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Motivational cues predict the defensive system in team handball: A model based on regulatory focus theory

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This study was based on the naturalistic decision-making paradigm and regulatory focus theory. Its aim was to model coaches' decision-making processes for handball teams' defensive systems based on relevant cues of the reward structure, and to determine the weight of each of these cues. We collected raw data by video-recording 41 games that were selected using a simple random method. We considered the defensive strategy (DEF: aligned or staged) to be the dependent variable, and the three independent variables were (a) numerical difference between the teams; (b) score difference between the teams; and (c) game periods. We used a logistic regression design (logit model) and a multivariate logistic model to explain the link between DEF and the three category independent variables. Each factor was weighted differently during the decision-making process to select the defensive system, and combining these variables increased the impact on this process; for instance, a staged defense is 43 times more likely to be chosen during the final period in an unfavorable situation and in a man advantage. Finally, this shows that the coach's decision-making process could be based on a simple match or could require a diagnosis of the situation based on the relevant cues.

Examination of recent research in the area of coaching practice and development reveals that coaching is fundamentally a decision-making process (Nash & Collins, 2006; Lyle & Vergeer, 2013) that occurs in a dynamic environment. Coaches constantly deal with constraints, and this is particularly true in competitive team sport situations, which many authors consider as dynamic and complex environments (e.g., Hagemann et al., 2008). Despite these features, the practices of expert coaches are likely to show some regularity (through identified variables, considered to be relevant cues), and follow generic rules, heuristics, or patterns that provide a link between decision-making and practice (Lyle, 2007). This suggests that one part of this decision-making process can be predicted using a statistical model. The coaching model created by Côté et al. (1995) provides a framework for identifying and understanding why and how coaches make the training and competitive decisions that they do, emphasizing the importance of contextual factors in the coaching process. More recently, numerous authors (e.g., Côté et al., 2007; Lyle, 2007) have reaffirmed the need to take these contextual factors into account in coaching process studies. Furthermore, Brehmer (1992) encouraged a more systematic introduction of motivational factors in experiments studying motivational factors in dynamic decision making in a nonexperimental fashion.

The main goal of this study, based on the naturalistic decision-making (NDM) paradigm (Klein et al., 1993) and regulatory focus theory (RFT) (Higgins, 1997, 1998), is to model coaches' decision-making processes regarding handball teams' defensive system based on relevant cues of the reward structure, and to determine the weight of each of these cues, and the weight of different patterns of cues.

The naturalistic decision-making paradigm

Schematically, there are two types of decision models (Kobus et al., 2001): analytical or computational decision-making models, which do not take into account the complexity of natural situations, and NDM models, which rely on the concept of "situation assessment." In operational settings, people do not make any formal comparison between options, and experts generally use experience to generate a single, plausible, and satisfying (although not optimal) option (Kobus et al., 2001). The NDM paradigm is characterized by many key features: dynamic and continually changing conditions, real-time reactions to these changes, ill-defined goals and ill-structured tasks, high stakes, and experienced decision-makers (Klein et al., 1993). So, this paradigm appears to be an appropriate mechanism for describing and explaining how coaches make decisions (Lyle, 2010; Lyle &

Vergeer, 2013; Debanne & Chauvin, 2014). Of the various NDM models, the best known is Klein's (1998) recognition-primed decision (RPD) model (see Fig. 1), which contains three labeled functions. The "simple match" function represents the case in which a decision-maker identifies a situation: "the goals are obvious, the critical cues are being attended to, expectations about future states are formed and a typical course of action is recognized" (Klein, 1997, p. 285). Diagnosis is "the attempt to link the observed events to causal factors" (Klein, 1997, p. 290). The function whereby a decision-maker evaluates a "course of action" represents a case "in which the course of action is deliberately assessed by conducting a mental simulation to see if it runs into any difficulties and whether these can be remedied, or whether a new course of action is needed" (Klein, 1997, p. 285). In accordance with this model, the decision-maker carries out a recognition process of the situation typicality through the interaction of four components (relevant cues, expectancies, plausible goals, and actions).

Researchers in NDM have emphasized the role of decision-makers in shaping their understanding of problem situations and in generating and evaluating possible solutions (Lipshitz et al., 2001). They have been sensitive to the impact of contextual factors (Mosier & Fischer, 2010). However, few studies concerned the influence of emotions, which are elicited by decision-making situations or by its potential consequences (Mosier & Fischer, 2010). Mosier and Fischer (2010) have argued that task-relevant affect may function as one cue in a pattern or may be used to evaluate a pattern of cues. Emotion is determined by both the level of arousal and the current motivational state of the individual (Apter, 2007). At expert level, the arousal level difference between people is small because they need to have an optimal level of arousal (not too high, not too low). Therefore, the relationship between emotion and motivation seems to be direct, and affect can be an informative cue, used as motivational factor, by influencing the judgment and impacting the analytical decision processes (Forgas, 1995, 2001). As a consequence, we argue that RPD model can integrate motivational theories as RFT.

