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SHORT NOTE

RECALL OF RANDOM AND NON RANDOM CHESS POSITIONS IN STRONG AND WEAK CHESS PLAYERS

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Three random and three meaningful chess positions were presented to strong and weak chess players during a 60 seconds time period. Recall was found to be superior in strong players for both kinds of material. This result is not explained by Charness (1976) model of expert performance and supports the idea that processes other than the identification or building of chunks might be at work in the encoding of the position.

INTRODUCTION

Expert chess players are known to the better than novices at recalling chess positions after a brief presentation (5 seconds) (Chase & Simon, 1973a, 1973b; de Groot, 1965). The authors have also showed that the experts' superiority disappears if meaningless positions are used (Chase & Simon, 1973a, 1973b; de Groot, 1965) and explain this phenomenon in terms of chess specific knowledge. The meaningless positions were obtained by morring pieces randomly in a real game position.

These data and variations on the same paradigm, (Frey & Adesman, 1976) support the hypothesis that good chess players perceive the position as a set of well known configurations of pieces. Each configuration is made of only a few pieces. Good players recognize those configurations (or "chunks") on the chess board and store only their identification. They are supposed to possess and access a vocabulary of those configurations in long term memory. The size of that vocabulary has been estimated to approximately 50000 different configurations (Simon & Gilmartin, 1973).

Identifications of those configurations were first presumed to be stored in short term memory but further research (Charness 1974, 1976) has shown that they may be stored in long term memory since performance is extremely resistant to proactive interference, while short term memory trace, usually, is not. It has also been argued that this two-store memory model is not the only theoretical possibility and that the processing levels approach could successfully be applied (Lane & Robertson, 1979).

The last version of the chunking theory (Charness, 1976) calls for the building of new chunks during encoding, and for long term memory storage, a theoretically slow process (Newell & Simon, 1972). The experts' superiority is then explained by the larger size of their preexisting vocabulary. They do not have to build as many new configurations as novices. The theory supposes that building new chunks or configurations takes more time recognition but that it takes the same time to experts or novices to build a new chunk. Experts just recognize more and build less. The theory is also useful in explaining the reasoning behavior of chess players. Moves or plans can be related to some configurations (chunks) and the task of chosing a move can be solved using a generate and test approach that is less time consuming than a complete search of the space of moves.

Despite those qualities, the theory is counter-intuitive. It is difficult to believe that a memory of configurations and associated plausible moves is all it takes to be a good chess player. Research also suggests that something more is involved in the choice-of-a-move task since in random, meaningless positions, good players consistently choose "better" moves (Holding & Reynolds, 1982). Holding and Reynolds (1982) and Holding (1985) explain this result by differences in search and evaluation abilities. Their experiment included a control recall task to ensure that the positions were not recalled more correctly by the strong players after an 8 sec. presentation but they did not test for recall after the task, which would have provided data for recall after a long exposition to the material. There are reasons, though, to investigate this possibility.

Charness' (1976) view is similar to Chase and Simon's position (1973a, 1973b): no recognizable chunk is supposed to remain in a random position and no skill related difference is to be expected for those positions whatever presentation time is used. Although the building of new chunks is allowed in Charness' version of the chunking theory, these new chunks are supposed to be built at the same rate by strong and weak players; thus there is no way to conceive of any advantage for strong players in the study of random positions. There are cues in the literature to suggest that this position may be too restrictive. Goldin (1978) has shown, in a recognition task, that good players achieve the same superiority on meaningless positions as on meaningful ones. This could be specific to recognition. But it could also be an effect of the presentation time. Goldin's presentation technique yielded long presentation times (an average 45 seconds) in comparison with the Chase and Simon's (1973) experiment. As soon as 1927, Diakow, Petrowsky and Rudik had shown that long presentation times lead to differences between strong and weak players in a memory task for chess-related material; the superiority of experts could appear in recall tasks for random material if long presentation times are used. That particular combination of a recall task with long presentation times has not been tested yet as far as we know.

Should Goldin's (1978) result be reproduced with a recall task, it would allow different explanations of Holding and Reynolds (1982) findings. It would again raise the possibility that the superiority of strong players in analysing random positions rests on perceptive abilities and memory organisation and not only on search skill, although, the underlying process cannot be the chunking process considered previously.

PROCEDURE

Three random positions and three meaningful ones were used and presented on a standard chessboard during a 60 seconds period. The position was then hidden by a screen and the subject had to reproduce it on an identical chessboard. There was no time limit for reproduction; the order of the presentation of the six positions was randomized.

Material. The three random positions were the positions used by Holding and Reynolds (1982); the three normal positions were quiet middle game positions taken from published games of great chess players (Alekhine, 1980, pp. 194, 195, 200). Each position contained 20 to 25 pieces.

