Error Rate in the Decisions of Elite Futsal Referees in the Context of their Position on the Pitch

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ABSTRACT

One of the primary requirements for a futsal referee is the minimum of incorrect decisions in a match. An important starting point for the possibility of the correct decision of the referee is his position on the court when deciding. The aim of the thesis is to find out whether the error rate of the futsal referee changes when assessing game situations (leading to a direct free kick) in connection with his position. The research group consisted of referees of the 1st futsal league in the Czech Republic (n = 15); average age 39.4 (SD = 6.2). A total of 685 game situations were assessed from 42 matches in the 2020/21 and 2021/22 seasons. The methods of work were: indirect observation of video recordings, notation analysis, expert assessment of game situations by an expert group (n = 5). Results: the error rate in the decisions of referees is 7%; inadequate positions detected 3%; A statistically significant relationship was found between the degree of error rate in the referees' decisions and the quality of the position (rs = .32, p < .001) but no material significance was found. We recommend a more detailed research solution to this issue.

Keywords: futsal, referee, error, decision-making, positioning

INTRODUCTION

The match of sports games requires very precise and, if possible, maximum performance of all participants of these games – if it is a top or professional competition. Player characteristics have been described in terms of performance for many years. The performance characteristics of the referees of these games are no less important - for the performance of the referees themselves, and thus for the overall quality of the match.

The activity of referees of invasive sports games in a match is referred to in the scientific field as the expert performance (Gilis, 2008; Helsen & Bultynck, 2004). The starting point is the so-called theory of deliberate practice, which emphasizes the length and quality of preparation for the activity - from which the acquired skills and abilities will emerge (Ericsson & Lehman, 1996).

One of the primary requirements for referees is the minimum of erroneous decisions. According to Bompa, expert performance in the perceptual-cognitive area is crucial for the referees, in terms of their decision on the game situation (1999). From a psychological point of view, the decision-making process in sport is a process of using the perceptions of the information obtained to determine whether an answer should be made, or what the answer should be (Elliott, 1999) – in our case, the answer is the referee's decision. The referee therefore interprets the perceived game information for the final, most appropriate answer. The quality of this decision depends on: 1. the quality of the perceived information obtained; 2. experience of the decision-maker (Abernethy, 1986). Bless et al. (2004) describes the individual steps of the referee's decision-making process in sports games in the following way: the primary is the stimulus (e.g., tripping an opponent), stimulus perception by the referee (referee saw the fault), categorization as a fault and subsequent integration of information with severity assessment (here the judge uses his memory and skills). The last step is a behavioral response (e.g., a direct free kick and a red card). If the above scenario is violated, a wrong decision may be made (Balkó et al., 2016; Plessner & Haar, 2006).

For several years now, there has been a targeted focus on the training of perceptual-cognitive abilities in the referees of the relevant sports game (Catteeuw, 2010; Kresta, 2015). In the world of popular games like football (Catteeuw et al., 2010), basketball (MacMahon et al., 2007), handball (Souchon et al., 2004) or American football a relatively large amount of knowledge has already been researched - regarding the referees´ decisions and their error rate. Less popular games lag somewhat in this respect - one of these sports games is futsal, which is the subject of our research plan.

Kresta (2018) comprehensively analyzes the current state of knowledge about the performance of futsal referees. He states that there are only a limited number of studies that deal with their physical activity during matches (Ahmed et al., 2017; Rebelo et al., 2007, 2009, 2011), and stress of the referees is analyzed by (Ferreira et al., 2009). New knowledge about the movement intensity of the match is brought by Serrano et al. (2021) and Bolotin & Bakayev report on the possibilities of individual fitness training (2017). Shared mental models are researched by Sinval et al. (2020) and Aragao e Pina et al. (2021). Burnout syndrome is researched by Ribeiro & Alvarez (2019). The overview futsal study is presented by Sanmiguel-Rodríguez & Giráldez (2021), but only limited to children's futsal play. The error rate of the elite futsal referees was solved minimally. Kresta (2018) found the elite referees´ error rate of 7% for the whole match. He found a statistically significant relationship between the degree of error rate in the referees' decisions and the quality of their position (Kresta, 2018).