Regulatory focus theory

Motivation has a strong influence on cognition and behavior (Maddox et al., 2006). For instance, a promotional orientation of behavior becomes a motivational necessity when an individual is in a state of loss, and when the risky option alone offers the possibility of avoiding loss (Scholer et al., 2010). Therefore, one's current focus depends on situational factors (Higgins, 1998; Shah & Higgins, 2001), and situations often induce a regulatory focus that can override dominant chronic regulatory focus (Shah et al., 1998).

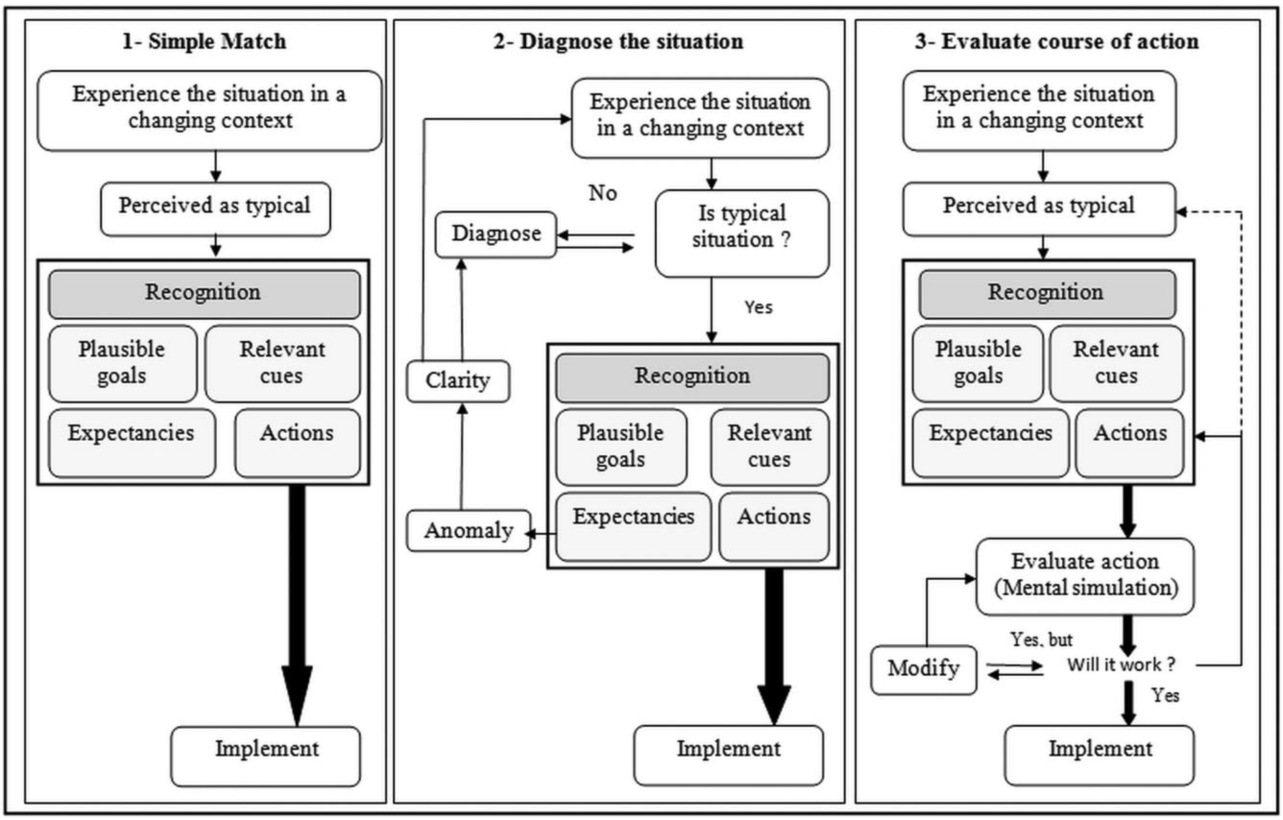

Fig. 1. Recognition-Primed Decision model: modified from Klein (1998) page 25.

Many recent studies have explored the influence of active goals [approach goals (desirable end-states that one wants to work toward) and avoidance goals (undesirable end-states that one wishes to prevent from occurring)] on behavior (Higgins, 2000; Fishbach et al., 2003; Ferguson & Bargh, 2004). RFT (Higgins, 1997, 1998) provides a framework that helps examine how situational differences influence people's decisions. According to this theory, decision making in dynamic environments depends on two motivational principles, which govern human behaviors and strategies to reach a goal: (a) a promotion focus, which is sensitive to the presence or absence of positive outcomes and approaches as a strategic means, for example: "*retrieve the ball quickly*"; and (b) a prevention focus, which is sensitive to the presence or absence of negative outcomes and avoidance as a strategic means, for example: "*we need to stay in front of the ball to protect the goal*."