Subjects. 21 male subjects volunteered to participate in the experiment but only 19 completed the task. Two subjects rejected one of the random positions, maybe because two random positions appeared consecutively and at the end of their randomized presentation order. The rejected positions were different in each case. The strength of chess players is usually assessed through their Elo score (Elo, 1966); that score is computed each year by Chess Federations from the results of tournament games. It is normally distributed with mean 1500 and standard deviation 200. Some of the weak players were novices, did not usually participate in tournaments and had no Elo. While it was obvious they belonged to the weak players group, their real strength was difficult to assess. They were assigned an Elo of 1200 which is probably an overestimation. Subjects were assigned to two groups by dichotomizing the Elo score. A cut-off point was chosen to be equidistant from the most extreme scores. With all due caution concerning the low Elo group, the means of the high and low Elo group were 1955 and 1265 respectively (standard deviation 138.8 and 100.8). This procedure also happened to divide our sample in two approximately equal groups: eleven strong and ten weak players) until the above mentioned subjects failed to complete the task. Both were strong players, none of them was the strongest player. This left 9 strong and 10 weak players.

Results

Dependent variables were RP and CP the percentages of replaced pieces (RP) and of correctly replaced pieces (CP). Since the number of pieces varied from position to position only percentages are given in Table 1. A log $(1+x)$ transformation was applied before analysis. To ensure generalizability to a population of positions, Position was treated as a random factor nested under Meaning in an ANOVA-3 (Group × Meaning × Position). Quasi-F's were computed from SAS type III sums of squares. Both variables were affected significantly by the Group factor ($F''(1,17)=6.16$ * for RP and $F''(1,18)=6.46$ * for CP) and $F\ (1,17)\ =\ 7.47$, $p<.02$ for CP) and by the Meaning factor ($F''(1,17)=26.28$** for CP and $F''(1,13)=15.57$ ** for RP). Note that RP and CP are correlated: the more pieces a subject replaces on the board, the more he is likely to place some pieces correctly. A similar analysis on $\log(1+CP/RP)$ only shows an effect of the Meaning factor ($F''(1,18)=19.5$ **) and no Group effect ($F''(1,17)=2.72$ NS) nor any interaction between those two factors ($F''(3,17)=1.37$ NS). This seems to rule out any interpretation in terms of differential guessing since differential guessing should have resulted in a decrease in CP/RP.

Tab. 1. — Mean probabilities for all conditions

	CP	RP	CP/RP
high random	.71	.88	.78
high normal	.93	.96	.96
low random	.46	.74	.63
low normal	.78	.91	.86

The Group × Meaning interaction proved significant only for RP ($F''(1,11)=20.9$ **), although a close examination of Table 1 shows that for both CP and RP, the fall in performance related to the meaning factor is larger in the low Elo group. It seems that this interaction could be the consequence of a ceiling effect.

Discussion

Since the Group × Meaning Interaction is significant only for RP and could be an artefact, there is one way to argue that the superiority of the best players is related to the existence of some rare but meaningful configurations even in random positions. We could assume that only good players are able to recognize those configurations because they are extremely rare in common play. This means that our random positions would not really be meaningless to them. Still, there would be no reason in this case for their superiority to appear with long presentation times and to vanish in recall tasks after a short presentation (Chase & Simon, 1973a, 1973b; Saariluoma 1985). According to Charness' model (Charness, 1976) those rare meaningful chunks should be recognized both with a short and a long presentation time. Since we have no short presentation time condition in the present experiment the idea that random positions in a short presentation time paradigm are learned independently of chess skill rests on previous findings by Chase & Simon (1973a, 1973b), De Groot (1965) and Saariluoma (1985). If we accept those results, our data suggest that some other recognition process operates, a process for instance, that, given enough time, can recognize distorted or incomplete chunks. A first hypothesis would be that meaningful but distorted configurations are abstracted from random positions.

There is another possibility. Recent research (Milojkovic, 1982) has shown that in certain circumstances, expert players can imagine capture moves and relations between pieces without being affected by the distance separating the pieces involved, which novices cannot do. Milojkovic suggests that they might use a conceptual representation of the board instead of a visiual one. In more recent work, Saariluoma (1985) has shown that experts are better at detecting checking moves in both random and meaningful positions and that there is no interaction in this task between the subject's expertise and the meaningfulness of the material. Detecting checks and detecting various defense and attack relations or imagining capture moves seem to be similar tasks. If our subjects had built descriptions of the random positions in such terms, it would explain the absence of interaction and it would also be consistent with Milojkovic's (1982) view. If strong players encode the positions as sets of relations between pieces and if they detect those relations faster, after some fixed time they will have a more detailed description of the position and, specifically, their representation will include more links between pieces. This is reminiscent of notions such as elaborative encoding (Anderson, 1983, p. 197) or processing depth (Lane & Robertson, 1979). The more connections there are between objects, the higher the probability of recalling an object using previously recalled objects as cue. This does not imply that we reject the chunking theory. It is perfectly possible that elementary relations between pieces are just the smallest chunks of all. We believe that the capabilities of experts for fast detection of relations of various degrees of complexity should be further investigated.

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