The referee's performance in a futsal match is conditioned by a certain technique and mechanics of decision-making, which is determined by futsal standards, especially the recommendations and obligations (for the referee and the second referee) arising from the futsal rules. In terms of position on the vicinity of pitch, it is a so-called diagonal control system (Ahmed et al., 2017; FIFA, 2021; Rebelo et al., 2011). The best position of the referee on the vicinity of pitch is considered to be the one from

which the referee can: make the right decision, control the whole game situation, have the maximum view (FIFA, 2021). These positions of referees also take into account sports and game variability – i.e., it is not always possible to dogmatically determine the exact position of the referee (e.g., the exact distance), because he must respond to the development of the game situation (FIFA, 2021; Mallo et al., 2010). When it comes to responsibility for offenses against rule XII (offenses and offenses leading to free kicks), the responsibility of both referees is divided into the so-called space around the ball, i.e., within the action area and space within the influence area). The referee makes most of the decision related to breaking Rule XII in the action area – which is a game situation that is the subject of our interest, both in terms of the referee's decision and his position. The aim of our work is to describe and explain the decisions (correct vs. wrong) of futsal referees in connection with their position on the vicinity of pitch. Hypothesis: the error rate in the referee's decisions increases depending on the declining quality of his position on the vicinity of pitch. The aspect of futsal decision making error rate, which is a key aspect of the proper conduct of the match, has not yet been sufficiently researched.

MATERIALS AND METHODS

Research group, expert group

The research group consisted of all 15 referees with the highest A license authorizing refereeing of the futsal 1st league (so-called group intended only for the 1st league), average age = 39.4 years ($SD = 6.2$); professional experience in refereeing futsal 1st league matches was on average 13.8 years ($SD = 5.2$). The height and weight of the referees were on average 178.8 cm ($SD = 2.3$), respectively 82.2 kg ($SD = 7.2$). We obtained personal data from the referees by personal anamnesis and somatometry; the somatic measurement tool was a medical scale with an integrated height meter (Tanita WB-3000, Tanita, Japan).

The evaluation expert group set up from leading Czech experts consisted of 5 people with an average age 51.8 years ($SD = 12.5$) and their professional experience was 22.6 years ($SD = 7.8$).

Methods, tools

We collected data on the referees' activities in the match by indirectly observing video recordings (ex post) according to Hendl (2005). We used expert assessment of selected game situations used in sports games (Helsen et al., 2006; Knudson & Morrison, 2013). The tool was a Samsung TV – UE40F6740 (Samsung Electronics, South Korea).

We used notation analysis to analyze the error rate in the referees' decisions (D´Ottavio & Castangna, 2001; Hughes & Barlett, 2002). We quantified the position on the vicinity of pitch by categorical systems according to Gavora (2000), which were already used directly for these purposes by Kresta (2018).

Research design

This is a non-experimental research, specifically an observational study. Data were obtained from the Czech 1st League matches of futsal in the competition years 2020/2021 and 2021/2022. The research sample consisted of referees from the population of elite referees in the Czech Republic. For these referees, we had the expert group assessing the error rate and the position of the referees on

the vicinity of pitch while assessing these game situations. The study was performed: anonymously; in accordance with the Declaration of Helsinki; the ethical standards of the university have been respected; it was carried out with the consent of the jury of the Futsal Association of the Football Association of the Czech Republic.

In the video recordings of the matches (n = 42), taken by the sports television station, which is the official broadcaster (Czech Television, 2022), we used notational analysis to identify offenses against rule XII of the futsal rules (FIFA, 2021); specifically, these were offenses leading to a direct free kick, or penalty kick. The subject of our research was only those game situations which the referee classified in the match as offenses, i.e., he interrupted the game with a whistle and ordered a direct free kick (or penalty kick) or signaled an advantage in the game. In accordance with the previous work (Helsen et al., 2006; Mallo et al., 2010), other game situations were not taken into account, if the referees did not evaluate the game situation as a violation of the rule. Both referees who manage a futsal match on the vicinity of pitch have the same powers on the assessment of these offenses in the match, therefore offenses were assessed throughout the match by both referees (i.e., the referee and the second referee). Their mandatory and recommended responsibilities and position on the vicinity of pitch were taken into account in the assessment (FIFA, 2021).

Analogous to the Kresta research (2018), we used an expert group, in which the training of assessors and verification of qualitative indicators of expert assessment was carried out (see chapter Results).

