CONTRIBUTION OF SIMULATION TO THE STUDY OF COGNITIVE EXPERTISE IN SPORT

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Abstract

This study has as its main object to show the effect of categorization of the configurations of play in football. According to Mervis and Rosch (1981), the category is an organization which makes it possible to gather various physical objects or concepts in the same class. This many make us suppose that the elements (i.e., specimens) of the same category have physical features (perceptive) or conceptual (concept) similarities. The main results of this study show, on the one hand, that the experts acquire a rich person repertory of conceptual knowledge by the practice and the experiment and the other hand, through the process of the activity that facilitates the visual data. This operating process of the expert system reduced considerably the space of research. This generally results in an effective and a rapid cognitive performance.

Keywords: Cognitive expertise, perceptual knowledge, simulation, sport

Introduction

The capacity of humans to recognize tens of thousands of objects appearing in rich and complex environments is probably one of the more surprising. It remains unmatched by the most powerful algorithms developed in artificial vision (Thorpe et al, 1989). Indeed, it appears that the perceptual system may acquire very early selective sensitivity to Visual information to which it is subject. The perceptual system would be a dynamic system that can adapt to the needs and requests of categorization faced by each individual. This effect can be

similar to a sensory modulation would be function of the categories in which are organized our knowledge of the world.

According to Goldstone & Barsalou (1998), the data obtained in categorical perception and perceptual learning allow to presume the existence of a continuum between the perceptual and conceptual level. It is important to explain that we are talking about "perceptual categories" and not "semantic categories". Semantics includes all of the information that describes the nature and function of the information in the environment. The perceptual level is only the form of the information. What interests us in this study, it is to show that football players of different levels of expertise are also sensitive to forms of game without taking into account the semantic characteristics.

Method and Materials

Hypothesis

The task of evocation requires knowledge of a lexical repertoire, characterizing the various systems of game, under a conventional type football concept digital (4-3-3; 4-4-2; 3-5-2) or a directory images, also conventional, when it comes to represent the game in a schematic form systems. The fact that non-practitioners do fail where can, might simply mean that this population does not control these lexicons. If that were the case, including where the practice would emerge forms corresponding to the systems, untrained players should be able to recognize these forms and classify them. We offer the following hypothesis:

If the game systems match productions resulting from practice, then, untrained players should be sensitive to the representative forms. This, to a greater degree than non-observant and to a lesser extent than the coaches and the players trained.

Participants

Four populations of 12 participants (coaches (CP), players trained (PT), untrained players and non-practitioners (PNT)) participated in the experience:

Hardware

This experience was programmed and conducted on a PowerBook G4 Macintosh computer via a program developed in the language (C+). Game configurations were presented on the computer screen. The size of the images on the screen was (32 cm x 21.5 cm) with a resolution of 980 x 750 pixels (width x height). Six types of categories of configurations were used in this second experience:

The five first categories of offensives game systems evoked by the coaches. For each category of the game system, five copies were used. Each copy was viewed outerwear a variant which corresponded to a space of players in attack, the same organization or belonging to the set of reference system. Each copy was thus composed of 10 players

attackers and 10 players defenders. These configurations were developed from selected by the coaches game systems. To closer to the conditions of the game and therefore increase the informational wealth of conventional schematic stimuli, we replaced the representative cross players by humanoid shapes in 2D, representing players of football via (Mavromatis & al, 2003) 3D reconstruction software;

The sixth category of coherent attack game configurations to be developed by three coaches did not participate in the first experiment. For this category, each coach was to build five copies of consistent configurations of attack in football (i.e., spatial organization of players on the ground that respects the rules which govern football in situation of attack activity), but is not a taught game system;

Thus, fifteen copies have been made. Among these configurations, five copies, only were considered as copies typical of offensive configurations corresponding to coherent configurations but cannot let appear the membership to no conventionally taught system have been selected

Total 30 configurations (6 categories * 5 copies) have thus been carried out.