Although people may differ as to which focus they habitually prefer, both foci are present in our behavioral repertoire and situational cues have been shown to activate the suitable regulatory focus in a wide variety of both judgmental and behavioral tasks (see Higgins & Spiegel, 2004, for a review). The focus that is activated is usually the one that best fits the specific situation's reward structure in terms of response strategy, that is, the gains or losses resulting from one's actions (Higgins, 2000; Maddox et al., 2006). When a promotional person (i.e., person with a chronic promotion regulatory focus) finds himself or herself in an environment promoting maximized gains, or when a preventive person is in an environment promoting minimized losses, we may conclude a regulatory fit. Conversely, when the regulatory focus and the reward structure do not match, we have a regulatory mismatch. As a consequence, the reward structure components are task-relevant affect that may be considered as one cue in a pattern or may be used to evaluate a pattern of cues.

In sport sciences, most studies focusing on sport performance from RFT were performed in experimental settings. These studies highlighted the link between athletes' chronic regulatory orientation and the situational reward structure on sport performance (e.g., Plessner et al., 2009; Kutzner et al., 2012). However, such studies in an ecological context are very rare. To our knowledge, only Worthy et al. (2009) have performed such an ecological approach. Debanne et al. (2014) also performed an ecological study, but rather than focusing directly on sport performance, they focused on the effects of motivational factors on team handball professional coaches' decision-making process during official games. The present study is, therefore, one of the few that has been conducted in an ecological setting. It hereby furthers Debanne et al. (2014) previous attempts to model the coach's decision-making process under specific relevant cues, and to determine the load of each cue in defensive system choice.

Defensive system as players' focus orientation

Team sports are characterized by a relationship of opposition between two teams with antagonist interests. Each team uses individual or collective strategies to gain the upper hand in this power struggle (Gréhaigne & Godbout, 1995). The handball coach's choice of defensive system appears central (Debanne & Fontayne, 2009) to these collective strategies. Thus, the coach must choose the appropriate defensive system in the context of the power struggle.

However, in a recent study, Debanne et al. (2014) studied professional handball coaches' decision-making processes in the French professional male championship. They showed that contextual cues, that are both motivational and temporal cues, also impact the handball coach's choice of defensive system. These authors conducted a quasi-experimental study in a real competitive environment with professional coaches, highlighting that some motivational factors (score difference, numerical difference) affected the situation's reward structure, defined as a setting that affects a specific evaluation of success (Ames, 1992), and is crystallized in the tension between the actual situation and the desired end state. Thus, while the match is in progress, the coach may choose to seek gain [for instance, while his team is behind and/or when it has a one-man advantage because of 2-min suspension(s)] or seek to avoid loss [for instance, while his team is leading and/or is at a man disadvantage after 2-min suspension(s)]. These defensive system choices induce the players' specific focus orientation.

1. A team structure where defenders spread out around the court to intercept the ball during passes between offensive players (see Fig. 2) is associated with a gains reward structure based on gain seeking (gaining the ball), and necessitates a promotional focus in order for the reward structure and regulatory focus to fit.
2. A team structure where all defensive players are positioned along the goal area line in order to protect the goal with a view to prevent gaps between defensive players and decrease the offensive players' possibilities of approaching the goal (see Fig. 2) is associated with a reward structure based on avoiding loss (preventing a goal), and necessitates a preventive focus to make the reward structure and the focus orientation fit.

In accordance with Gréhaigne et al. (1997), defensive intentions from both players and coaches are represented either when recapturing the ball or when defending the goal, and are linked with the two defensive systems (aligned or staged), and also with different specific coaches' expectancies. We can suppose that with an aligned defense, coaches could expect that (a) defensive players are more gathered with a player between the ball

