Visualizing Market Data

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http://computer.org/internet/v5n2/tac.htm

I n finalizing plans for the International Conference on Multiagent Systems (ICMAS 2000) competition, we began investigating ways to visualize agent activity during the trading agent competition (TAC). We wanted to create images that would allow participants and observers to follow a game as it unfolded. In the end, we displayed each bid using combinations of color, height, width, and spatial location to let viewers efficiently identify bid properties, trends, and relationships.

Visualization Design

Figure 1 shows a visualization of activity from the second game of the ICMAS finals. It displays five different bid attributes: *time, auction, agent, price,* and *quantity*. Rectangular towers represent each bid made during the game, and a bid's time and auction define the tower's location on the underlying grid. Time increases from left to right along the horizontal axis, and each row corresponds to a separate auction. Each tower's color, height, and width show the bid's agent, price, and quantity, respectively. A higher buy (or sell) price increases the height of the tower, and bids for larger quantities produce wider towers.

A bid string ((q1 p1) ... (qn pn)) with multiple bid points is displayed as a horizontal row of *N* towers in the appropriate grid cell (defined by the time and auction). Bids made by different agents at the same time in the same auction are shown as separate rows of towers drawn in a common cell. This arrangement uses spatial density to represent the level of bid activity at different locations in the game.

Lessons Learned

Visualizing the game in its entirety revealed several properties that were not obvious from the activity logs or the market graphs. Some agents, for example, periodically made very low buy bids for hotel rooms to ensure that the hotel auctions would "stay alive." Some used a strategy of submitting multipoint bids for different quantities at different prices. These are displayed as a horizontal row of towers with increasing or decreasing height. Bids from agents that chose to bid marginal utility (the estimated value of a hotel room, assuming an agent had purchased everything else it needs for the trip) stand out as tall towers near the end of the game.

Our visualizations offer important insights into individual agents' performance following various strategies, as well as into the structure and flow of the TAC game as a whole.
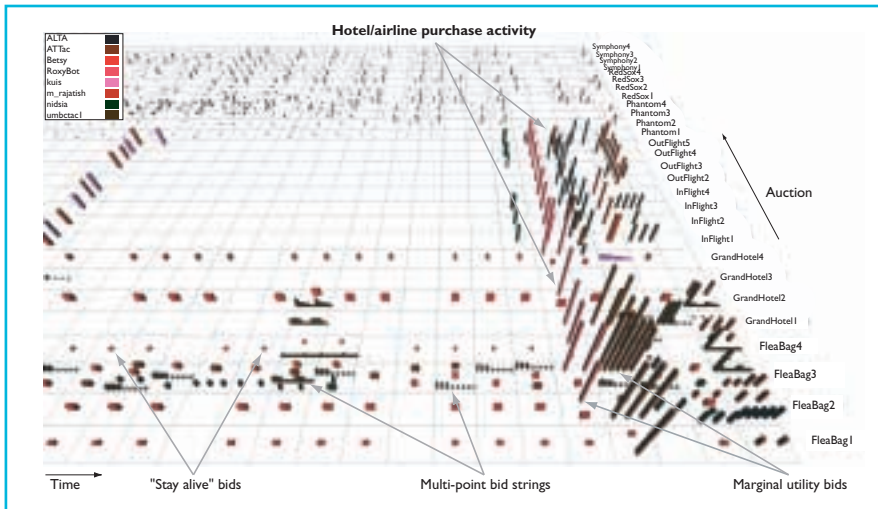

Figure 1. TAC game 3055. This visualization shows "stay alive" bids, multipoint bid strings, marginal utility bids, and late-game airline and hotel bids from the second trading agent competition (TAC) game at the ICMAS 2000 finals.