The Effects of Part-Set Cuing and Chunking on the Facilitation of Spatial Memory

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The present project is designed to explore the sequential effects of part-set cuing and chunk type in spatial memory. Typically, in a part-set cuing task, participants are asked to recall words (in our case, chess pieces) from a previously studied list (chess board) and, when they are given some of the words (pieces) from the studied list (board) as cues/hints, they tend to do worse than participants who were not given hints from the studied board (e.g., Bauml & Samenieh, 2012). Although researchers have claimed that part-set cuing produces no benefit on recall tasks, Watkins et al. claims that part-set cuing may enhance memory while playing chess. Since chess consists of individual pieces that can be remembered in relation to each other, Watkins et al. tests if part-set cuing has a positive effect on memory (Watkins et al, 1984). Despite the fact that part-set cuing did not enhance recall, Watkins et al. experiment has influenced us to find a relation between part-set cuing and spatial ability. Also, another variable that is involved in our study is chunking. Chunking can be defined as the ability to cluster information or responses due to relatedness, which helps to improve memory in a recall task. Chunk type can be described as either dense, the pieces of information are grouped together in meaningful units, or sparse, the pieces of information are further spread apart.

Previously, our experiment consisted of four independent variables, besides chunk type and cued type, the type of display (Sequential vs. Simultaneous) and the location of the chess pieces were considered. The type of display (Sequential vs. Simultaneous) describes how the chess pieces were presented to the participants in either succession or simply shown at once. The type of display was a decision that we rejected from our study because it would have taken longer to conduct. The experiment would have had six trials that tested sequential-dense cued, sequential-dense uncued, sequential-sparse cued, sequential-sparse uncued, simultaneous cued, and simultaneous uncued. By simply testing each participant for all six conditions takes up so much time, we predict that each participant would approximately take thirty minutes to complete our study. Therefore we concluded that we should modify our study by removing the variable, the type of display (Sequential vs. Simultaneous), to reduce the time to complete the experiment and receive effective results. Additionally, the location of the chess pieces was a variable that we studied, but realized that it too would have taken a lot of time for the participants to complete.

The present study will examine both cued type and chunk type in spatial memory using chess as a design. In order to test chunk type, chess pieces in certain trials were randomized in either a dense or sparse order. To test part-set cuing, the two different types of chunks were paired with a cued or uncued set. For instance, participants were tested for dense cued, dense uncued, sparse cued, and sparse uncued conditions. Participants were asked to reconstruct the order of four game positions that were revealed by quadrants. After viewing each game position, participants sat in a cubicle and were asked to reconstruct the previously game position that they just viewed, in which 24 chess pieces were presented. On two trials, the reconstruction task was uncued (none of the chess pieces will be in the correct positions; all must be reconstructed). On the other two trials, the reconstruction task was cued (half of the chess pieces that were previously seen on the chess board are presented in their original positions; participants must reconstruct the location of the remaining chess pieces). Both the order of the trials and the positions of the cues were counterbalanced across participants. The technique that we used was an incomplete counterbalance: the Latin Square. The Latin Square is an experimental design that allows each trial to be randomized by chance. For instance, the first participant might receive the four trials in an order of A, B, C, D, whereas the second participant may receive the four trials in a sequence of B, C, D, A and so forth.

After a week of gathering people and running our experiment, we ended up with a sample size of 23 participants and received interesting results. On the surface it seemed as though there was little difference between dense cued, dense uncued, and sparse cued since the average percentage of correctly placed pieces were within three percent of each other. To analyze our data we used an ANOVA, which stands for analysis of variance. An ANOVA is a statistical model used to compare the variation of the different conditions and also shows if there is any interaction between the different groups. Between the different chunk types, dense and sparse, we received significance value of $p=0.110$. Since this value is above $p=0.05$, it shows that there is no statistically significant difference of how well participants did if they were shown a sparse or dense chess board. The cue type of the other hand had a p-value of 0.03, meaning it was significant. But, even though there was significance between how well participants performed based on cue type, there was a clear interaction between the cue and chunk type. The interaction shows that if a participant was shown the board with the dense condition, there would be no

effect on their performance based on if they were given cues or not. The sparse board, on the other hand, shows that the cues had a positive effect on their performance, thus showing part-set cuing facilitation.

Looking towards the future our group had several ideas on what experiments we would like to run in the fall. First, we hypothesized that the difference in performance of the sparse condition is because it promotes a different strategy of remembering, reconstructing, or both that is not present in the dense condition. The cues that were given to the participant would also have a beneficial effect because their strategy is consistent with the cues. Although it is not an idea for an experiment, we would ask the participant after they finished if they paid attention to the cues that were given to them and if the cues were useful in their reconstruction of the boards. A final hypothesis we had to explain our results for our current experiment has to do with the time differences of when the participants placed the chess pieces. We believe that a study that compares how fast a participant is able to place the pieces and how cues might affect their speed and performance might show some interesting results.