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A Psycholinguistic Investigation of Football Players'

Mental Representations of Game Situations: Does Expertise Count?

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Abstract

In order to progress through a competitive sporting event, athletes need to form mental representations of the situations they encounter. In this paper, we present three experiments exploring the mental representations of football players when presented with written material describing football game situations. Experiment 1 assessed off-line processing by having players of different levels generate written football scripts. The results predominantly showed that players of lower expertise were less "other-oriented" and included more emotional elements in their mental representations. Experiments 2a and 2b further explored these differences. Using an on-line measure, a reading-time paradigm, we showed that First Division players' mental representations more easily included "others" and less readily included emotions, as opposed to both National League and Fifth Division players. Although Fifth Division and National League were similar, different cognitive processes may underlie the construction of the players' mental representations.

Keywords: cognition, sport, mental representations, problem solving, football

An athlete's mental representation of a situation he or she encounters is crucial in any sport as it determines the mental and behavioral responses to the situation (Huber, 1997). More specifically, the particular nature of team sports requires mental skills that permit anticipation of events, symbolic representations of team structures, and proper role understanding (Allard & Starkes, 1991). In this paper, we use a novel method to investigate athletes' mental representations during game situations. This method takes advantage of the connection between verbal and perceptual traces in memory and is a well-established method for studying the content of mental representations in the field of psycholinguistics (Zwaan, Madden, Yaxley, & Aveyard, 2004).

The term "mental representation" has been used in very different domains of psychology and in very different ways (see Blanc & Brouillet, 2006, for a review). In the present study, this term refers to the construction of a life-like representation of a situation that incorporates explicit elements of the situation as well as elements derived from people's own knowledge stored in long-term memory, commonly called background knowledge. Essentially, people go beyond what is presented to them when comprehending the world. For example, if presented with the sentences, "We got some beer out of the trunk. The beer was warm." (from Haviland & Clark, 1974), readers might include in their representation of the situation that it was a sunny day. This information is based both on the text and on common knowledge about what happens when you leave your car in the sun. This concept of a mental representation as a mental model of the world has been successfully applied to many subfields of cognitive psychology (e.g., Garnham & Oakhill, 1994; Johnson-Laird, 1983; Legrenzi, Girotto, & Johnson-Laird, 1993). In this paper, we apply the same logic to investigate athletes' mental representations when reading about specific football scenarios. Moreover, we use this method to investigate whether mental representations are differentially specified for different levels of game expertise.

A crucial distinction in research on mental models is between "automatic" and "strategic" concept activation (McKoon & Ratcliff, 1992), meaning that the concept has either been incorporated during reading or after having read the sentence, respectively. Others have preferred the terms "on-line" and "off-line" (Graesser, Singer, & Tabasso, 1994). Given time, people can incorporate a significant amount of information into their mental models. In the example above, readers might incorporate concepts such as picnic, holidays, weekend, shorts, t-shirts, lake, park, etc. The question is which concepts are activated while the sentence is being read (on-line) and which are activated after the sentence has been read (off-line). In this paper, we investigate both processes. Note that the methodologies used to access these processes are very different, as automatic or on-line processes occur fast and with little awareness. In Experiment 1, in which we investigated off-line processes, we presented athletes with one or two sentences and asked them to write down all the concepts activated by those sentences. In Experiment 2 (2a & 2b), in which we investigated on-line processes, we measured the reading times of sentences containing the concepts derived from Experiment 1. Slower reading times were assumed to indicate that the concepts in a given sentence were not contained in the athlete's mental model. Hence, we predicted that this method would enable us to differentiate between athletes of different levels of expertise.

The method used in the present paper is predicated on the notion that particular written information, when presented to athletes, generates specific mental models (off-line and on-line). This is consistent with the notion that when interacting with the world, perceptual traces are automatically associated with words, themselves activating related traces (Zwaan et al., 2004). Recent advances actually showed a link between language and spatial representation (e.g., Levinson, Kita, Haun, & Rasch, 2002), language and gender representation (e.g., Gygax, Gabriel, Sarrasin, Garnham, & Oakhill, in press), and language and the visual representation of movement (e.g., Zwaan et al.). We hypothesized that investigating athletes'

mental representations while they are reading about game scenarios would allow us to assess conceptual elements of real game situations relevant to skill level.

A complex aspect of situation processing in sport is that the problems encountered by athletes are not always extensively defined. Athletes have to allocate a relatively high amount of mental effort to structure the problem (Ball, Evans, Denis, & Ormerod, 1997; Goel & Pirolli, 1992; Ripoll, Kerlirzin, Stein, & Reine, 1995). Such a structure, in turn, depends on the way the athletes perceive and appraise the game situations (Seiler, 2000). Therefore, it can be expected that there are interindividual differences in how athletes represent particular situations.

The study of cognitive skills underlying decision making in sport has mostly been achieved by simulating situations presented on film or slides (e.g., Ripoll et al., 1995). Studies have found differences in information processing between experts and non-experts: The former are generally more accurate and rapid in solving problems than the latter. In visual exploration tasks, which are considered a complementary way to identify these cognitive operations, experts appear to function more economically (i.e., lower frequency of visual fixations, longer mean fixation duration, etc.; see Ripoll et al.).

Although psycholinguistic tasks are not often used in sport research, prior work on knowledge related to expertise using verbal reports indicated that experts exhibit a more sophisticated knowledge structure in terms of (a) quantity of knowledge (which is more differentiated and complete), (b) hierarchical development (with greater hierarchical goal structure of the problem to be solved), and (c) reorganization of content (same hierarchical goal structure but different attributes are considered important) (McPherson & Thomas, 1989). McPherson and Thomas showed that expert-novice differences in the quality of decisions made within the context of a game (i.e., selection of an action) were greater than differences in the quality of the execution of particular actions. These authors concluded that,

compared to non-experts, experts possess a greater number of concepts, establish more interconnections among them, and can rely on more rules concerning how to perform in response to a specific situation. Along the same line of thinking, Williams and Davids (1995) suggested that skilled performers have a more refined and elaborate task-specific knowledge base and differ from non-experts in the amount and the type of knowledge they possess as well as in the way this information is used during task performance.