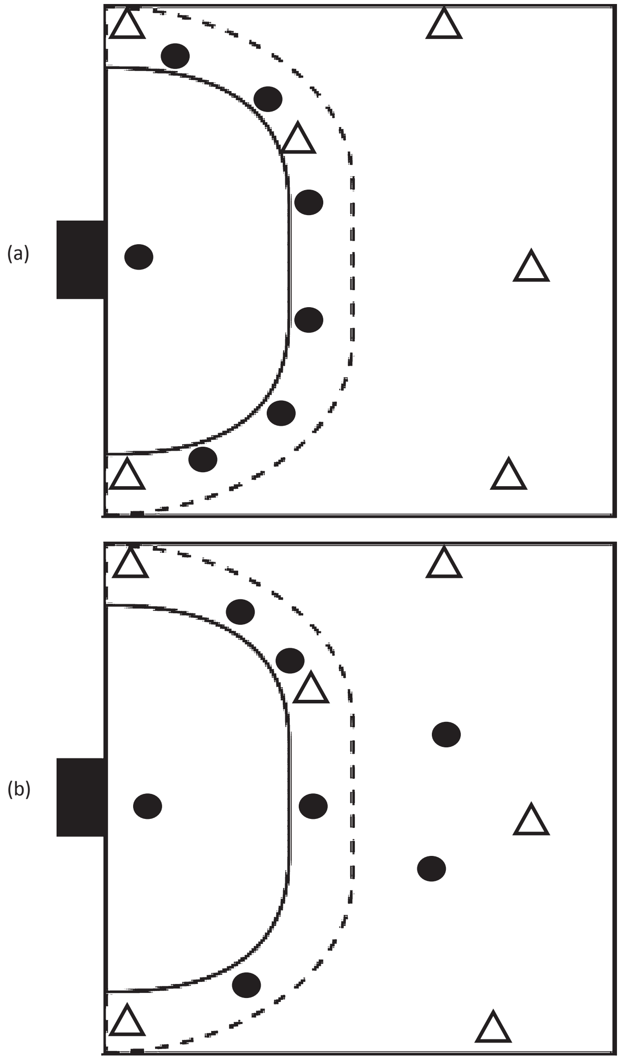

Fig. 2. Schematic defensive system: (a) aligned defense (prevention) and (b) staged defense (promotion).

and the goal during the whole defensive phase; (b) they use the block to avoid the ball getting to the goal; and (c) the attack needs more time to find a solution. Then, with a staged defense, coaches could expect that (a) the defense players interfere with the ball circulation to intercept it; and (b) they reduce the time the opponent keep the ball.

Debanne et al. (2014) showed a main reward structure effect on the defensive strategies coaches used; the more the reward structure is gain oriented, the more often they tend to choose promotion-oriented defensive strategies. These authors also showed a main game periods effect on the adopted defensive system; during the second half of the second halftime, the defensive system is more promotion oriented than during other periods, highlighting “the goal looms larger effect” in which motivation increases as the distance to the goal decreases (Förster et al., 1998). Moreover, they highlighted an interaction effect of the situation’s reward structure and game periods on the defensive strategies coaches used; when there is a losses reward structure, the defensive system is significantly more frequently prevention oriented during the second half of the second halftime than during the second half of the first halftime, and when there is a gains reward structure, the defensive system is more often promotion oriented during the second half of the second halftime than during any other game period. However, they did not clearly assess the importance of this effect and the impact of each relevant cue (score difference and the difference in the number of players on the field between the two teams).

Therefore, in the present study, we evaluate behavioral decision making through an analysis of behavior by adopting a holistic ecological approach, where it is not a stimulus that generates a response, but it is a decision-making behavior that generates perceptions, and perceptions that generate decision-making behaviors in a cyclical fashion.

Our aim was to model the coaches’ decision-making process regarding handball teams’ defensive systems based on specific motivational cues (score difference, the difference in the number of players on the field) and temporal cues (game period), and to determine the weight of each one and the weight of different patterns of cues.

Hypothesis

Based on this theoretical background, we hypothesized that coaches’ decision making about the defensive system is based on relevant cues of the reward structure.

1. When there are gains motivational factors, the coach will choose a staged defense (players’ promotion-oriented focus). Thus, when the difference in score between the teams is unfavorable, or when the difference in the number of players between the teams creates a numerical superiority, the coach will choose a staged defense.
2. When there are losses motivational factors, the coach will choose an aligned defense (players’ prevention-oriented focus). Thus, when the difference in score between the teams is favorable, or when the difference in the number of players on the court between the teams creates a man disadvantage, the coach will choose an aligned defense.
3. During the last game period, gains motivational factors effects will be increased. Therefore, during the last game period, if the score difference between the teams is unfavorable, and/or the difference in the number of players on the field between the teams creates a numerical superiority, the probability of choosing a staged defense will increase. This case will represent a simple pattern matching in the RPD model.

Methods

The research was conducted in accordance with ethical standards (Harris & Atkinson, 2009), and was approved by the local Ethics Committee of the University of Paris-Sud. The method for data collection and analysis previously validated by Debanne et al. (2014) was replicated in the present study.

Participants

Conversely to the study of Debanne et al. (2014), only the best professional league was retained for analysis. Thus, all of the professional handball coaches ($n = 14$) from the French first division professional male championship during the 2011–2012 season participated in this study.

Material and design

The raw data were collected through the video recording of 41 games, and downloaded from the website http:///www.dartish.tv. Games were selected using a simple random method [i.e., each game has an equi-probability of being chosen (Yates et al., 2003)], with the only criterion being that each coach should be observed at least five times, in order to normalize the inter-individual difference among coaches.

