Setting the Stage for the Culturally Adaptive Agent

Patricia O'Neill-Brown

Department of Linguistics
Georgetown University
Washington, DC
poneillb@mail.mntva.com

Abstract

Much attention has been given to the creation of adaptive user interfaces by the intelligence user interface design community. Such efforts have been driven by the recognition that different users are motivated by different needs and goals. Of late, driven by the same need for user customization, attention has focused on the research and development of adaptive agent technologies. However, in both of these areas--intelligent user interfaces and agents--little attention has been given to the cultural influences at play in the shaping of user needs and user modes of interaction and communication. This paper argues that culture underlies every aspect of social behavior and influences individual communication style, personality, character, motivation, knowledge, and cognitive mechanisms. The role of the individual within the group; modalities of communication, that is, the degree and mix of verbal and non-verbal communication; and group dynamics are all culturally dependent. Since this is the case, there is a need for socially intelligent agents that have mechanisms for understanding and producing communicative behaviors which are culturally reflective of the users and other agents with which they interact. If the cultural influences at work in shaping social behaviors are not factored into agent design, then communication between agents and users and amongst agents will be strained.

Cross-Cultural Communication

Culture underlies every aspect of social behavior and influences individual communication style, personality, character, motivation, knowledge, and cognitive mechanisms. Cross-cultural differences in communication styles have been explored extensively in the linguistics and cultural anthropology literature at large. Cross-linguistic studies have been carried out in almost every focus area of linguistics, including sociolinguistics, cultural linguistics, pragmatics, semantics, applied, theoretical and computational linguistics.

Sociolinguistics research in particular focuses on the social roles and relationships involved in language use. Sociolinguists analyze language within the framework of social activities, and set about to discover "the specific patterns or social rules for conducting conversation and discourse" (Wolfram 1997). Thus, patterns and norms for doing such things as opening and closing conversations, turn-taking, or asking questions are described and cast within a framework of social interaction. What has come to light in the wake of this research is that these rules and patterns vary depending on the language.

What we see is that culture and language are inextricably interwoven, each helping to shape the other. Culture helps to define the rules and patterns of each language. Spun into this fabric of interaction between the individual and one's culture are group values. Group values and communicative behaviors accepted by the group help shape and influence the individual's communicative behaviors. Thus, individual communicative behaviors, such as the degree and mix of verbal and non-verbal communication one uses in conversation, are reflective of one's language and culture. Individual communicative behaviors can also tell us about one's place within the group or even about where one hopes to be within the group.

Examples abound which illustrate how communicative behaviors, both verbal and non-verbal forms, are exhibited differently in different languages. There are cross-cultural differences in expressions of emotion (Emantatian 1995). So for instance, while a laugh in American culture usually signals that the one laughing is happy, amused or pleased, in Japanese culture, this is not necessarily the case: a laugh may signal nervousness or uncomfortableness. Body language may signal different things in different languages: in American culture, looking directly into the eyes of the person to whom one is talking is seen as a positive trait; a sign of confidence and directness on the part of the speaker, whereas not looking directly at someone is considered to be evasive and a sign of a lack of confidence. In Japanese culture, on the other hand, looking too directly at someone is considered negative, as rude and improper.

Why is it important to keep in mind that every language has a different set of and various functions for its array of communicative behaviors? It is important because there is already evidence that developers of agents are designing agents that mirror their own modes and manners of communication. We are witnessing the birth of agents that are reflective of individual designers' communicative behaviors. Unless there is a recognition and accounting for such influences in the design of agents, what we may see are agents growing up not able to communicate with people from cultures different from their designers or with agents designed by different developers. Communication failures will impede system performance.