Abernethy (1999) summarized the difference between experts and novices by saying that the expert athlete's advantage is not due to the inheritance of superior sensory and motor systems, but to the way they process and interpret task- and domain-specific information. Experts in sports, like in other domains, display a greater and more richly organized knowledge base about both the facts and the procedural strategies of their sport and appear to recognize and recall patterns better. In this paper, we assess the content of the mental representations of players of different levels of expertise by measuring the ease with which certain game elements are retrieved.

The primary aim of Experiment 1 was to identify the mental models shared by football players using an off-line task. Qualitative data were collected by asking players from the Swiss First and Fifth Divisions to read specific sentences, and for each of them, to generate written material describing their thoughts and actions in the football game situation described by the sentence. Recurring categories, or themes, were analyzed. We expected the situation described in the sentence to compel the players to engage in a "mental simulation" (to use Oatley's, 1994, term) of the situation. The recurring themes allowed us to assess the athletes' strategic construction of different mental models of game situations and, further, to construct scripts to be used in Experiments 2a and 2b, whose aim was to assess the ease or readiness with which these categories are automatically activated in players of different levels of expertise. For this purpose, in Experiments 2a and 2b, we used a reading-time paradigm, in

which the participants' task was to read sentences, presented one after the other. Reading times of target sentences were recorded, enabling us to evaluate which information had been automatically integrated into readers' mental representations. The rationale behind such a measurement is that the faster a sentence is read, the more likely it is that some of the sentence information has already been integrated into reader's mental representations (see Keenan, Potts, Golding, & Jennings, 1990, for a review). To the best of our knowledge, this psycholinguistic method has never been used in sport psychology research.

First and Fifth Division football players participated in Experiment 1. In Experiments 2a and 2b, players from the Swiss National Football League were also included to explore the effect the level of expertise has on the automatic construction of mental models. As players from the Swiss National Football League were more difficult to recruit, they were only included in the on-line phase. Our hypotheses concerning the impact of expertise on the content of players' mental models are formulated below.

<div align="center">Experiment 1</div>

Method

    Participants. A total of 18 male football players participated in this study, 9 football players were from the Swiss First Division (i.e., semi-professional players), and 9 were from the Swiss Fifth Division (i.e., amateur players). Only one player (First Division) was not a native speaker of French, but his French was fluent. We did not select players according to which position they played. Most players from the Fifth Division had played in several positions, and players from the First Division regularly changed position. It was thus difficult to clearly arrange our participants into groups based on field position. However, since none of the sentences used described goal-keeping situations, goalkeepers were not included in the study.

Material. Twelve different descriptions of game situations were created and presented to the participants (e.g., "I'm suddenly alone in front of the goalkeeper, the ball at my feet…"). For each situation, the participant was to respond by writing a suitable continuation. Seven situations were described in which the protagonist was either a striker (two situations), defender (three), goalkeeper (one), or captain (one) (see Table 1 for examples). These situations were written so as to be representative of a common football game and to encompass a variety of positions on the field.

Insert Table 1 about here

Procedure and design. Participants received the situation descriptions in a questionnaire format by regular mail and were instructed to complete them in a quiet place, one sentence after the other, in the order in which they were presented. The instructions made it clear that they could write words or sentences about the actions and reactions activated by the given situation descriptions. The participants had a limited amount of space to write in, but were instructed to use a separate sheet of paper if they wished. The order of presentation of the situations in the questionnaire was randomized. Participants were told that there were no good or bad answers. All responses were treated anonymously.

One coder conducted the primary analysis, identifying recurrent categories, and these resulting categories were evaluated by a second coder. A category comprised semantically close textual elements. In other words, textual elements referring to the same concepts were grouped into the same category. Concrete examples are given below. The coders were unaware of the players' level of expertise when analyzing their answers and had no expectations regarding the players' responses.

Results and Discussion

The taxonomic system depicted in Figure 1 was created on the basis of the collected data and is presented for the purpose of clear exposition. The different categories emerging from the analysis of both groups were clustered into three main groups: *physical action*, *mental action*, and *writing style*. The physical action group contained only one category: *mobility,* which was divided into movement and static subdivisions (see below for examples). The mental action cluster contained five categories: *appraisal*, *outcome evaluation*, *orientation of focus*, *emotion*, and *confidence*. The outcome evaluation category was subdivided into positive outcome and negative outcome. Orientation of focus was subdivided into self-oriented focus and other-oriented focus. Confidence was subdivided into confident and unconfident categories. Appraisal and emotion were not subdivided. The writing style cluster contained two categories: *game field* and *technical language*. Table 2 presents each category along with an operational definition. Figure 2 shows the total number of occurrences of textual elements from each category and subdivision from all situations at both levels of expertise.

Insert Figure 1 about here

Insert Figure 2 about here

Insert Table 2 about here

Figure 2 shows differences between the two groups of players in other-oriented oocus

and emotion (see below for statistical analyses). There was a very high correlation between

the two groups of players regarding the number of elements mentioned in these categories (r

$= .97$, $p < .0001$), indicating that both groups, although showing some differences, seemed to

be matched in the information that they see as important in game situations.

Physical action cluster. The mobility category of the physical action cluster represents

elements pertinent either to motion or stability (movement vs. static responses). In the

movement subdivision of the mobility category, players were the main agent (i.e., "I…") and

were in motion (e.g., "I'm shooting."). Verbal actions, such as talking or shouting (e.g., "I ask

the referee for the 9 m."), were also included in this subdivision. Most of these movement

elements were self-oriented and were thus also included in the self-oriented focus subdivision

of the orientation of focus category, which we will discuss later. In the static subdivision,

actions were included that involved no limb movement (e.g., "I'm watching the ball."). Most

of the elements in this category referred to particular moments when the players were waiting

(e.g., "I'm waiting, I take my time."), concentrating (e.g., "I concentrate, I don't ask myself

any questions, I try to focus."), or observing other players, whether from their own team (i.e.,

"I watch my strikers.") or from the other team (e.g., "I look at the goal keeper."). These

descriptions are particularly relevant as they allowed us to infer that the players are

representing a large number of possible alternatives before making the decision to engage in

the action they think is most appropriate (as in Ball et al., 1997). No differences were found

between the two expertise groups in this cluster.