This study includes one dependent variable (DV), defensive strategies (DEF), and three independent variables (IV) (categorical or ordinal), including two motivational factors: (a) the difference in the number of players between the teams; and (b) score difference between the teams; and one temporal factor: (c) the game periods (see Table 1). Based on the positions of the defensive players on the court, defensive strategies (DEF) evaluated (a) aligned defense [all the players line up around the 6-m goal line, (coded aligned, with value 1)], and (b) staged defense (one or more players cruise outside the 9-m perimeter, defense, (coded staged, with value 2)]. The difference in the number of players (NUM) between the teams may be numerical inferiority [when the opposing team has a one-man (or more) advantage over one's own team (coded INF, with value 1)], numerical equality (coded EQU, with value 2), and numerical superiority [when one's own team has a one-man (or more) advantage over the opposing team (coded SUP, with value 3). The score difference between the two teams (SCORE) is considered as unfavorable when SCORE < -2 (coded UNFAV, with value 1), balanced when $-2 \leq$ SCORE ≤ 2 (coded BAL, with value 2), and favorable when SCORE > 2 (coded FAV, with value 3)]. However, this evaluation (unfavorable, balanced and favorable) cannot be satisfactory just before the end of the game, so we chose that during the final two defensive phases, the score difference would be considered unfavorable (coded UNFAV) if SCORE < 0, the score difference would be considered balanced (coded BAL) if SCORE $= 0$, and it would be considered favorable (coded FAV) SCORE > 0. In accordance with Debanne et al. (2014), two game periods (PERIOD) were identified for each match: the first halftime and the first half of the second halftime

Table 1. Variables of the study

Variables			Coding	Value
Dependent variable	Aligned defense		AD (preventive focus)	1
	Staged defense		SD (promotion focus)	2
Independent variables	Temporal factor	Game periods	P1	0
			P2	1
	Motivational factors	Score's difference	DEFAV (gains reward structure)	1
			EQU	2
			FAV (losses reward structure)	3
		Numerical difference	INF (losses reward structure)	1
			EQU	2
			SUP (gains reward structure)	3

Table 2. Breakdown of defense systems by contextual factor

Game periods	Score's difference	Δ NUM	Aligned defense	Staged defense	Total
P1	BAL	EQU	558	513	1071
		INF	114	2	116
		SUP	49	107	156
	FAV	EQU	293	188	481
		INF	55	7	62
		SUP	23	48	71
	UNFAV	EQU	206	228	434
		INF	58	10	68
		SUP	16	57	73
P2	BAL	EQU	133	135	268
		INF	29	2	31
		SUP	12	24	36
	FAV	EQU	137	69	206
		INF	24	1	25
		SUP	12	19	31
	UNFAV	EQU	55	163	218
		INF	23	2	25
		SUP	1	43	44
Total			1798	1618	3416

BAL, balanced; EQU, numerical equality; FAV, favorable; INF, advantage over one's own team; NUM, number of players; P1, first half of the second halftime; P2, second half of the second halftime; SUP, advantage over the opposing team; UNFAV, unfavorable.

(P1, with value 0), and the second half of the second halftime (P2 with value 1).

Procedure

The first step involved breaking down each of the 41 observed games ($n = 4656$) into sequences of defense phases. The coaches' decision-making processes are inferred only from game observation. Consequently, the choice of the defensive system can be taken into account only in placed defenses. Placed defenses are phases where the defense sets up after a stoppage in play or when a counter attack is countered, allowing defensive players to close the gaps around the goal line area. They can be structured with different defense systems: 6-0; 5-1; 3-2-1; 4-2; 3-3, or a man-to-man defense system, for example. 73.4% of the defensive phases were analyzed ($n = 3416$). In a second step, the first author coded each defensive system (aligned vs staged). We associated each defensive system with the three IVs (numerical difference, score difference, and game periods), as shown in Table 2.

To test the reliability of the coding scheme, we asked three professional coaches to code the data independently. They met expert-coach criteria (Côté et al., 1995) with (a) a minimum of 10 years of coaching experience; (b) a performance outcome measure, having played at the international level; and (c) recognition as being among the best to develop elite athletes. Each agreed to code three matches, so a sample of nine matches was coded, allowing us to assess coding reliability ($n = 777$). The reliability points were estimated using a kappa index (k), which represents the normalized proportion of inter-observer agreement in excess of what would be expected based on chance or random assignments. We used MacKappa software (Watkins, 2002), which calculates both general and conditional coefficients, and tests the statistical significance of agreement among many observers assigning objects to nominal scales based on Fleiss's (1971) computational formulae. The overall kappa revealed a significant agreement among the coders ($k = 0.99$; $z = 28.37$, $P < .0001$). All of the conditional coefficients were also high and significant (see Table 3). Overall, these results showed acceptable reliability of the coding.