We used a proven categorical observation system to assess the error rate and position of futsal referees (Kresta et al., 2015; Kresta, 2018). The expert consensus of our expert group was quantified using two scales: 1. three-level categorical scales for assessing the decision-making position, where the criterion for inclusion into one of the categories was whether the realized position of the referee in the game situation corresponded to the futsal standards in the context of the game situation, or to what extent; this scale took values from 1–3 (see Table 1). 2. dichotomous categorical scales for assessing the correctness of decisions, where the criterion for inclusion into one of the categories (correct vs. wrong decision) was whether the decision made by the referee was in accordance with rule XII of the futsal rules of the game; each judge made a verdict on the decision of the referee on the relevant game situation (correctly or incorrectly, value 1 or 0); Based on the ratio of the judges' verdicts, a consensus of the expert group was made, i.e., whether the referee decided the game situation correctly or incorrectly (see Table 2). The design validity of both scales was positively verified (Kresta et al., 2015; Kresta, 2018).

Table 1. Referee´s positioning assessment scale with calculation record

Position	Points	Consensus value
Adequate	3	
Acceptable	2	1–3
Inadequate	1	

Note: adequate positioning as consensus of the expert group is to be found within the interval 2.8 – 3; acceptable within the interval 2 – 2.6; inadequate within the interval 1 – 1.8. E.g. 4 evaluators set adequate positioning (value 3) and one evaluator inadequate (value 1), that is $(4 \cdot 3 + 1 \cdot 1) : 5 = 2.6$ (consensus of the expert group).

Table 2. Scale to assess a referee´s decision with calculation record

Decisions	Ratio of verdicts (correct : erroneous)	Consensus value
Correct	5:0	1
	4:1	0.8
	3:2	0.6
Erroneous	2:3	0.4
	1:4	0.2
	0:5	0

Note: according to the ratio of verdicts in individual evaluators (the average of correct decisions) was the consensus value 0 – 1 (one decimal). The closer the value was to 1, the more agreement the expert group showed in assessing a referee´s decision.

The examined game situations (685 video clips from 42 matches) were presented on a TV connected to a computer to each judge separately. It was also possible to play repeatedly, slow down, or with the possibility of stepping or stopping the recording. The assessor first solely assessed the position of the referee (regardless of the correctness of the decision). He then assessed the correctness of the decision - his task was not to take into account the position of the referee. We used a code system and a record sheet verified by Kresta to record the data of the expert group (2018). The above procedures allowed us to record and subsequently quantify the opinion of the expert group on the referee' decisions and their position on the vicinity of pitch in these decisions.

Statistical data processing
Due to assessing data normality by Shapiro-Wilk W test we can state that the monitored quantities (decision $p < .001$ and position $p < .001$) have different than normal distribution. We analyzed the relationship between position and decision by Spearman's Rank Order Correlations. The tools used: software Microsoft Excel 2020 (Microsoft Corporation, USA) a Statistica PRO trial version (StatSoft, ČR).

RESULTS

Below we will first present information about the assessed game situations and the expert group. Subsequently, we will describe the degree of error rate in the decisions of the referees and the quality of the position in these decisions. Finally, we will present the relationship between the error rate in decisions and the quality of the position.

Assessed game situations
A total of 685 game situations leading to a direct free kick were judged. Season 2020/21 (season No. 1) in 22 matches, season 2021/22 (season No. 2) in 20 matches. Details in Table 3.

Table 3. Investigated game situations - descriptive characteristics

Season No.	n	M	SD
1	358	16.2	3.6
2	327	16.3	2.8
1+2	685	16.3	3.2

Note: M = Mean, SD = Standard Deviation

Expert group

The expert group established by us was subjected to training, after which the qualitative indicators were verified. Criteria validity of our expert assessment, verified on the selected game situation (criterion), reached 93 % compliance with this criterion. The inter-subject reliability, assessed among observers, was 88 % for error and 85% for correctness of position. Intra-subject reliability in terms of stability of observations over time (repeatability) was 91 % for error rate and 83 % for position accuracy. The stability of the group's expert consensus over time was 85 %.

Error rate in decisions

The referees, in the 685 game situations we examined, decided almost 93 % correctly (637 decisions with a value of 0.6 or 0.8 or 1, according to Table 2). The error rate in decisions is therefore 7 % (48 wrong decisions with value of 0 or 0.2 or 0.4). Details are given below (Table 4).

Table 4. Frequency of decisions assessed by the expert group

Decision	Value of decision	Frequency			
		Absolute (n)	Relative absolute (%)	Cumulative absolute (n)	Relative cumulative (%)
	0	7	1	7	1
Erroneous	0.2	21	3	28	4
	0.4	20	3	48	7
	0.6	61	9	109	16
Correct	0.8	146	21	255	37
	1	430	63	685	100
Total		685	100	685	100

The stated values are the consensus of the evaluation of the expert group as a whole according to the mentioned methodology. The consensus of the expert group on the referees' decisions was on average close to 0.9 (SD = 0.21) out of the maximum possible value of 1, which would mean 100 % agreement of all the judges. It is therefore possible to state 90% agreement of the judges in this variable.