Mental action cluster. The mental action cluster was divided into five categories:

appraisal, outcome evaluation, orientation of focus, emotion, and confidence. Appraisal was

either explicit (e.g., "I'm looking for a solution, …to analyze the situation, I check if there's a

way to go through.") or implicit (e.g., "I observe, I watch, I fixate the wall."). Players often

mentioned that these appraisal processes were conducted slowly or meticulously, as if they

needed time for them to take place. These responses represented the rational and conscious

stage of the whole decision-making process. More intuitive concepts will be presented in the

categories related to the affective status of the players.

Outcome evaluation encompassed those responses that depicted situations as having

either positive or negative outcomes. The positive elements were not always focused on the

same aspects of the game, but were either related to the protagonist (e.g., "I exult, I'm pretty

gifted in it.") or to his move (e.g., "I run faster than him, I hit this ball marvelously, I score.").

Not surprisingly, the term "I score" was often mentioned. Negative outcomes, though fewer

than positive ones, often comprised elements reflecting a certain lack of support (e.g.,

"Nobody is free, nobody comes to support me.").

When the participants depicted the protagonist's environment, they mentioned both

self- and other-oriented concepts (orientation of focus category). Self-oriented concepts

referred to the players' egocentric vision of the situations, mostly expressed through the use of

the first person. Conversely, the other-oriented concepts referred to the inclusion of other

players in different situations (i.e., "… he is asking for the ball, hoping that other defenders

come back, I check the goal keeper's position.").

The emotion category was exemplified by either emotional terms such as exulting,

happiness, hate, or anger, or by an implicit mention of emotional reaction (e.g., "I'm lucky.",

"It's a real shame."). Finally, the confidence category comprised explicit references to feeling

confident or unconfident. In the confident subdivision, players were certain that the situation

was standard and not problematic (e.g., "as usual," "as the great players do," "having trained

this"). Other responses portrayed optimistic views of the situation (e.g., "I think I have a good

chance."). The unconfident category portrayed the players clearly hesitating between several

options (e.g., "I wonder if I have to do this or that," "I have two aims, either…or…"). In this category, we also included instances in which the players were solely hoping for good solutions to emerge. Either they were hoping that other players would help them (e.g., "hoping that the other defender will come over to support me") or they were hoping that their decision was the right one (e.g., "I cross over to the other side hoping that it is the appropriate one.").

In the mental action cluster, two categories were shown to differ significantly in the two groups. As shown in Figure 2, First Division players exhibited more other-oriented focus than Fifth Division players, $t(16) = 2.7$, $p < .05$, $r = .56$. Note that the athlete's focus of attention (especially towards others) has been extensively studied by sport psychologists, mainly in relation to achievement attribution (Cashmore, 2002). To interpret these other-oriented findings in terms of expertise, one could view expertise processes as being similar to developmental processes. Children's perception is often primarily egocentric and subsequently develops to reach a broader scope, including others' points of view in their mental representations (Miller, 1983). Likewise, football players with less expertise might concentrate their attention on close, controllable elements of the environment (i.e., the self). The relevance of social orientation has often been emphasized in collective sports research (e.g., Schilling & Hayashi, 2001; Urdan & Maehr, 1995).

The second category in which a difference was observed was the emotion category (see Figure 2). Fifth Division participants mentioned emotional concepts more often than First Division participants did, $t(16) = 3.02$, $p < .05$, $r = .60$. Emotions, especially the monitoring and control of affect during performance, have always had a prominent position in sport psychology (Cashmore, 2002; Hanin, 2000; Ntoumanis & Biddle, 1999). Our data, although based on a small population sample, suggest that emotions are an important distracter to performance. Cashmore considers emotion a "subjective state or sensation that momentarily

interrupts otherwise steady functioning" (p. 97). Emotional reactions drive attention away

from stimuli and henceforth have an impact upon concentration (Lesyk, 1998). Not

surprisingly, a large amount of research has focused on the different strategies enabling

athletes to control their emotional reactions, or at least to regulate their negative emotional

responses (Ntoumanis & Biddle). In our study, most expert players did not mention emotional

reactions. This absence of affect could be considered a coping strategy whereby emotional

reactions are controlled to avoid any venting of unpleasant emotions, for example (Gaudreau

& Blondin, 2004). The Fifth Division players might not be able to adopt such a mechanism;

for these players, emotional reactions seem to be more prominent in their mental

representations.

Writing style cluster. The analysis also revealed the use of technical terms associated

with the game itself (technical language) or with the game environment (game field). The

technical language category incorporated not only specific terms associated with the game

(e.g., shoot), but also elements specifying a rapid action time span (e.g., "I'm passing the ball

as quickly as I can."). The category game field included background elements that formed

part of the situation (i.e., the corner point). Non-active players in the periphery were also

included in this category. No differences were found between the two expertise groups in this

cluster.

Conclusion

Although the correlation between the two groups in the amount of elements in each

category was very high, there were differences between First Division and Fifth Division

football players in the emotion category and in the orientation of focus category. Sentences

were therefore constructed from items in these two categories for Experiment 2a (emotion)

and Experiment 2b (other-oriented focus).

Experiment 2a: Emotion

We first focused on the representations that athletes build as they read situations eliciting emotional reactions[1]. Each script used in this study was constructed so as to depict a game situation with a particular outcome (first target sentence), either positive or negative, eliciting a positive or negative emotion, respectively (second target sentence).

