Software Agents

(Jennings and Wooldridge, 1996)

Dave Almeida

Artificial Life Seminar
Identify three distinct classes of agent in “extant” (circa 1996) applications:

“gopher” agents, which execute straightforward tasks based on pre-specified rules and assumptions (eg inform me when the share price deviates by 10% from its mean position or tell me when I need to reorder stock items).

“service performing” agents, which execute a well defined task at the request of a user (eg find me the cheapest flight to Paris or arrange a meeting with the managing director some day next week). Finally, there are

“predictive” agents, which volunteer information or services to a user, without being explicitly asked, whenever it is deemed appropriate (eg an agent may monitor newsgroups on the INTERNET and return discussions that it believes to be of interest to the user or a holiday agent may inform its user that a travel firm is offering large discounts on holidays to South Africa knowing that the user is interested in safaris).

All of these three classes of agents have “Agenthood”:
The Key Characteristics of “Agenthood”: (Wooldridge and Jennings, 1995):

• **Autonomy**: agents should be able to perform the majority of their problem solving tasks without the direct intervention of humans or other agents, and they should have a degree of control over their own actions and their own internal state.

• **Social ability**: agents should be able to interact, when they deem appropriate, with other software agents and humans in order to complete their own problem solving and to help others with their activities where appropriate.

• **Responsiveness**: agents should perceive their environment (which may be the physical world, a user, a collection of agents, the INTERNET, etc.) and respond in a timely fashion to changes which occur in it.

• **Proactiveness**: agents should not simply act in response to their environment, they should be able to exhibit opportunistic, goal-directed behaviour and take the initiative where appropriate.
Three types of Applications of agents are examined:

Personal Information Management

Electronic Commerce

Business Process Management

Their examples are somewhat dated, so I would like to take their definitions and characteristics and look at some modern applications that didn’t exist in 1996, and also some real Electronic Commerce applications from that period, and see if they fit the criteria for “Agenthood” as set out by Jennings and Wooldridge
(Jennings and Woodridge 96) “Software Agents” Claim that “hundreds” of systems are already using “agent technology” (in 1995). Maybe so, but I doubt it.

Here’s one that did:

Microsoft’s Clippy

It all started with another great Microsoft idea …

Clippy is a predictive agent (by their definition). Discuss?
Clippy is
- autonomous,
- has “social ability” (mostly the ability to get users very angry)
- responsive
- proactive. Clippy brought itself up, much to the chagrin of most users.
Thankfully, Clippy got “The Boot”
Another (potential) predictive agent:
PIMs (Personal Information Management)

Dice.com “bot”

Discussion: Does this really qualify as an “agent”? I filled out some forms to do an automatic search. I’m not sure I call that “learning”. But it does run this “autonomously” and email me results, without my having to do anything. It certainly “amplifies” my abilities in terms of searching for contracts. It does not go out and negotiate a contract and rate for me.

Seems to fit the definition given of **Gopher Agent**, as well as a **Service Agent**.
Amazon.com

This probably comes closer to being a real software agent, that acts autonomously, and does not relate only to PIM, but to electronic commerce as well:

It “learns” from what I look at and what I have previously bought.
It “autonomously” comes up with recommendations for me. And these recommendations are mostly not bad, (But I would never buy a Paul McCartney album – with his money, he should probably give them away.)

[But I see below that that I can actually buy Paul McCartney!]

Amazon may even use some type of “Agent” software for this.

Seems to fit the definition of a predictive agent, as well as service performing agents.
Yahoo profiles: my.yahoo.com

- does this qualify? It does go out and retrieve a number of things that I am interested in, without my doing any more work than authenticating myself.

- I suppose this could be called a Gopher Agent.
Another Application area:

A category that was mentioned only briefly in the paper was intelligent computer and network administration and diagnostic tools, such as vulnerability analysis tools like SATAN:

![Image of SARA and SATAN with text](https://example.com/sara.png)

**SARA**

The Security Auditor’s Research Assistant (SARA) is a third generation Unix-based security analysis tool that is based on the SATAN model.

**SATAN**

SATAN, the System Administrator Tool for Analyzing Networks, is a network security analyzer designed by Dan Farmer and Wietse Venema. SATAN scans systems connected to the network noting the existence of well-known, often exploited vulnerabilities. For each type of problem found, SATAN offers a tutorial that explains the problem and what can be done.

For additional information, see:

- CIAC Note 95-07
- CIAC Note 95-08
- Courtesy

![Image of SARA and SATAN with text](https://example.com/sara.png)
(Real) Electronic Commerce

Aside from Amazon, most EC on the Web is not very sophisticated.

Unless we look at **Financial Markets**. “Auto-Exectution” protocols and exchanges do allow for agent-type functionality.
And also allow agents to interact “socially” with humans buying and selling things on the other side.
GovTrade and RepoTrade (Credit Suisse First Boston)

I was involved in developing the first TCP/IP-based “automatic” bond-trading systems – GovTrade and RepoTrade, at CSFB in 1994-1996. The systems “negotiate” with other systems and with users (using the Bloomberg Financial Network).

This system had a variety of rules set up to tell it what it could trade, and went about this trading autonomously (with a “kill switch”, of course).
- criteria: prices, size limits, customer agreements

Were these systems agent-based? I’m not sure how to answer that, but the press said we were replacing people, and indeed, we were.

Here, we were automating very high-paid, egotistical “Bond Traders”.
They autonomously negotiated in the set-up environment.
They negotiated with other “autonomous” systems.
They negotiated “socially” with humans in the exchange market environment.
They fed information onto other processing systems so that proper “business process management” occurred.
**Discuss:** do any of these Real E-Commerce systems qualify as “Software Agents”?
They certainly fit the model shown for Electronic Commerce in the paper:

![Diagram of Electronic Marketplace]

Figure 2: The Electronic Marketplace

These systems combine all of the application characteristics that were mentioned –

**Personal Information Management**
**Electronic Commerce**
**Business Process Management**

They were not built with any specific “Agent” technology – they were built with C++, Unix, and NT.
TradeWeb LLC

Is an electronic “exchange”, that I also helped develop (in 1997), that acts as an agent to allow users to buy and sell fixed income securities (Bonds) for the best price, from a large number of sources. The system itself is automatic, so it performs the functions that Humans used to do (with telephones).

Sell-side Systems that use TradeWeb’s protocol can connect to it and do bond trading.

Buyers use a specialized browser that allows real-time financial information to be disseminated quickly to make Fixed Income (bond) trades, or, their own or third party software that can also allow them to automate this work.
TradeWeb has both the described characteristics of an electronic marketplace:

Figure 2: The Electronic Marketplace
And those of business process management:

But there was very little overall effort made to think of “Agents” in the development of any of these systems.

Discuss? So, if it walks like a duck, and quacks like a duck, is it a duck?
In the conclusion, Problems and Promises, Woodridge and Jennings mention:

Software agents may be used to help make software friendlier.

Software agents may be over-hyped.

Software agents will not solve all problems

Significant Concerns exist
- privacy
- loss of information (Spam or email filters)
- financial concerns (Automatic transactions may subject users to loss).
Future Directions for Software Agents?

E-Voting
Thank You