Process

The task proposed to the participants was a perceptual categorization task. The task was to recognize the appropriate label placed bottom of the screen corresponding to the image that appears at the center of the screen, the faster and more precisely. The participants were to give their answer by a "click" on the appropriate label. Data collection program was used as an interface developed with a (C) language. The labels represented five categories of attack in the football game system, conventionally known, form digital (4-3-3; 4-4-2 3-5-2 3-4-3; 3-3-4).

A coherent category of game configurations of type "Other" which does not match any labels characterizing the game system. The experimental set up took place in three phases:

Participants begin by familiarizing themselves with the material and images by viewing. In this way they have an idea of the type of images they have associates. This familiarization time is left to the discretion of each subject;

Subsequently, the participants begin a phase of learning that is, a series of twelve trials whose results are not harvested. This phase allows them to get used to the task;

They then pass phase test during which thirty configurations are presented in random order. When the participant associated with the label to an image, a new image appears. The

subject will need to categorize the images more quickly and efficiently as possible. We measure the relevance of the answers (correct answers) and the response times

Variables and statistical analysis

For experiment 2 dependent variables are:

- The nature of responses (correct answer %);
- Response time (ms);

The data were processed in several analyses of variance analysis results focused on:

- The effect expertise;

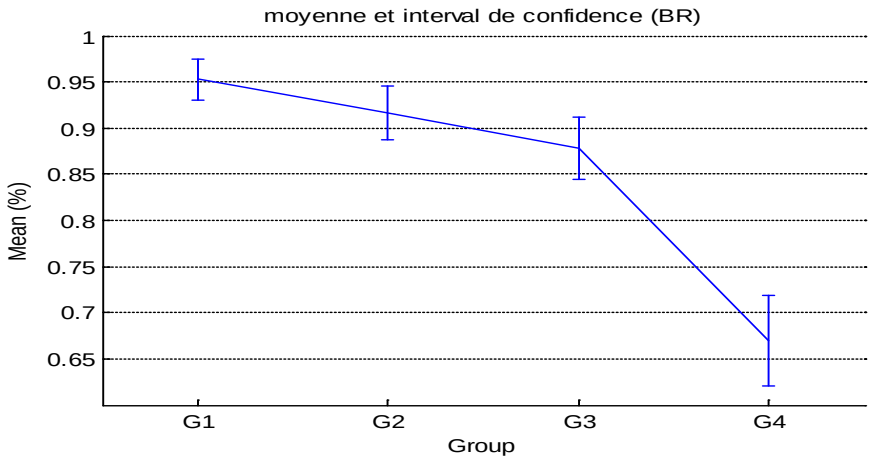
The effect of the categories of the game system. The analysis of significant effects was followed by further analysis (post-hoc test). The level of significance was set at $p < .05$ for all of the tests)

Results and Discussion

Result of the level of expertise

Population	*CO*	*PT*	*NP*	*NPT*
% Correcte Answers	96	92	88	67
Response Time (ms)	359	418	516	982

Table 1: Percentage of correct answers and response times in the task of perceptual categorization according to the level of expertise



Graph 1: Percentage of good answers according to the level of expertise

The percentage of correct answers

The analysis of the percentage of correct answers shows a performance of superior categorization in (M = 96%, and = 3.62) coaches of trained players (M = 92%, and = 3.62).

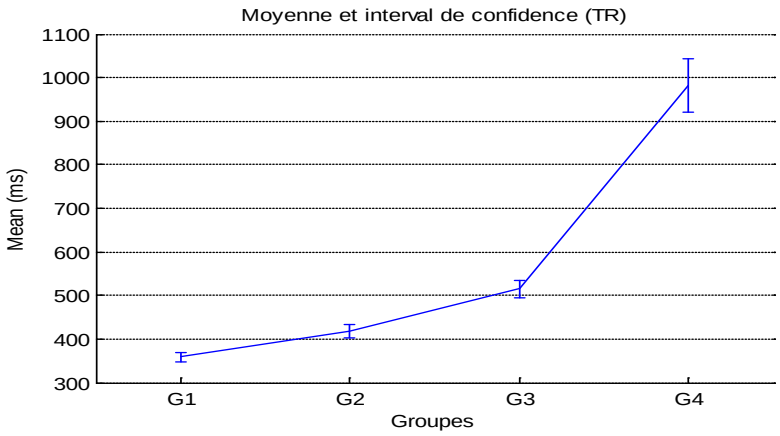
Similarly the performance of categorization of untrained players (M = 87%, and = 5.56) is superior to the performance of non-practitioners (M = 67%, and = 11,17).