To assess the emotional content in the players' mental models, participants were presented with sentences containing descriptions of emotional responses to the positively or negatively valenced outcomes presented in the preceding sentence. These emotions could be incongruent or congruent with the preceding outcome (e.g., after being presented with "I missed." in the outcome sentence, they were then presented with the emotion "I feel ecstatic." [incongruent] or "I feel bad." [congruent]).

Due to the results from the Experiment 1, we expected the Fifth Division players to automatically represent emotion information in their mental models. Thus, we expected them to read sentences containing emotional information congruent with preceding outcomes faster than sentences containing incongruent emotion information. National League players (i.e., professional players) were included as a third participant group. We expected the difference between reading times of emotionally congruent and incongruent information to be greater for the Fifth Division than for the First Division group, and greater for the First Division group than the National League group. This result would support the notion that players with less expertise allocate an important part of their mental representations to emotion information, and that emotion information may not be included in expert players' mental representations. This hypothesis is derived from the idea that emotions are disruptive to performance (e.g., Cashmore, 2002; Lesyk, 1998) and hence might be better controlled by more expert players. In our paradigm, we believe that the latter process of control is reflected in the non-inclusion of emotion information in more expert players' mental models.

Method

Participants. A total of 43 male football players participated in this experiment. None of the participants in this experiment had participated in Experiment 1. All in all, 13 players were playing in the National League, 14 in the First Division and 16 in the Fifth Division. To avoid any cohort group effect, players were selected from at least two different clubs in each participant group (four teams in the National League group, two teams in the First Division group, and two teams in the Fifth Division group). Two players from the National League were removed from the analysis as they did not understand the instructions. All players were native speakers of French. As in Experiment 1, no specific field positions were selected, and goalkeepers were not included.

Materials. Twelve scripts were created using the material collected in Experiment 1. The scripts were created by using the most recurrent categories to construct stereotypical situations (see Table 3 for an example). The last two sentences (i.e., first and second target sentences) were the most important sentences: The first target sentence of each script described a positive or negative outcome (e.g., "I scored.", "I missed."), whereas the second target sentence described either a congruent or incongruent emotion (e.g., "I feel bad.", "I feel ecstatic."). Various situations were used: seven scripts describing a striker situation, three a defender situation, one a goalkeeper situation, and one a captain situation.

Insert Table 3 about here

Apparatus. The scripts were presented on a Powerbook Macintosh G3 using Psyscope Software (Cohen, MacWhinney, Flatt, & Provost, 1993). Responses to the final two sentences of each script were collected using a response button box attached to the computer, which permits millisecond accuracy.

Procedure and design. The participants were instructed to read each script at a normal reading speed, as though they were reading a magazine. To make sure that participants read the scripts carefully, some scripts (*N* = 4) were followed by a question related to the text. Participants had to answer the question by pressing a button labeled either "yes" or "no." Each script was presented in eight sentences, with the last two sentences being the target sentences. Participants were instructed to press the "yes" button after reading each sentence (as in Gygax, Oakhill, & Garnham, 2004). Reading times for the target sentences were recorded. The participants first read three practice scripts, all of which were followed by questions to familiarize them with the procedure and with the kinds of passages that they would be reading.

Each experimental script appeared in four conditions, which were defined by the target sentences (positive outcome – congruent emotion, positive outcome – incongruent emotion, negative outcome – congruent emotion, negative outcome – incongruent emotion). Since there were four conditions per script, four different lists of scripts were constructed. In each expertise group, an equal number of participants were assigned to each list. Each list had three scripts in each of the four conditions, and each script appeared the same number of times, across the experiment, in each of the four conditions. For each participant, the scripts appeared in a random order.

Results and Discussion

Before conducting the statistical analysis, the data were transformed to account for the fact that the target sentences were not all of the same length. The transformation procedure was taken from Trueswell, Tanenhaus, and Garnsey (1994) and was conducted as follows: For each participant a regression equation of time (i.e., reading time) against length (i.e., number of characters in the target sentence) was produced, using all measures of the target sentences. Then, for each participant's reading time, the residual time was calculated by subtracting the

reading time predicted by the regression equation from the actual reading time. The statistical analysis was then conducted on the residual times. Negative residual times mean that reading times were longer than expected. This data transformation is particularly adequate as it accounts not only for each item length, but also for variations between participants' reading speeds. Moreover, the regression line for each participant will act as the baseline condition. Results are shown in Figures 3 and 4 for each target sentence.

Insert Figure 3 about here

Insert Figure 4 about here

A general 2 (Valence: positive vs. negative outcome) X 3 (Groups: National League vs. Fist Division vs. Fifth Division) ANOVA on residual times, with valence as a within-subject variable and groups as a between-subjects variable, yielded a nonsignificant interaction, $F(2, 38) = 2.12$, $p = .12$. A specific 2 (Valence: positive vs. negative outcome) X 2 (Groups: First Division vs. Fifth Division) ANOVA showed a significant interaction, $F(1, 28) = 4.87$, $p < .05$, $\omega = .24$. Football players from the First Division group read negative outcomes faster than positive outcomes, a trend that was reversed for the Fifth Division group (see Figure 3). No other main effect or specific interaction was significant. Fifth Division players were faster at reading sentences containing positive outcomes, and First Division players were faster at reading sentences containing negative outcomes, whereas National League players were equally fast at reading both positive and negative outcomes.

The analysis of the second target sentence (Figure 4), which consisted of either congruent or incongruent emotions, showed the expected main effect of congruency, $F(1, 38)$ = 9.81, $p < .05$, $\omega = .35$ (see Figure 4). The expert groups were expected to be less sensitive to emotion information than the Fifth Division group. This is the case numerically for the First Division compared to the Fifth Division group, as a 2 (Congruency: congruent vs. incongruent) X 2 (Groups: First Division vs. Fifth Division) ANOVA, with congruency as a within-subjects variable and groups as a between-subjects variable, showed a close to significant interaction, $F(1, 28) = 3.15$, $p = .09$. On the other hand, the interaction between the National League and the Fifth Division was clearly not significant, $F(1, 25) = .22$, $p = .64$.