The statistical approach was designed in two steps (STATISTICA 10.0 for Windows, StatSoft, Maisons-Alfort, France) using a logistic regression design (logit model) in order to explain the link between the binary-DV (DEF) and the three categorical IVs (NUM, SCORE and PERIOD). The "logit" model solves the following problem:

$$\ln[P/(1-P)] = \alpha + \beta X + e \qquad [1]$$

where p is the probability that event Y occurs (aligned defense: $Y = 1$); $P/(1 - P)$ is the odds ratio; and $\ln[P/(1 - P)]$ is the log odds ratio or "logit." Additionally, the Wald test was used to test the true value of the parameter based on the sample estimate. The first step consists of studying the link between each IV and the DV using (a) a univariate regression model (Spearman's rank correlation coefficient for nonparametric measure), and (b) the calculation of odds ratio (with $P < .05$). The second step consists in crossing the effect of the three IVs on DV, under the condition that the IV has a significant link with the DV in the univariate model. A multivariate logistic model is then proposed.

Table 3. Reliability of coding sample

Defensive system	Number (%)	Kappa	Z
Aligned	485 (62.4)	0.99	8.04*
Staged	292 (37.6)	0.98	10.05*
Overall	777	0.99	28.37*

*$P < .001$.

Results

Univariate regression model

Spearman's coefficient correlation

The univariate Spearman linear regression shows a significant effect (all Ps < 0.05) of all three IVs as presented in Table 4.

Calculation of odds ratio

Percentage of correct prediction and overall odds ratio. The "percentage of correct predictions" statistic assumes that if the estimated p is greater than or equal to 0.5, then the event is expected to occur and not occur otherwise. The aligned defensive system is predicted for 78.4% of the occurrences whereas the staged defensive system is predicted for 43.3% of the occurrences. Overall, the model predicted 68.7% of occurrences. The overall odds ratio is 1.11, meaning that the aligned defensive system has 1.11 times more chance of appearing than the staged one.

Odds ratio for IVs. The game periods have a significant effect on the defensive system. Indeed, during the second half of the second halftime, a staged defense has a 1.06 times greater chance of occurring than an aligned defense, ($P < 0.02$) while during P1, an aligned defense has a 1.18 times greater chance of occurring than a staged defense ($P < 0.02$). The difference in the number of players has a high significant effect on the defensive system; during a numerical inferiority, an aligned defense has a 13.46 times greater chance of occurring ($P < 0.005$), while during numerical superiority, there is a 2.64 times greater chance that a staged defense will occur (Ps < 0.01). Lastly, the score difference shows a significant effect as well; in a favorable SCORE, an aligned defense has a 1.64 times greater chance of occurring ($P < 0.01$), whereas in an unfavorable SCORE, a staged defense also has a 1.4 times greater chance of occurring than an aligned one ($P < 0.001$).

Table 4. Spearman's coefficient correlation

PERIOD VI	P1 + P2	P1	P2
PERIOD	0.05*	–	–
SCORE	–0.15*	–0.08*	–0.31*
NUM	0.29*	0.29*	0.32*

*$P < .05$.

NUM, number of players; P1, first half of the second halftime; P2, second half of the second halftime; PERIOD, game period; SCORE, the score difference between the two teams.

Multivariate regression model

PERIOD × SCORE interaction effect

When combining the effect of the IV, only the mixed PERIOD × SCORE has a significant effect on the defensive system in two situations (P2 × favorable SCORE; P2 × unfavorable SCORE):

During P1, in a favorable SCORE, the aligned defense has a 1.52 times greater probability of occurring than a staged one, while in an unfavorable score, the staged defense has a 1.05 times greater probability of occurring than an aligned one ($P < 0.01$). During the last period in a favorable SCORE, an aligned defense has a 1.94 times greater probability of occurring than a staged one ($P < .01$), while in an unfavorable SCORE, the probability of a staged defense is 2.63 times greater during the last period ($P < .01$).

PERIOD × NUM interaction effect

During P1, in a situation of numerical superiority, a staged defense has 2.4 times greater probability of occurring than an aligned one ($P < .01$), while in a situation of numerical inferiority, an aligned defense has an 11.9 times greater probability of occurring than a staged one ($P < .001$). During P2, in a situation of numerical superiority, a staged defense has a 3.44 times greater probability of occurring than an aligned one ($P < .01$), while in a situation of numerical inferiority, an aligned defense has a 15.2 times greater probability of occurring during the last period than a staged one ($P < .001$).

SCORE × NUM interaction effect

In a situation of numerical superiority and unfavorable SCORE, a staged defense has a 5.89 times greater probability of occurring than an aligned one. In a situation of numerical inferiority and favorable SCORE, an aligned defense has a 9.88 times greater probability of occurring than a staged one ($P < 0.001$).