Agents as Mirror Images of Their Developers

There are indications that not only embodied agents in concrete, dynamic environments carry cultural configurations, but the wide array of computational processes. It appears that whether the agent characters are implemented as data structures and computational processes or as robots, cultural influences are at work in the developer's design process (O'Neill-Brown 1997). An example of cultural influences at work in the developer's design process can be seen in some of the current work in the development of socially intelligent agents. For the purpose of developing a service agent, developers at Sony Computer Science Laboratory are attempting to account for the totality of the speech act, including verbal and non-verbal (body language) behaviors as well as situational context (Nagao and Rekimoto 1996). Presumably, the service agent, *The Ubiquitous Talker*, which recognizes and produces spoken language, is programmed to communicate only in Japanese. The developers report that they are taking into account prosody and gestural information (Nagao and Rekimoto 1995). However, it is not clear whether the developers are considering having the service agent communicate in languages other than Japanese.

If they are, they must keep in mind that if they wish to design an application that can be used effectively by speakers of languages other than Japanese, they will need to take into account the fact that prosodic features of languages and gestures, such as nods and gazes, vary according to language and culture. Such behaviors may vary in terms of amount, duration, and timing. In addition, the meaning ascribed to gestures and other non-verbal forms of communication also varies according to the language and culture. For instance, when a native speaker of English who is American asks the question, "who, me?," he may point to himself, and if she does, it is usually at the upper chest area. However, when a native speaker of Japanese asks the same question, he points to his nose.

It was asked in the Call for Papers for this symposium as to what degree do artificial agents which communicate with humans have to be human-like (e.g. possess a human-face, mimic human speech or gestures and so on) to be socially acceptable to human societies. It was also asked what, if anything, will be lost by excluding such human physical characteristics. The answer to these questions depend in part on the culture that the end user comes from. It may be the case that some users will desire anthropomorphic agents and some will not, and such preferences may have a cultural basis. Some anecdotal evidence from the U.S. market suggests that U.S. users do not tend to favor anthropomorphic agents while Japanese users prefer them.

Microsoft's "Bob," for instance, did not stimulate too much interest in the U.S. marketplace. In addition, one often hears U.S. users remarking that they do not favor acting in intimate ways with machines, such as ATM machines. Similarly, of note is that the preponderance of those leaders in the field of Human Computer Interaction voicing their opinion at the Intelligent User Interface 97 Conference that anthropomorphic agents were not necessary or desirable and can even, in some cases, be an intrusion or a detriment to a user completing a task, happened to be Americans who were native speakers of English.

Japanese users, on the other hand, seem to openly embrace human-like agents. Strong research and development directions are being taken by the Japanese to develop adaptive agent systems, and many of these have an anthropomorphic look and feel if not "face." In a benchmarking study on human-computer interaction technologies in Japan, the study team reports:

> The fundamental idea behind the work we observed is to make computers behave as humans would, obeying social rules and communicating with emotional feedback (Holdridge 45:1996).

The JTEC panel cites the research being carried out at the Japan-based Sony Computer Science Laboratory, Inc., which is focused on how facial expressions, voice tones and gestures communicate human feelings to illustrate efforts towards the goal of introducing emotion into human-computer interactions. Sony researchers have found through testing with users, that facial expressions are helpful; they note, especially "upon first contact with the system" (Nagao and Takeuchi 1994).

Similarly, researchers at the Image and Media Laboratories at Sharp Corporation developed an agent which gauges the nodding and gazing behaviors of the human it is interacting with and responds appropriately with its own nodding and gazing responses (Sakamoto 1997). In order to develop such an agent, Sharp researchers studied Japanese subjects engaged in conversation in order to characterize nodding behaviors and gaze direction. They then programmed a knowledge of such behaviors into the agent which included how to detect and respond to them. An agent was built for the purposes of helping the user select a television station. An experiment was then set up in which the subjects switched from having the agent response mode turned on to having it turned off. After testing, surveys taken to assess user preferences revealed that they preferred the response feature.