In summary, Fifth Division players included positive outcomes in their mental representations, First Division players included negatively valenced information, and National League players included both. Our hypothesis about the sensitivity to emotion information was only partially supported by a non-significant trend; the First Division group was less sensitive to emotion information than the Fifth Division group. Interestingly, the pattern of results for the National League players resembled that of the Fifth Division players. This means that National League players demonstrated a higher sensitivity to emotion information than expected.

<div align="center">Experiment 2b: Inclusion of Others</div>

Except for the information portrayed in the scripts, centered on other-oriented information, everything in this study was similar to Experiment 2a. Experiment 1 showed that Fifth Division football players favored a less other-oriented focus of attention. We therefore expected the Fifth Division group to read sentences containing information pertaining to the self faster than information pertaining to others, due to the content of their respective mental models. We expected this effect to be reversed for expert players (National League and First Division) and the reversed trend to be more pronounced for the National League players.

Method

  Participants. As in Experiment 2a.

  Materials. Twelve scripts were created using the material collected in Experiment 1. The scripts were created using the most recurrent categories. As in Experiment 2a, there were two target sentences. In Experiment 2b, the first target sentence was the most important as it portrayed a move made with fellow players or alone. (The second target sentence portrayed a positive or negative outcome.) Apparatus, procedure, and design were the same as in Experiment 2a.

Results and Discussion

  Reading times for the last two sentences were recorded. The statistical transformation applied to control for sentence length in Experiment 2a was also applied here (Trueswell et al., 1994). Results are shown in Figure 5.

        Insert Figure 5 about here

  A 2 (Players: others involved vs. no others involved) X 3 (Groups: National League vs. First Division vs. Fifth Division) ANOVA on residual times, with players as a repeated measure and groups as a between-subjects variable, showed a significant interaction, $F(2, 38) = 3.51$, $p < .05$, $\omega = .20$. This interaction was supported first by a close to significant 2 (Players: others involved vs. no others involved) X 2 (Groups: First Division vs. Fifth Division) interaction, $F(1, 28) = 3.09$, $p = .09$, in agreement with our predictions, and second, most interestingly, by a significant 2 (Players: others involved vs. no others involved) X 2 (Groups: National League vs. First Division) interaction, $F(1, 23) = 4.67$, $p <. 05$, $\omega = .23$. We did not expect players from the National League to show such a pronounced effect in the same direction as the Fifth Division. National League players seem to exclude others from

their mental representations, as did the Fifth Division players. The analysis of the second target sentences showed no significant main effects or interactions.

General Discussion

We investigated football players' mental models when they were asked to read game situations, using both an off-line (Experiment1) and an on-line task (Experiments 2a & 2b). The scripts used in Experiments 2a and 2b were constructed from data obtained in Experiment 1, in which two categories, the emotion and the other-oriented focus categories, yielded differences between First and Fifth Division players. The First Division players mentioned emotion elements less often and were more likely to generate information about others. Experiments 2a and 2b assessed the automatic inclusion of these categories in footballers' mental representations. Our aim was to find out whether, when presented with scripts describing game situations, football players automatically incorporate emotions (Experiment 2a) and other-oriented information (Experiment 2b) into their mental representations of the situations. National League, First Division, and Fifth Division players' reading times for sentences comprising different types of information were measured.

The results from Experiment 2a suggest that First Division players incorporate negative outcomes into their mental representations, whereas Fifth Division players incorporate positive information. In contrast, National League players seemed to automatically include both types of information in their representation of game situations. It is possible that First Division players are more realistic than Fifth Division players. That is, they foresee problems, maybe in anticipation of a counterattack or an offensive move from their opponents. In addition, Fifth Division players might not be fully aware of some of their technical limitations, hence the automatic inclusion of positive outcomes in their mental representations. National League players, on the other hand, appear to automatically activate all possible outcomes activated in order to respond to any eventuality.

Interestingly, the non-significant trend in the emotion information condition suggests that the National League players and the Fifth Division players may be equally sensitive to emotions, whereas the First Division players were less sensitive to the main protagonist's emotional status. These results did not support our prediction that players with more expertise are less emotional than those with less expertise. Our results even counter the idea that emotions are disruptive to performance (Cashmore, 2002) and that they have a negative impact on concentration (Lesyk, 1998). The data suggested that although there was a difference between First Division and Fifth Division players, National League players' responses resembled those of Fifth Division players.

We suggest two possible interpretations. First, although National League and Fifth Division players both show emotion representations, which may lead to emotional reactions, National League players may have a sufficient level of control to inhibit them when encountering specific situations. In the event that inhibition does not occur, automatic sensitivity to emotion might be disruptive (Cashmore, 2002). If emotions are indeed disruptive, our data suggest that National League players use an inhibition mechanism to avoid the disruptive nature of emotions in real-life game situations.

Second, even though the results of the National League and the Fifth Division players were similar, the underlying cognitive processes might be different. We could speculate that Fifth Division players use emotions to compensate for a lack of technical skill, whereas National League players use emotions to complement their technical skills. In our data, the representation of emotions appears to progress in a U-shaped function as expertise increases, the least sensitivity being in mid-expertise (First Division). In fact, although the present results do not permit strong conclusions about emotion processes, the data suggest that emotional reactions might not play a crucial role in mid-expertise players, but may play different roles in National League and in Fifth Division players. There is evidence to show

that there might be a turning point at which optimal performance actually increases as emotion intensifies (Kamata, Tenenbaum, & Hanin, 2002). Therefore, it might not be so surprising that National League players automatically incorporate emotional information into their mental models.

In Experiment 2b, we expected the primarily self-oriented focus in the Fifth Division mental models to move towards a more other-oriented focus in First Division players (as in Experiment 1) and the other-oriented focus to be even more pronounced in National League players. Although we did find the expected pattern moving from the Fifth Division players towards the First Division players, the pattern of results for the National League players was unexpected. National League players were faster at reading sentences containing self-oriented information than at reading those containing other-oriented information, and this pattern was even more evident than for the Fifth Division players. Our data hence suggest that both National League and Fifth Division players constructed self-oriented models.

