On January 12, users on an Internet Relay Chat channel watched Brandon Vedas die. Some of them literally watched, using a webcam. Some of them talked to him online and tried to help. One of the users was a robot.

(Specifically, this user was a chatterbot, a program that logs on just as a person does and can be addressed as a person.)

Online environments are real social worlds, where people live and die, face love and loss, and build and abide by social norms to improve their communication. And chatterbots already live in them …

A user asks Pnutbot for the URL of Vedas's webcam, which Pnutbot supplies.

A user, wondering about the dosage Vedas has taken, employs Pnutbot as a calculator.

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[02:29:21] [Oea] look at him
[02:29:24] [hast] get his stomach pumped
[02:29:24] [@phalaris] 130 + 160 ?
[02:29:24] [%Pnutbot] 290
...
[02:33:25] [hast] kolonopinz.com
[02:33:26] [hast] or something
[02:33:27] [%Pnutbot] better than nothing
[02:33:33] [Oea] rippercam
[02:33:33] [%Pnutbot] http://www.klonopinz.com/webcam.html
...
[02:53:49] [grphish] poison control is <reply> 1-800-222-1222
[02:54:00] [grphish] poison control
[02:54:00] [%Pnutbot] 1-800-222-1222
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A user teaches Pnutbot the phone number for poison control, then checks to see that Pnutbot has learned it.

Arby — An Agent to Assist in Bargaining and Mediation

Arby is a computer program that can live in a MUD or MOO (types of all-text virtual environments) and can conduct conversations to help participants resolve disputes or bargain about substantive issues. Like Cobot [1], which used reinforcement learning to make its behavior more socially acceptable, Arby draws on well-established mathematical and computational principles — in this case, ideas from game theory about how people can bargain effectively — and allows us to consider how they can be applied in a difficult-to-model social world, with norms and expectations that are not always clear. ¶ Without trying to understand all the details of a particular bargaining situation or dispute, Arby asks the participants to parametrize the issues and state their positions, having them rank which part of the other proposal is best and which is worst. Then, Arby offers advice about who should make the next compromise, determined by computing the solution to what seems then to be the corresponding Nash bargaining problem. Arby also suggests what a good next proposal might be. ¶ Results from a preliminary study involving a contrived scenario, "roommate accord," and about 100 users, were encouraging, but revealed that trying to participate in a complex social process, even in a simple way, can be difficult. Arby offered advice that was helpful to some, but the format it used often proved too inflexible. Observation of how users negotiate online, on their own, showed that Arby asks users to undertake only a few of the effective actions that people try. Still, some users said that even this first version of Arby was helpful and led to satisfying outcomes. Arby's limitations provide essential information. An improved version should be able to facilitate more of the types of communication that users actually rely on — speaking qualitatively at first, for instance, and discussing the issue in more detail so as to elaborate the original set of parameters and allow for agreement to begin with smaller-scale compromises.

Arby asks the participants to parametrize the issues and state their positions. Then, Arby offers advice about who should compromise.

Can a chatterbot really serve to help in bargaining situations and substantive disputes? We believe it can. Weizenbaum was horrified when people said his Eliza had helped them work through psychological problems [3], but people use even less "intelligent" artifacts, such as diaries, to improve their well-being [2]. People also often bargain and settle disputes without a mediator being involved at all. We think many different entities — not just human mediators — may be helpful; chatterbots should be among them. ¶ In the future, we will investigate other ways that algorithms can be applied to the operation of chatterbots in online social worlds and to the understanding of those worlds. This will involve building a more complete model of the social world, extending on the model that was built in Cobot, so that a chatterbot can automatically adopt to different MUDs or MOOs using machine learning techniques. Having the chatterbot learn about users' personal idiosyncrasies might also make it more effective. But an essential step will be awareness of the social situation and of what sort of activity is going on in the online environment at any particular moment. Being able to model this activity is a new problem that arises in online virtual environments. Fortunately, this problem stems from the rich and interesting nature of such online worlds — places where one can move about to different locations, talk, and undertake different sorts of actions, privately or publicly.

In the future, we will investigate other ways that algorithms can be applied to the operation of chatterbots in online social worlds and to the understanding of those worlds.

[1] Isbell, C. L., Shelton, C. R., Kearns, M., Singh, S., and Stone, P. A social reinforcement learning agent. In *Proceedings of the Fifth International Conference on Autonomous Agents* (Montreal, Canada, 2001), J. P. Müller, E. Andre, S. Sen, and C. Frasson, Eds., ACM Press, pp. 377–384.
[2] Turkle, S. *The Second Self: Computers and the Human Spirit.* Simon and Schuster, New York, 1984.
[3] Weizenbaum, J. *Computer Power and Human Reason: From Judgment to Calculation.* W. H. Freeman and Company, San Francisco, 1976.

Eliza, 1964–1966
Joseph Weizenbaum creates the first chatterbot at MIT. It imitates a psychotherapist. Users, using a Teletype to talk with it, shock Weizenbaum by treating his program as if it were a human being.

Cobot, 2000–2002
Charles Isbell and others at AT&T create a bot that lives on LambdaMOO, keeps social statistics, can introduce people and start conversations, and learns to behave appropriately with reinforcement learning.

Arby, 2003–
Montfort, with Kearns, Isbell, and Penn undergrad Ben Packer, creates a bot to help with two-party bargaining situations in a MUD or MOO. In early testing, Arby helps about 100 users bargain with one another.

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