Quality of position in decision making

The referees took an adequate position in approximately 63 % of cases. The position categorized as still bordering adequate was found in almost 34 % of cases. Inadequate position was detected in only 3 % of cases. See Table 5 for details.

Table 5. Frequency of values in referee´s positioning while making decisions on game situations

Positioning	Value of positioning	Frequency			
		Absolute (n)	Relative absolute (%)	Cumulative absolute (n)	Relative cumulative (%)
Inadequate	1.0	3	0	3	0
	1.8	18	3	21	3
Bordering adequate	2.0	20	3	41	6
	2.2	65	10	106	15
	2.4	36	5	142	21
	2.6	111	16	253	37
Adequate	2.8	197	29	450	66
	3.0	235	34	685	100
Total		685	100	685	100

### *Relationship between error rate and quality of position*

The relationship between error rate and quality of position is comprehensively presented in Figure 1. The total percentage of errors in the decisions of referees standing in adequate positions (positions are defined in Table 1), without distinguishing the value of the consensus of the expert group, is less than 2%. With a deteriorating position, the error rate of the referees also increases. A still adequate position corresponds to almost 15% error rate and an inadequate position to 34 % error rate.

If the referee took an adequate position, he decided the game situation mostly correctly, however, within the adequate positions, evaluated by the consensus of the expert group only 3.0, a total of 235 decisions were made – out of this 97 % correct and 3 % wrong, which shows a higher error rate than adequate positions overall.

Paradoxically, there is a list of inadequate positions for which the expert group unanimously agreed (n = 3, consensus 1.0) – in these judges they always decided correctly (the consensus of the expert group on the correctness of the decision with the values was always 0.8; see Table 2). For inadequate positions with a consensus value of 1.8 (n = 18), both right and wrong decisions are already appearing, see Figure 1.

Based on the results of Spearman Rank Order Correlations, we can state that the correlation between the two variables was proven, rs = .32, p < .001, that is, the position of the referee influences his decision.

Figure 1. Referees´ decisions in context to their positioning

	Adequate positioning	Bordering adequate positioning	Inadequate positioning
■ Decision (n): Erroneous	7	34	7
■ Decision (n): Correct	425	198	14
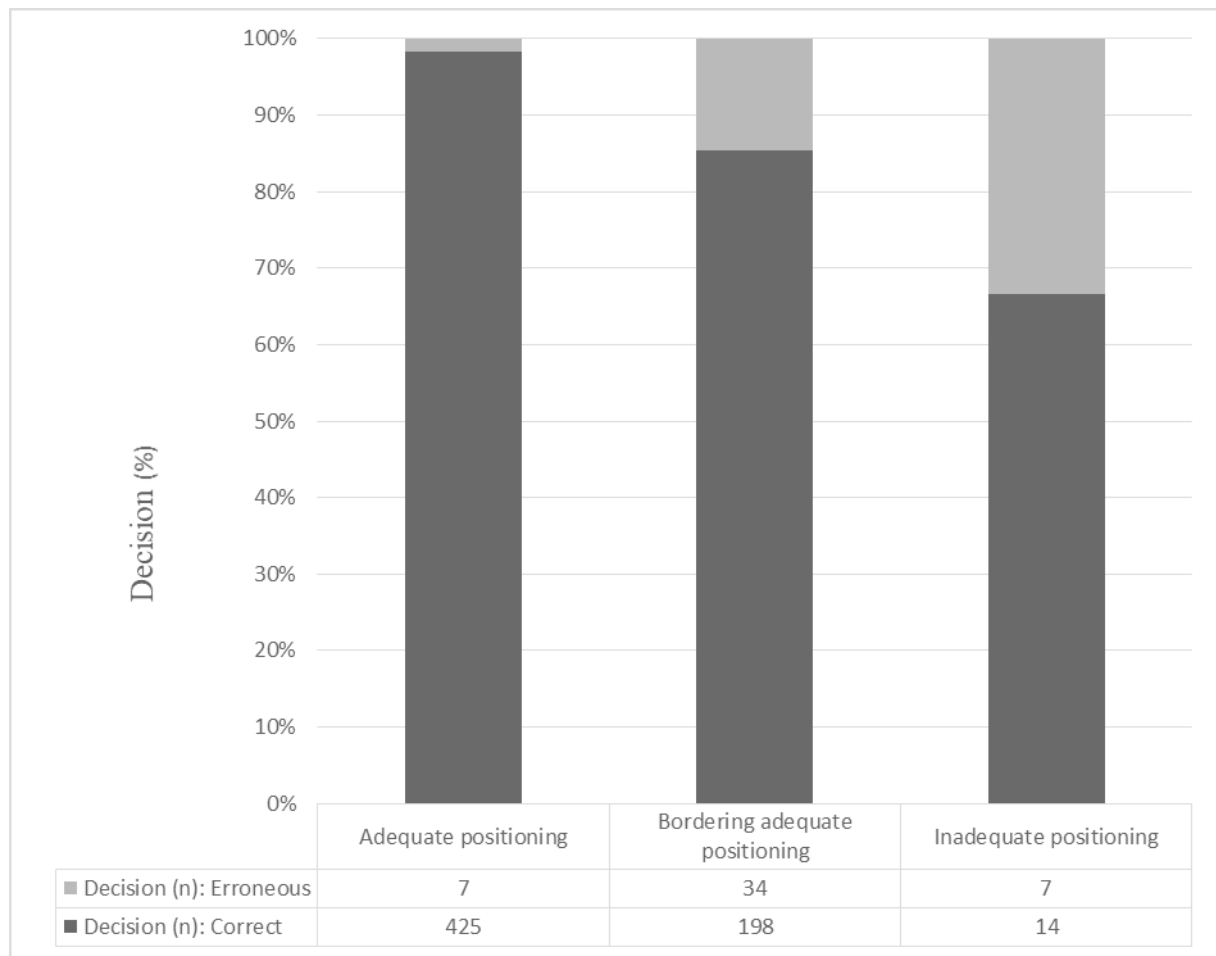
DISCUSSION