The results of the analysis of variance showed a significant effect of the level of expertise [F (3.16) = 38.06, MSe = 68,78 , p <.000]. The supplementary analysis (test Dunett) shows a significant level of expertise between:

- Coaches and players non-trained (p <.014);
- Coaches and non-practitioners (p <. 000);
- Trained players and the non-practitioners (p <. 000);
- Players not trained and non-practitioners (p <.000);
- However, no significant effect of the level of expertise was revealed between:
- The coaches and players trained (p <. 252)
- Trained players and players non-trained (p <. 181);

Response time

Average time of responses shows that coaches, the players trained and untrained players have response times of shorter, respectively, (M = 359 ms, and = 60.49;) M = 418 ms, and = 80.71; (M = 515 ms, and = 124,19) the average response of non-practitioners (M = 982 ms, and = 278,35) (see graph 2).



Graph 2: Latency time (ms) responses depending on the level of expertise

The analysis of the variance in response time results show a significant effect on the level of expertise [F (3.16) 214,622, MSe = 3, 654E8, p = <. 000].

The analysis results show a significant effect between:

- Coaches and non-practitioners (p <.000);
- The players trained and non-practitioners (p <.000);
- Non-trained players and the non- practitioners (p <.000);
- However, there is no significant effect of the level of expertise
- Between coaches and trained players (P ≪.42);

- Coaches and players non-trained ($p < .02$);
- Trained players and players non-trained ($p < .14$);

Discussion

In categorization, the objective of this study was to investigate the process of perceptual categorization among football players of different levels of expertise. Indeed, in the field of categorization, many works which have defended the idea that the attributes which underlie the categorization process are flexible and that flexibility is guided by these information as well as the category history of the individual (previous knowledge). The phenomenon of categorical perception illustrates this (Goldstone, 1998) interaction between processes of low level (perceptual knowledge) and high-level (conceptual knowledge) process. Moreover, the work related to the study of cognitive expertise widely highlighted the importance for any theory of the expertise of formalizing the interaction between perceptual knowledge and conceptual knowledge. Indeed, one of the few studies in the field of the categorization of sporting scenes (Laurent & al, 2006) has shown that Visual discrimination of situation of a basketball game is done on the basis of category membership. Experts distinguish more easily two different perceptual descriptions when these stimuli belong to different categories.

This perceptual sensitivity facilitates very fast extraction of relevant information about a game situation and rapid access to information which set the boundaries of the category (Goldstone, 1998). Also, different empirical work in the field show that experts have more categories than the novices (French, 2003) and that they have a remarkable ability to categorize natural scenes (Torpe et al, 2001). These authors have shown that 100 to 150 ms of treatment are sufficient to decide whether or not an image that has never been seen previously contains an object. In line with this work, our coaches and trained players' results confirm the results achieved in the area of categorization. Indeed, experts are very sensitive to familiar and consistent game configurations.

This sensitivity of experts in their domain familiar information facilitates, the interaction between the perceptual and conceptual knowledge. These, translates into faster and more effective categorization performance. Moreover, results also reveal a performance of the untrained players above the threshold of the chance. This result seems very relevant to us. Indeed, untrained players participating in the activity through free practice, which does not allow the acquisition of a rich repertoire of (declarative) conceptual knowledge as it has been shown in the task of evocation (experiment 1) have become as sensitive as experts to forms of the game. This result reflects that the perceptual categorization process is a product

of the activity which facilitate the processing of environmental information. In other words, the same free participation in a form of the game has enabled productions resulting from the practice. This activation leads to the identification of a particular shape and its discrimination among a set of game form. However, the results of non-practitioners do not show a perceptual sensitivity to forms of the game. Exposure to television retransmissions attests that only practice is essential for the acquisition of perceptual knowledge to facilitate the categorization process.

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