Detecting and Responding to Different Forms of Social Interaction

As agents are being built to interact with humans and with other agents in multiagent heterogeneous systems, it will be critical to code into these agents built-in features for a) detecting different forms of communicative behaviors and b) responding to them appropriately. Such a feature will be necessary to build into any agent, whether it be a robot or some sort of computational process such as a software agent, if this agent is to be able to interact with agents in heterogeneous environments and a host of individuals from

a wide variety of backgrounds.

Human beings are able to bridge cross-cultural differences in communication behaviors and styles by being able to a) detect such differences and b) respond appropriately. The ability to detect differences and respond appropriately to achieve successful communication can be learned explicitly. We do this when we learn second languages. Indeed, as any second language learner can attest to, it is vital to simulate the behaviors exhibited by native speakers of the target language if one is to effectively communicate with the speakers of that language.

There is a precedent for the development of adaptive systems in the intelligence user interface design community. If we look at the directions in interface development over the last decade or so in the Human Computer Interaction (HCI), Intelligent User Interface (IUI) and Arificial Intelligence (AI) communities, we see much attention being given to user adaptivity issues at the interface level. Users are not viewed as "cookie cutter cut-outs," but rather, as individuals with different desires, goals and needs. Thus, there has been a good deal of research and development activity in interfaces that are automatically adaptive to individual users or can be customized by users themselves depending upon their individual preferences, needs and goals. For a sampling of such work, see Greenberg and Witten 1984; Kuhme et.al. 1992; Kuhme 1993; Thomas 1993; Piyawadee 1993; Maes 1994; Thomas and Krogsaeter 1993; Benyon and Murray 1993. See also project descriptions of The Human-Computer Interaction Laboratory at the University of Maryland, now in its fourteenth year of operation, which has been at the forefront in the development of adaptive user interfaces. See program description and list of projects at http://www.cs.umd.edu/ projects/hcil/index.html.

Spinning off from the work that has been carried out in intelligent user interface development are current efforts that are being focused towards the development of adaptive agents in multiagent and human-agent systems. The 1997 International Conference on Intelligent User Interfaces devoted a portion of the program to a discussion of adaptive agents; see Kerpedjiev et. al 1997; McCoy et.al 1997; and Schlungbaum 1997. Likewise, the American Association for Artificial Intelligence (AAAI) has increasingly been holding symposia and workshops on adaptive agents; see Sandip 1996, Milind and Gmytrasiewicz 1996, and Ibrahim 1996.

While such efforts at developing adaptive interfaces and agents exist, very little attention has been given to the cultural influences at work in the shaping of user needs and user modes of interaction and communication. However, since there are already existing approaches geared to capturing and developing systems which are adaptable to and by users, it would not be a stretch for developers to fold in a mechanism to account for the cultural differences of users.

The Culturally Adaptive Agent in Action

It is easy to see the need for service agents to have a mechanism for detecting and producing culturally acceptable forms of communication in order to help effectively meet the needs of the user that it is servicing. The issue of service agents makes me think of the discussion I engendered after delivering my paper at the AAAI Spring Symposium on Computational Models for Mixed Initiative Interaction. In my presentation, I discussed the ways in which cultural influences are already playing a major role in the design of software and hardware agents, in both natural and synthetic environments, providing evidence of this through comparative analysis of the behavior of agents developed by Japanese versus U.S. developers. One of the participants in the symposium, a German woman, about twenty-nine years of age who was in the United States for the first time, agreed that cultural influences factor very much into our interactions with people.

She pointed out an instance in which she had recently been at a restaurant in the U.S. and the waiter started to initiate casual conversation with her. She commented that she had a funny reaction to his behavior since to her, a waiter is a waiter, he's there to serve and not to speak to you as if he was your friend. This impression was confirmed by the organizer of this symposium, a German woman as well. Based on input such as this, one might begin to consider whether a service robot designed to interact with people from Germany ought to be designed to act differently from a service robot geared to Americans, for example, in order to maximize effective communications, and thus, user satisfaction. After all, expectations about service and the communications by which it is facilitated, are, in part, informed by culture.

