ACT-R Lemonade Bot Specification v1.0 – 12/30/09

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The bot consists of three interdependent components: action, prediction and selection. Those techniques are inspired by human cognition, and correspond to the functions of procedural strategies, declarative sequence learning, and metacognitive evaluation, respectively. The workings of these components are detailed in the following sections.

Action

Action consists of a number of independent strategies. The three default ones are, in order:

1. **Sticky**. Pick a position at random, move there and stay there as long as the strategy is applied.
2. **OppW**: Predict the next position of the weakest opponent (weakness is defined by least number of total points up to current time) then move opposite to it on the clock. Each subsequent iteration in applying this strategy will require estimating the next position of that opponent and moving there.
3. **OppS**: Same as the previous strategy (OppW) but applied to the stronger of the two opponents.

Prediction

Action strategies 2 and 3 (OppW and OppS) require the ability to predict the next position of an opponent. Each opponent will be predicted separately. The basic prediction algorithm that will be used is as follows:

1. For every game update, record the position of each opponent at that iteration.
2. Given the current opponent position c_t and its previous position c_{t-1}, compare it to all past position triplets c_s, c_{s-1} and c_{s-2} for s<t. If $c_t - c_{t-1} = c_{s-1} - c_{s-2}$ then make the prediction for that opponent $c_{t+1} = c_t + c_s - c_{s-1}$. That prediction carries a weight of $\frac{1}{\sqrt{t-s}}$. If $c_t - c_{t-1}$ is not equal to $c_{s-1} - c_{s-2}$ then no prediction is made for that value of s.
3. Repeat for all past values of s<t, summing up the weights for all identical predictions (i.e., the same predicted value of c_{t+1}). The value of c_{t+1} with the highest weight is selected as the prediction for that opponent to be used in the action strategies above. If no prediction can be made (i.e., there is no s<t for which $c_t - c_{t-1} = c_{s-1} - c_{s-2}$), then the opponent position is assumed to be the current one, i.e. $c_{t+1} = c_t$.

Selection

The action strategies will be picked in order, starting with Sticky, followed by OppW and OppS, and then back to Sticky. The current strategy will keep getting used as long as it is winning (defined as a payoff of 8 or more). If it loses (i.e., gets a payoff of less than 8) two iterations in a row, then the next strategy in the order is selected.