Perception in TsumeGo under 4 Seconds Time Pressure

Atsushi Yoshikawa and **Yasuki Saito**
NTT Basic Research Labs.
3-1 Morinosato Wakamiya, Atsugi-shi, Kanagawa Pref. 243-01 Japan
yosikawa@rudolph.brl.ntt.jp

Introduction and Methods

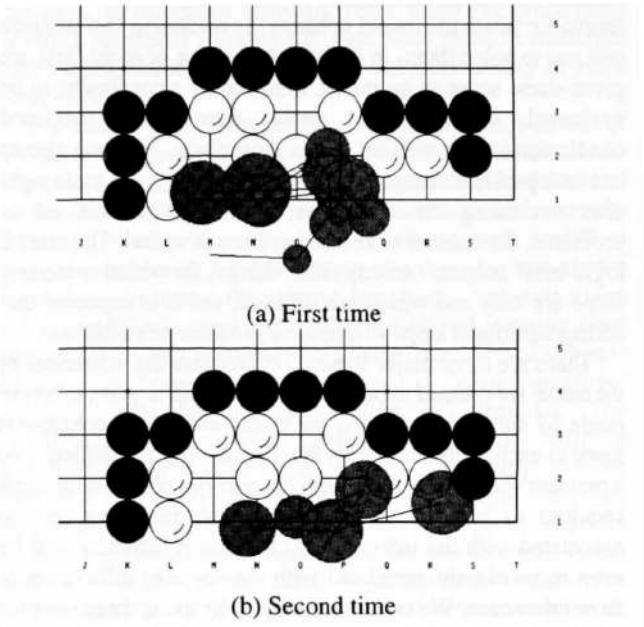
The purpose of our research is to model the perception of Go players. Our previous study shows that with 3 seconds time pressure, Go players will recognize board situations differently according to their skills (Yoshikawa & Saito, 1995). In order to investigate the difference, we used eye camera data.

2 subjects were investigated. One was 6 dan (stronger player), another was 2 kyu (weaker player). They wore NAC EMR-600 eye camera. TsumeGo problems (life and death problems usually near the edge of the board) were displayed on the computer monitor for 4 seconds. They must answer the first move using a mouse within that period of time. They go through 311 problems of various difficulty. Among them, 10 problems appear twice.

Results

Some of the results obtained so far are listed below:

1. **Fixation points:** Eyes fixate on stones themselves and empty points in TsumeGo, while eyes fixate on the boundary of stones and empty points in ordinary Go games (Yoshikawa & Saito, 1993).
2. **Fixation is limited to small area:** Even though there were many stones and empty points on the board, eyes fixated only to a small area in TsumeGo.
3. **Stronger player v.s. Weaker player:** (1) Stronger player has shorter fixation time(200ms) than weaker player (300ms). (2) When a stronger player answered correctly, his eyes fixated at correct point for a long time. But, when his answer was incorrect, his eyes wonder around on several points which were almost irrelevant to the correct answer.
4. **Different eye fixation to the same problems:** (1) Even when the same problems were given, subjects did not fixate at the same points (see Figure 1). But the stronger player's final answer was the same. (2) When fixation time was summed up, the stronger player looked at nearly the same points longer than any other points.
5. **Correct answer:** When the stronger player answered correctly, he usually looked at correct points within 200ms from the problem presentation. A weaker player, regardless to the correctness of his answers, tended to look at several important points, such as Atari (a threat to capture), Kiri (cut), which can be easily identified from the board configuration. When a stronger player was incorrect, his eye movements are similar to weaker player.
6. **Pattern knowledge:** When stronger player points out his answer within 2 seconds by mouse, his eyes fixate on the answer within 300ms. In this case, he seems to use pattern knowledge, because he answered same point to different problems which contain same partial pattern, regardless of his answer's correctness.



(a) First time

(b) Second time

Figure 1: Stronger Player's Eye movements to the same problem at different occasion.

Conclusions

Through the analysis of TsumeGo solving task under 4 seconds time pressure, we found: (1) stronger player has many pattern knowledge, (2) stronger player's pattern knowledge is not so strict, (3) within 300ms, stronger player can find out the correct answer if he knows the pattern, (4) when stronger player can't use pattern knowledge, the strategy is similar to the weaker player's.

References

Yoshikawa A. & Saito Y. (1993). Cognition of Board Situation in Go. In *Proceedings of SIG-AI of Information Processing Society of Japan* (pp. 41–53).

Yoshikawa A. & Saito Y. (1995). Perception in Tsume-Go under 3 sec. Time Pressure. In *Proceedings of the Game Programming Workshop in Japan '95* (pp.105–112).