Tutoring agents will also have to be culturally adaptive if they are to be effective instructors. In Microsoft's package *TutorAssist*, aimed at helping children to develop basic skills which will be introduced into the marketplace in September, is an animated character, Professor P.T. Presto, which will recognize when students require help. It will be interesting to find out what this character looks like and how it interacts with children in order to see whether this character can work effectively with children speaking different languages and coming from different cultures. Since pedagogical approaches and attitudes, expectations about the student-teacher relationship, and the mode and manner of student and teacher interactions all vary according to culture, it will be interesting to see if Professor Presto will turn out to be a one-size-fits-all kind of teacher. Perhaps Professor Presto's teaching style will have to be modified depending on the varying needs of his or her students. Perhaps Professor Presto may have to undergo a name change, as the word "presto" suggests that learning is to take place as if by magic, a belief to which every culture may not ascribe.

In addition to cultural influences at work in agent design, it appears that male-female differences are also playing a role in determining "the look and feel" of the agents that are springing to life. Nagao and Rekimoto's personal shopper agent seems to be reflective of male shopping behaviors (Nagao and Rekimoto 1996). Judging from the features described, it seems as if the reason for having the agent is to help expedite the shopping exercise; in other words, to help the shopper get out of the store more quickly. This approach to the shopping exercise is very "male"--at least typical American males prefer to get in and out of a store as quickly as possible. Generalizing about American male versus female shopping behaviors, males seem to be very goal-directed in their approach, whereas females tend to view shopping as an experience, preferring to "browse before the kill." Perhaps Japanese males and females exhibit these same differences. If so, perhaps females may prefer a feature that would help them to browse more effectively as opposed to getting out of the store more quickly.

In sum, if we are to develop socially intelligent agents that have mechanisms for understanding and producing communicative behaviors which are culturally reflective of the users and other agents with which they interact, then communication between agent and users and amongst agents will be improved. Agents that are able to communicate effectively in multiagent systems will result in improved system performance. Improved communication between socially intelligent agents and humans will help to create satisfied "customers," and in turn, help to expand the market base for these agents.

References

Basso, Keith. 1990. *Western Apache Language and Culture*. Tucson: Univ. of Arizona.

Benyon, David and Dianne Murray. 1993. Developing Adaptive Systems to Fit Individual Aptitudes. In Proceedings of the 1993 International Workshop on Intelligent User Interfaces, 115-121.

Casson, Ronald W. 1981. *Language, Culture and Cognition*: *Anthropological Perspectives*. New York: Macmillan.

Emantatian, Michele. 1995. Metaphor and the Expression of Emotion: The Value of Cross-Cultural Perspectives. *Metaphor and Symbolic Activity*, 10(3):163-182.

Greenberg, Saul and Ian H. Witten. 1984. Adaptive Personalized Interfaces - A Question of Viability Behaviour and Information Technology, 4(1): 31-35.

Holdridge, Geoffrey M., ed. 1996. *JTEC (Japan Technical Evaluation Center) Panel Report on Human-Computer Interaction Technologies in Japan*. Baltimore: International Technology Research Institute.

Imam, Ibrahim F., Chair. 1996. Intelligent Adaptive Agents. In Papers from the 1996 AAAI Workshop Technical Report WS-96-04. http://www.aaai.org/TechReports/Contents/Workshops/WS-96-04.html.

Kerpedjiev, Stephan and Giuseppe Carenini, Steven Roth, and Johanna Moore. 1997. Task-based Approach to Multimedia Presentation. In Proceedings of the 1997 International Conference on Intelligent User Interfaces.

Kuhme, Thomas. 1993. A User-Centered Approach to Adaptive Interfaces.
Knowledge-Based Systems, 6(4):239-248.