Fifth Division players might construct self-oriented mental models because their lack of technical ability prevents them from allocating attention resources to others. We suggest that National League players demonstrated similar self-oriented mental models due to significant pressure to perform well or to perform better than others. We hypothesize that this result is a consequence of the competition found in high-level football, where playing positions (as opposed to substitution) are highly valuable. Players always attempt to stand out. This is supported by the idea that "athletes are ego involved when they engage in a sport to demonstrate their level of competence to others" (Vallerand & Blanchard, 2000) although it is considered a hindrance to performance (Vallerand & Blanchard).

The interpretation of these results is based on the assumption that slower reading times are an indication of readers' difficulty integrating elements into their mental representations. Although this assumption has been widely acknowledged in psycholinguistic research (Blanc

& Brouillet, 2006), Gnesa and Gygax (2005) discussed the possibility that slower reading times are a sign of enhanced concentration (i.e., people read more slowly because they are allocating more attention to gleaning information they believe to be most important). This would mean that the National League players concentrated most on other-oriented information. However, the results shown in Figure 4 suggest that the players were slower at reading incongruent information, hinting that slower reading times indeed indicate a difficulty integrating elements into readers' mental representations.

Finally, we will outline the shortcomings of this study and suggest possible studies for the future. First, the participants were tested using a task that provided an indirect indication of the mental models they might construct during real game situations. We tested players by asking them to write down elements they considered important in game situations and then by evaluating the automaticity of the inclusion of certain concepts in their mental models. When players engage in a real game situation, other elements will be included in their mental models, and these elements may not be accessible using the present paradigm. Second, it is also possible that our scripts encouraged the participants to process information that may not always be relevant to them. For example, although one script described a player approaching the goal and aiming to score, players of a higher level of expertise might include other goals or sub-goals, or more refined sub-goals in their mental representations. As those were not described in the script, they may have had to adjust their normally constructed mental models to mental models that we forced upon them. However, since the scripts were constructed from items freely generated in Experiment 1, this possibility was partially controlled for (although the first sentence was imposed, perhaps limiting some of the possibilities).

Finally, unfortunately, we were not able to integrate playing position as an independent variable into this experiment. This is a possible route for further research

particularly as a within-subject variable to investigate whether a given player activates different mental models depending on his role or position on the team.

In conclusion, the results from the present study suggest that the emotion/valenced-outcome and the focus-of-attention issues divide athletes of varying expertise in a non-linear way. These results are interesting and deserve additional consideration as they raise broader questions concerning expertise and mental representation in sport. They suggest that some aspects of an athlete's mental representation proceed in a non-linear fashion as expertise increases. An awareness of these issues could be important in establishing greater levels of expertise in sport.

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Footnotes

[1] Experiments 2a and 2b were actually conducted as a within-subject design. For clarity reasons, the two parts of the experiment are presented separately.

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Table 1

Four Examples of Descriptions of Situations

Striker   *Alone against two defenders, I move forward…*

Defender   *I am the last defender against the striker…*

Goalkeeper   *I am the goalkeeper, and the referee has just given a penalty against us. One opponent picks up the ball and puts it on the penalty spot…*

Captain   *I am the captain, and the referee has just called me for the toss. I win the toss and have to make a decision…*

Table 2

The Different Categories That Emerged From the Analysis of the Players' Responses

Category of response and subdivisions	Operational definition
Mobility	
Movement	Physical action
Static	Elements explicitly stating a lack of movement
Appraisal	Evaluation of the parameters included in the situation
Outcome evaluation	
Positive outcome	Mention of positive outcomes
Negative outcome	Mention of negative outcomes
Orientation focus	
Self-oriented focus	Attention focused on the self. Characterized by the use of the first person
Other-oriented focus	Inclusion of other players in the representation of the situation
Emotion	Explicit reference to an emotion (positive or negative)
Confidence	
Confident	Certitude concerning the outcome
Unconfident	Uncertainty about the outcome
Game field	Background items
Technical language	Specific terms associated with football
Speed	Speed of action

Table 3

Example of a Stereotypical Script Derived From the Different Categories Revealed by the

Athletes' Responses

Situation	Categories
I find myself alone against the goalkeeper.	*Base sentence*
I look at the goalkeeper.	*Appraisal, Static*
I convince myself that I'm going to score.	*Confidence, Self-oriented focus*
I try to be efficient and move as quickly as possible.	*Self-oriented focus, Speed*
I take on the keeper as if I were Ronaldo.	*Movement, Confidence*
I do a little trick by shooting in the opposite direction of my gaze.	*Movement*
My teammate gets the ball.	*Other-oriented focus*
The keeper did not have enough time to react. It's a goal.	*Other-oriented focus, Positive outcome*
I lift my arms and shout with joy.	*Emotion*

Figure Captions

Figure 1. Flow chart of the different recurrent categories.

Figure 2. Total number of textual elements in each category and in each participant group in Experiment 1. The only two significant differences between the two participant groups were in the other-oriented focus and in the emotion categories (*significant at $p<.02$).

Figure 3. Reading times (residual times in ms) of sentences in Experiment 2a including information about positive or negative outcomes. Negative residual times indicate that reading times were longer than expected.

Figure 4. Reading times (residual times in ms) of sentences in Experiment 2a including information about emotions (congruent or incongruent). Negative residual times indicate that reading times were longer than expected.