PERIOD × SCORE × NUM interaction effect

In a situation of numerical superiority, (a) with an unfavorable SCORE, a staged defense has a 43 times greater probability of occurring during the last period than an aligned defense ($P < .001$); and (b) with a favorable SCORE, an aligned defense has a 1.58 times greater probability of occurring during the last period than a staged defense ($P < 0.05$).

In a situation of numerical inferiority, (a) with an unfavorable SCORE, an aligned defense has an 11.5 times greater probability of occurring during the last period than a staged defense ($P < .001$); and (b) with a favorable SCORE, an aligned defense has a 24 times greater probability of occurring during the last period than a staged defense ($P < 0.001$).

In a situation of numerical balance, (a) with an unfavorable SCORE, a staged defense has a 2.7 times greater probability of occurring during the last period with respect to the rest of the game ($P < 0.01$); and (b) with a favorable SCORE, an aligned defense has a 1.44 times greater probability of occurring during the last period with respect to the rest of the game ($P < 0.01$).

All these results are summarized in Fig. 3.

Multiple regression logistic model

Table 5 shows the coefficients of correlation for the multiple logistic regression. The log–likelihood is –2156. Each estimated coefficient is the expected change in the log odds of having a staged defense for a unit increase in the corresponding predictor variable holding the other

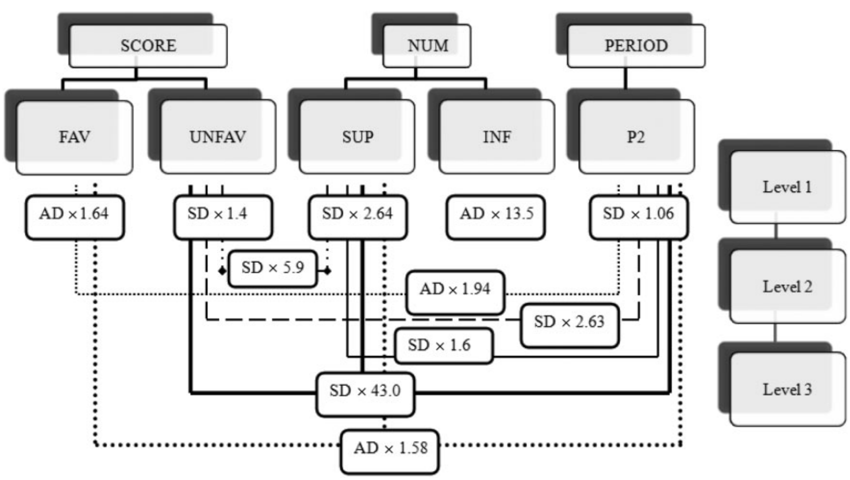

Fig. 3. Hierarchical effect of the motivational factor on the choice of the defensive system (promotion-staged vs prevention-aligned). AD, aligned defense; FAV, favorable; INF, advantage over one's own team; NUM, number of players; P2, second half of the second halftime; PERIOD, game period; SCORE, score difference between the two teams; SD, staged defense; SUP, advantage over the opposing team; UNFAV, unfavorable.

Table 5. Multiple logistic regression for staged defense

	Coefficient	SE	Wald test	P value
Intercept	–2350	0.218	10 756	0.000
PERIOD (P1 = 0, P2 = 1)	0.234	0.083	2 816	0.005
SCORE (1 = UNFAV 3 = FAV)	–0.464	0.052	8 924	0.000
NUM (1 = INF 3 = SUP)	1533	0.096	15 928	0.000

Number of observations: 3416.

FAV, favorable; INF, advantage over one's own team; NUM, number of players; PERIOD, game period; SCORE, score difference between the two teams; SE, standard error; SUP, advantage over the opposing team; UNFAV, unfavorable.

predictor variables constant at a certain value. Each exponentiated coefficient is the ratio of two odds, or the change in odds in the multiplicative scale for a unit increase in the corresponding predictor variable holding other variables at a certain value. When written linearly, the equation is:

$$\operatorname{logit}(P) = \log[P/(1-P)] = -2.350 + 0.234 \times \mathbf{PERIOD} - 0.464 \times \mathbf{SCORE} + 1.533 \times \mathbf{NUM} \quad [2]$$

The fitted model indicates that, with SCORE and NUM maintained at a fixed value, the odds of having a staged defense during the last period (Rest of the game = 0) is exp (0.234) = 1.26, suggesting that a staged defense has a 55% chance of occurring during the last period. The coefficient for SCORE suggests that, in the last period and for a fixed value of NUM, we will see a 37% decrease in the odds of having a staged defense for a one unit increase in SCORE (1 unit = switch from unfavorable to balance to favorable). Finally, the coefficient of NUM indicates that, in the last period for a fixed value of SCORE, we will see an 82% increase in the odds of having a staged defense for a one unit increase in NUM (1 unit = switch from inferiority to balance to superiority).

