various facial features, the visualization may lead to a distorted face that has an unexpected emotional impact on the viewer and can be hard to decipher [5]. With our design, we are not depicting individual facial features completely independently, but instead have a set of templates for particular facial expressions, which can be varied based on a set of values such as responsiveness and intensity while still maintaining the overall sense of the emotion represented. We have designed the visualization format to avoid distortion for all potential values of data.

Criticism of Chernoff faces has also suggested that the novelty of the format is a distraction (especially where the information being presented has nothing to do with faces). But for social visualizations, in which the information is about people, it seems more natural to use a face and a human body. It is important, however, that we consider the social meaning of the data that is mapped to the visual components of the face and body. The potential of distorting the social significance of messages that a participant has written is a key risk of using the face to visualize an individual's information [2]. It may be necessary to refine our design after further examining social reactions to the visualization in use.

One advantage of the anthropomorphic visualization format is that it employs Edward Tufte's notion of small multiples[8]. Small multiples use a compact visualization format in which multiple pieces of related data are all legible, and various visualizations with varying data can easily be compared. The face, arms, legs, and torso of the human body offer numerous possibilities for varying shape, color, texture and size that can represent different data values.

#### Implementation details of the test bed application

The visualization was implemented using Java's 2D graphics library to render data gathered from Usenet newsgroup messages that are stored in a relational database. The system includes a data model that organizes the data into information about the participants, threaded conversations, messages and the group overall. The client application includes a user interface that allows users to browse groups, threads, and messages, with anthropomorphic representations of authors shown as the messages are displayed.

#### INITIAL OBSERVATIONS AND DISCUSSION

##### Visible patterns in the visualization

We have found that by generating Anthropomorphs for all of the participants in a particular group over a month's time, many patterns are visible concerning their roles in the group. A core group of active users are easily identifiable with their larger bodies and spread out legs indicating a central place in the group. On the outskirts of the group are marginal members who have posted only a single message

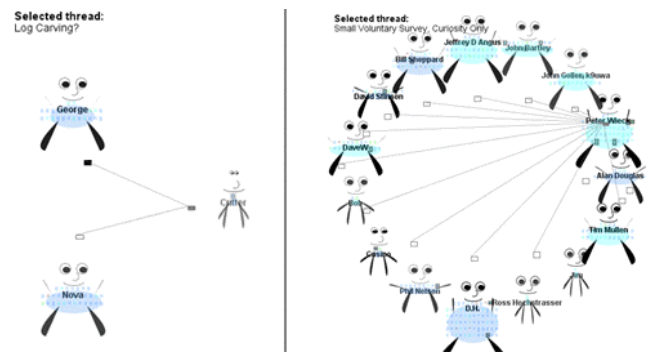


Figure 2:

The thread on the left depicts two central members in the rec.woodworking group responding to a question from a participant posting his first question. The thread on the right depicts several core group members responding to an opinion poll initiated by a central group member.

— often a question posed to the group looking for information. Usually a few “angry” Anthropomorphs are visible, with their multiple angry messages indicating argumentative participants or flammers. More subtle distinctions are also visible. For example, central members who only reply to others' messages look slightly different than active members who introduce new discussion topics and information to the group as well as responding in conversation.

Rendering threads with each poster represented by their Anthropomorph also can provide a quick visual indication of the type of conversation that is taking place. Examples include marginal members asking for advice with central members responding, and opinion polls in which a core group of central members share opinions with each other [see Fig. 2].

##### Key questions raised by the visualization

Anthropomorphic visualization uses facial expressions and an abstract representation of a body because of their evocative qualities. As discussed in Donath's examination of “Mediated Faces”[2], faces in a user interface can have a social effect, resulting in people behaving more politely and spending time on small-talk. They rapidly convey details about individuals that may result in stereotypes, allowing us to make assumptions about people we have limited experience with. These effects may be desirable in certain discussion groups, perhaps discouraging flaming, and making it clear to newcomers who the most active and responsive members are. Conversely, they may encourage some of the negative aspects of social behavior we experience offline such as discrimination against others who are unfamiliar. The degree to which the use of anthropomorphic visualization is appropriate for particular groups may be dependent on how much members desire more social interaction.

We are attempting to find the right balance between the social effects of the face and the more abstract capabilities of information visualization. We would like our approach to generate more social responses among participants, and also communicate the information contained in the visualization effectively. By using a more abstract format for the body features that can double as graphical representations of data, we hope to help users get more information about the authors of the messages they read. There is a risk, however, that users will misinterpret these features by taking the human qualities of the visualization too literally. They may make assumptions about particular body configurations or facial expressions and misinterpret a message written by an author, influenced by the appearance of the Anthropomorph of the author.

To test the degree to which users react socially and correctly interpret the data about authors, we are beginning formal user studies to evaluate our example approach to anthropomorphic visualization. We will compare users' reactions to reading a set of messages shown with the Anthropomorphs of their authors to other users' reactions to reading the same messages with the supplementary data about the authors shown in a bar chart form. We will also ask users to interpret the data shown in the visualizations.

Another issue to consider is the visual style of the Anthropomorphs. The cartoon-like style we are using has prompted a number of unsolicited comments about how "cute" the Anthropomorphs are. Other variations we have created seem less appealing. We will be investigating whether the appeal of a particular design impacts the way users perceive the other members of the group. It is unknown whether particular styles will be considered more or less appropriate for particular types of discussions.

We also need to consider the privacy issues raised by the visualization. Users do not currently expect that the data generated from the messages they write will be analyzed and presented back to the community. Further study is necessary to evaluate how users feel about having other participants' and their own data interpreted into a visual representation. The possibility of users trying to manipulate such a system by writing nonsense messages to alter their own depiction is also a potential issue. Allowing users' to influence some aspect of their own and others' representation may also be desirable, similar to the use of reputation systems on the eBay and Slashdot web sites in which users rate each other's behavior and comments.

## CONCLUSION

By using the human form to visualize historical information about participants in online spaces, we have created an approach that is evocative and raises some intriguing questions. It can be difficult to use anthropomorphic figures in user interfaces effectively. Our approach attempts to use a more abstract representation to create a less literal response to the people being represented and also to convey

supplementary information about authors. A variety of potential designs combining abstract forms with human faces and bodies are feasible. Future work will formally investigate users' reactions to different variations of the visualization approach to identify whether it is possible to use the human form in visualizations that augment social responses and avoid misleading users in their perceptions of others online.

## ACKNOWLEDGMENTS

The authors wish to thank Chen Xiao for assistance with implementation of the test bed system, Roger Booth for customizing the LIWC software, and the members of the Sociable Media Group for their technical assistance, input and feedback.

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