

Meta-Cognitive Attentions: A Case Study of Learning in Game Playing

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Introduction

We studied protocols of learning a new problem and observed two kinds of meta-cognitive attentions, i.e. *orientational* attention and *selective* attention. Scopes of these attentions are different in activities. When people confront with a new problem, it is required to regulate weakly coupled activities, such as making better understanding of the problem through experiences and finding immediate solutions using heuristics. Orientational attention is the meta-cognition on this regulation of multiple activities, whereas selective attention is a meta-cognition on reasoning in each activity.

Meta-Cognitive Attentions in Protocols

We request subjects to learn a board game, whose goal is to remove all tiles from the board in the shortest number of moves. Subjects are not informed of rules for legal moves, but they are guided by showing possible moves for each candidate tile selection. Also, partial rules are enough for removing all tiles. Verbal and action protocols are recorded.

The orientational attention appears in usage of move's types. In the case of orientationally attentive type, the usage of specific moves (Figure1: Subject2's striped area between thick lines) remarkably decrease in the middle phase of his

self-training process. These moves increase difficulties of game's state although reduce total number of moves. Changes are the result of focusing on immediate solutions rather than well-defined knowledge for optimal solutions.

The selective attention appears in verbal protocols. Verbal protocols are classified into three categories, (1) reactive: simple report of findings and recognition, e.g. "Aha, it turns to red", (2) reasoning: report of plan execution and its evaluation, e.g. "Rightward, here comes disconnection. So, this guy first ...", (3) meta-cognitive: making hypotheses and evaluating reasoning processes, e.g. "Um, the destination must be the same color, sure sure, it can't move." The meta-cognitive verbal protocols come from the selective attention. Table 1. shows the ratio of each categories based on protocols until the first success of each subject.

Conclusion

Two kinds of meta-cognitive attentions are experimentally observable and subject's attentiveness is distinguishable. Although meta-cognitive attentions are different in their scopes for activities, subject's types of attentiveness correlate to each other.

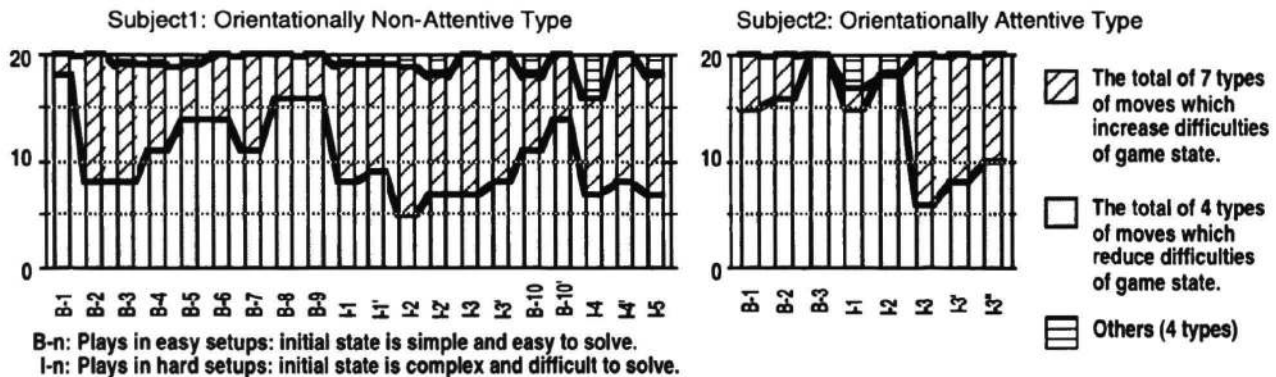


Figure 1: Frequency of move's types used by each subjects during first 20 moves in self-learning

Categories of Verbal Protocols	Subject 1: Selectively Non-Attentive	Subject 2: Selectively Attentive
Reactive	4% (114)	11% (409)
Reasoning	71% (2324)	42% (1502)
Meta-cognitive	25% (832)	47% (1691)

Table 1: Categories of verbal protocols (# of characters)