Kuhme, Thomas, and H. Dieterich, U. Malinowski, and M. Schneider-Hufschmidt. 1992. Approaches to Adaptivity in User Interface Technology.
In Proceedings of the IFIP {WG2.7} Working Conference on Engineering for Human-Computer Interaction.

McCoy, Kathleen F. and Patrick Demasco, Christopher Pennington and Arlene L. Badman. 1997. Some Interface Issues in Developing Intelligent Communication Aids for People with Disabilities. In Proceedings of the 1997 International Conference on Intelligent User Interfaces.

Maes, Pattie. 1994a. Social Interface Agents: Acquiring Competence by Learning from Users and other Agents. In Software Agents, Papers from the AAAI 1994 Spring Symposium Technical Report SS-94-03, 71-78. http://www.aaai.org/TechReports/Contents/Symposia/Spring/SS-94-03.html.

Maes, Pattie. 1994b. Learning Interface Agents. In Proceedings of the 1994 Friend21 International Symposium on Next Generation Human Interface.

Nagao, Katashi and Akikazu Takeuchi. 1994. Speech Dialogue with Facial Displays: Multimodal Human-Computer Conversation. In Proceedings of the 32nd Annual Meeting of the Association for Computational Linguistics (ACL-94), 102-109.

Nagao, Katashi and Jun Rekimoto. 1996. Agent Augmented Reality: A Software Agent Meets the Real World. In Proceedings of the Second International Conference on Multiagent Systems (ICMAS-96). http://www.csl.sony.co.jp/person/nagao.j.html.

Nagao, Katashi and Jun Rekimoto. 1995. Ubiquitous Talker: Spoken Language Interaction with Real World Objects. In Proceedings of the 14th International Joint Conference on Artificial Intelligence (IJCAI-95), 2,:1284-1290.

O'Neill-Brown, Patricia. 1997. The Need for Culturally Adaptive Agent Behavior. Presented at the American Association for Artificial Intelligence Spring Symposium Series Computational Models for Mixed Initiative Interaction. http://www.mntva.com/pobtest/pob.ps.gz.

Palmer, Gary B. 1996. *Toward a Theory of Cultural Linguistics*. Austin: University of Texas.

Schlungbaum, Egbert. 1997. Individual User Interfaces and Model Based User Interface Software Tools. Poster Session, 1997 International Conference on Intelligent User Interfaces.
http://smi.stanford.edu/projects/mecano/iui97/ap.htm.

Sen, Sandip, Chair. 1996. Adaptation, Coevolution and Learning in Multiagent Systems. In Papers from the 1996 AAAI Spring Symposium
Technical Report SS-96-0.
http://www.aaai.org/TechReports/Contents/Symposia/Spring/SS-96-01.html.

Sukaviriya, Piyawadee. 1993. From user interface design to the support of intelligent and adaptive interfaces: an overhaul of user interface software infrastructure. *Knowledge-Based Systems*, 6(4):220-229.

Tambe, Milind and Piotr Gmytrasiewicz, Cochairs. 1996. Agent Modeling.
In Papers from the 1996 AAAI Workshop Technical Report WS-96-02.
http://www.aaai.org/TechReports/Contents/Workshops/WS-96-02.html.

Thomas, Christoph G. 1993. Design Implementation and Evaluation of an Adaptive User Interface. *Knowledge-Based Systems*, 6(4):230-238.

Thomas, Christoph G. and Mete Krogsaeter. 1993. An Adaptive Environment for the User Interface of Excel. In Proceedings of the 1993 International Workshop on Intelligent User Interfaces, 123-130.

Wolfram, Walt. 1997. Sociolinguistics: Language as Social Behavior. http://www.lsadc.org/Wolfram.html. In The Field of Linguistics, the Linguistic Society of America, http://www.lsadc.org/flxtitlepg.html.

Wolk, Martin. 1997. Microsoft to Launch Line of Education Software,
http://www.yahoo.com/headlines/970818/tech/stories/education_1.html.