Discussion

The main goal of this study, based on RFT and the NDM paradigm, was to model coaches' decision-making processes regarding handball teams' defensive systems based on relevant cues of the reward structure and to determine the weight of each one and of different patterns of cues as well. The RFT attempts to explain subjects' responses to reward structures. In accordance with this theory and the study of Debanne et al. (2014), we hypothesized that when there are gain-related motivational cues, coaches will choose a staged defense (players' promotion-oriented focus). Thus, when the score difference between the teams is unfavorable, and/or when the difference in the number of players between the teams creates a numerical superiority, the coach will choose a staged defense. Our results confirm this hypothesis. Indeed, in a situation of numerical superiority, and/or when the team is behind (unfavorable score difference), coaches more frequently choose a staged defensive system. The typical pattern of these cues (unfavorable score difference + numerical superiority) dramatically increases the probability of a staged defense system. With such defense system, we can suppose that coaches expect to (a) prevent good ball passing between opposing players or/and to prevent middle-distance shots, or (b) attempt to retrieve ball possession. However, they probably also consider the pertinence of their choice based on the relationship of opposition between the two teams.

Conversely, our second hypothesis was that when there are loss-related motivational cues, coaches will choose an aligned defense (players' prevention-oriented focus), that is when the score difference between the teams is favorable, and/or when the difference in the number of players between the teams creates a man disadvantage, the coach will choose an aligned defense. The results confirm this hypothesis:

1. Coaches match the cue "man disadvantage" with an aligned system. This suggests that coaches consider numerical inferiority as one cue sufficiently important to assess the opposition relationship between the two teams. The choice of an aligned defensive system in a situation of numerical inferiority is consequently independent of the characteristics of the opposing teams.
2. When the team is leading (favorable score difference), coaches more frequently choose an aligned defensive system to attempt orienting players' prevention focus.

Among the motivational cues composing a situation's reward structures, the difference in the number of players seems to have the greatest impact on the choice of a defensive system (see coefficients of eqn. [2]). This could easily be explained by the fact that the defensive advantage is a structural advantage of the antagonist interaction between the two teams. Indeed, unlike the score difference, which is temporary (it evolves continuously throughout the game), the numerical advantage puts the team in a more favorable situation. For this reason, a numerical advantage may be defined as a structural advantage. Consequently, it modifies the opposition relationship between the teams, unlike the game periods or the score difference. This structural advantage induces a structural modification (i.e., a new defensive system).

Our third hypothesis was that during the last game period (P2), gain-related motivational factor effects will be increased. Indeed, results show that if the score difference between the teams is unfavorable during the last game period, and/or the difference in the number of players between the teams creates a numerical superiority, the probability of choosing a staged defense will increase. Thus, being in the second part of the second halftime catalyzes the effect of each reward structure component. This catalyzing effect could be explained by the "Goal looms larger effect" (Förster et al., 1998). Indeed, during the first halftime and the first part of the last halftime, the coaches choose a defensive system by taking into account the interaction between the teams (with a low influence of the motivational cues). During the second part of the second halftime, however, the importance of the motivational factors increases dramatically, with the SCORE factor becoming more predominant than NUM. As a consequence, coaches carry out a simple match between a specific pattern of cues (numerical superiority + score unfavorable + last game period) and the choice of a staged defense, as suggested by Klein's model.

The RPD model explains (Fig. 1) that the coach's decision-making process could be based on a simple match or could require a diagnosis of the situation or an evaluation of the course of action. So, from a dynamic point of view, the decision could either be direct or require more time. Among the 18 patterns of cues [3 (numerical difference) × 3 (score difference) × 2 (game period)], seven of them [1 (man disadvantage) × 3 (score difference) × 2 (game period) + 1 (numerical superiority) × 1 (unfavorable situation) × 1 (P2)] are simply matched with a specific defensive system. In other cases, even if motivational cues impact the defensive system choices, other relevant cues are taken into account, making this defensive choice more complex and requiring more time (cases b and c of Fig. 1) to diagnose the situation or evaluate the course of actions. Finally, this shows that the coach's choice of defensive system is not the result of a strict addition of motivational factors, and as a consequence proves the complexity and dynamics of human behavior in a real setting.

Perspectives

The present study reveals that motivational cues are relevant to allow the coach to choose the defensive system. One limit of this work is that the factors we identify are not exhaustive. In order to attempt to improve our predictive model, it could be interesting to take into account coaches' chronic regulatory focus orientation. Furthermore, we encourage future research to focus on other relevant cues, especially those characterizing team interactions (strengths and weaknesses), and highlight coaches' expectancies, which is one of the cues of Klein's model that our model did not take into account. These could be determined using qualitative approaches such as video-cued recall interviews (Lyle, 2003).

Key words: Coaching, motivation, self-regulation, logistic regression, odds ratio, naturalistic decision-making, recognition-primed decision.

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