Figure 5. Reading times (residual times in ms) of sentences in Experiment 2b including information about others or information not including others. Negative residual times indicate that reading times were longer than expected.
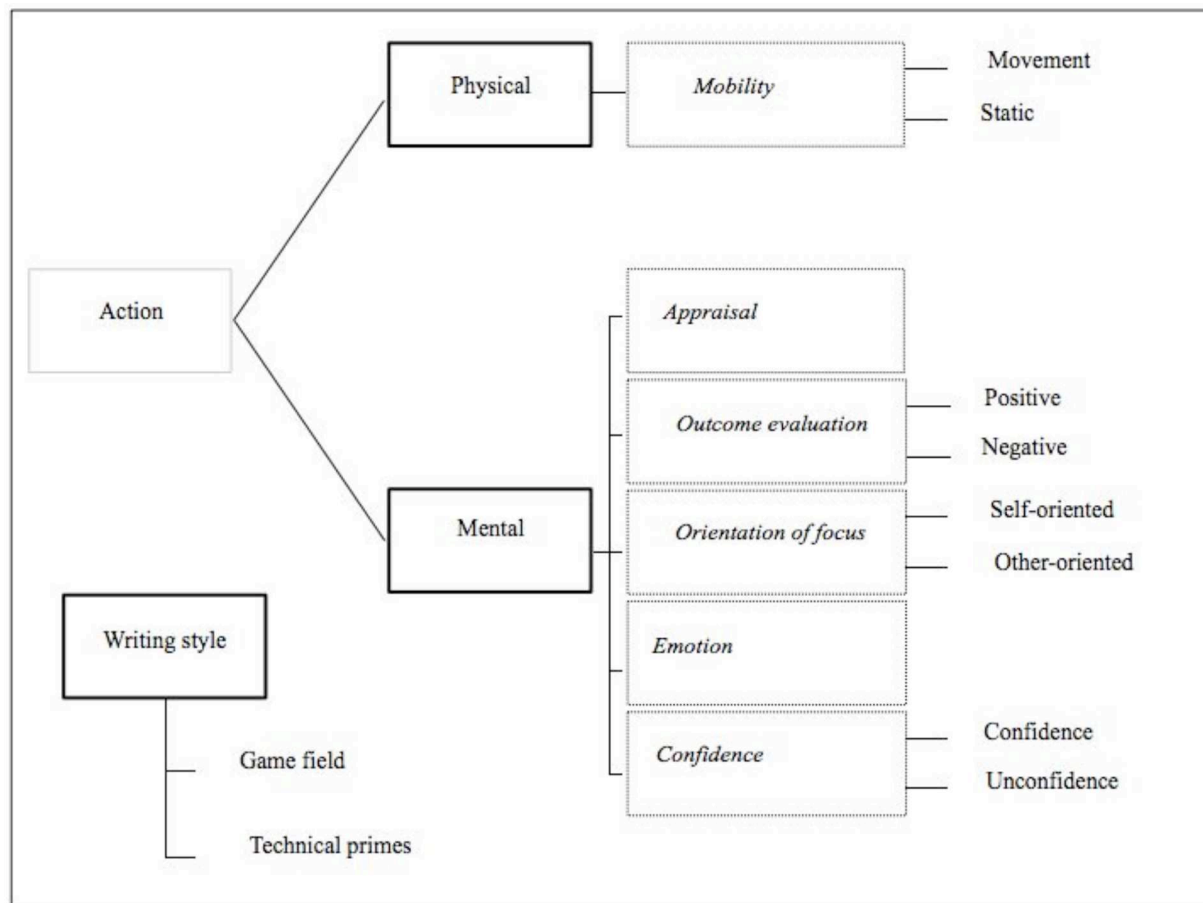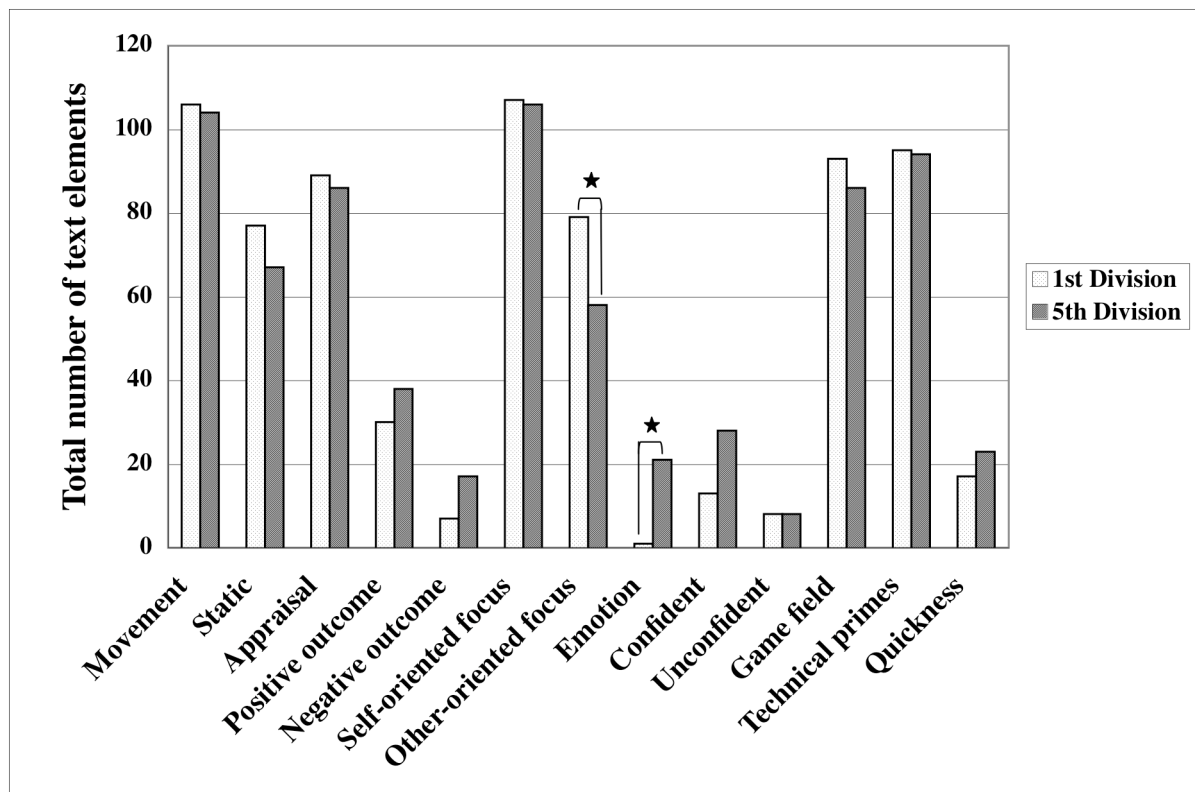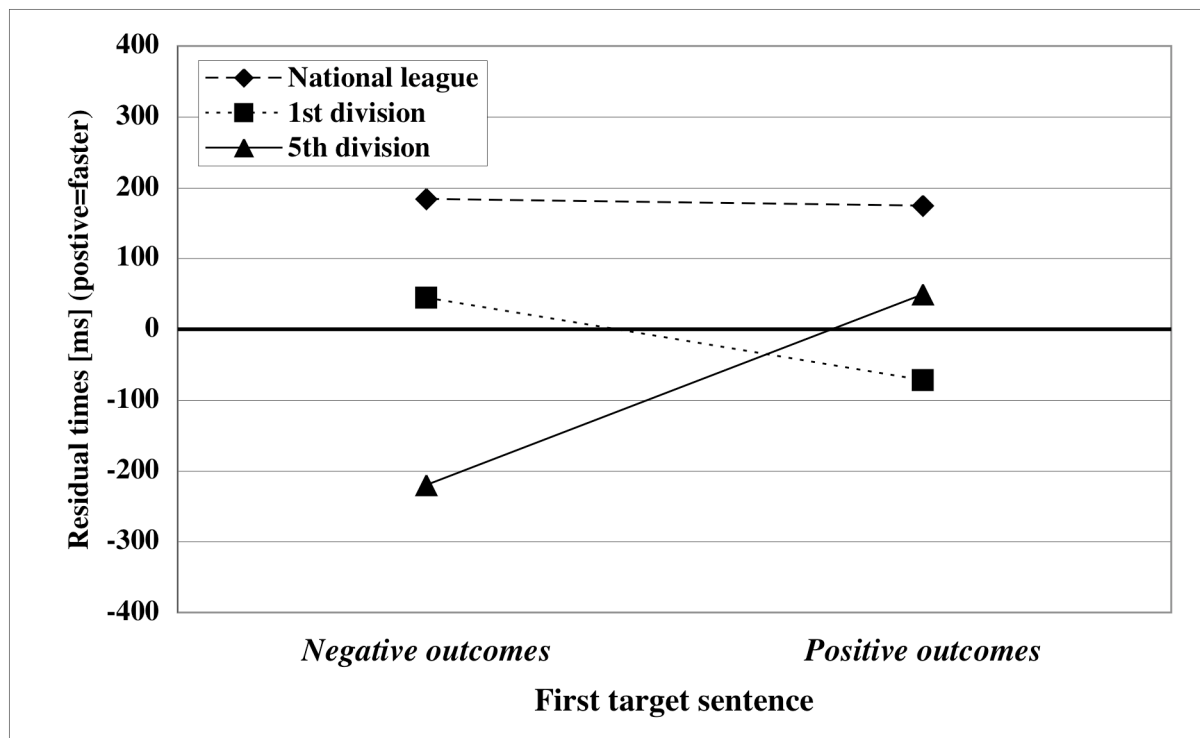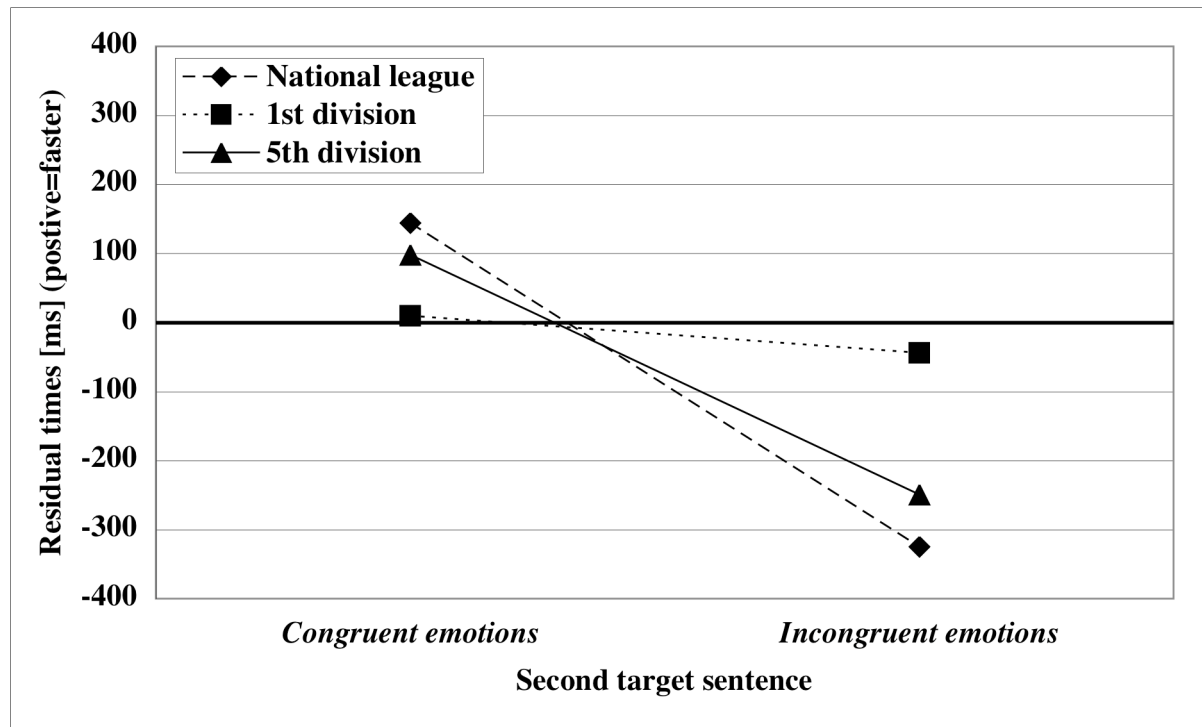
Figure 1

Figure 2

Figure 3

Figure 4

Figure 5