We chose elite futsal referees for our work, with whom we focused mainly on their error rate in decisions during the two seasons of the Czech highest competition. We consider this aspect of error rate to be crucial for the referees' activities in the match. The informative values of the submitted research may be qualified by certain limitations (research sample, the problem of subjectivity of assessment by referees and expert group). We will discuss the results analogously to the results section.

Assessed game situations

In accordance with Helsen & Bultynck (2004), we placed 685 game situations into our assessment, into the category of observable referee decisions i.e., when the referee whistles a direct free kick and interrupts the game or signals an advantage in the game and does not interrupt the game. According to our experience, these decisions are easily identifiable.

Our results show that the average number of decisions per match (M = 16.3, SD = 3.1) is approximately 2 such decisions in five minutes of play. Comparisons are made possible by official statistics of international competitions, which report an average of 11 accumulated fouls per match, however, with a large range of variation (FIFA, 2021), indicating 1–2 decisions in five minutes of play. Here, however, it is necessary to point out the different competitions (national

versus international), where our own experience shows us substantial differences in this parameter. A relevant comparison with the previous futsal study by Kresta (2018) is not possible, because there were also assessed indirect free kicks and it was not primarily an analysis of frequencies. Comparison with other invasive sports games does not seem appropriate with regard to other pitches, number of players, referees, etc.

It should be noted that this is not the total number of these referee's decisions in the match, because there are typologically identical game situations, which the referee does not evaluate as an offense, does not interrupt the game, or does not signal an advantage in the game. Consistently with Helsen & Bultynck (2004), we argue that the quantification of unobservable decisions causes methodological difficulties. This is especially the data collection when categorizing the game situation, when it is necessary to analyze this with the referee.

Expert group

Our expert group showed similar qualitative indicators as the group used by Kresta, also in futsal (2018). Our values and Kresta´s are relatively close to most indicators: criterion validity (93 % let us say 92 %) compliance with this criterion; inter-subject reliability, assessed among observers (88 % let us say 89 %) for error rate and for position (85 % let us say 81 %); intra-subject reliability in terms of stability of observations over time (repeatability) 91 % let us say 90 % for error rate and 83 % let us say 81 % for position; stability of the expert consensus of the whole group in time (85 % let us say 81 %).

The consensus values of the expert group on the decisions of the referees found by us were close to the average value 0.9 (SD = 0.21), therefore, we find 90% assessor agreement for this key variable. They unanimously agreed in 63% of the game situations, i.e., all 5 judges confirmed the referee's decision. This is a minimal difference compared to the previous futsal research of similar parameters, where 59% agreement was calculated.

The agreement of the expert panel, according to Button et al. (2009), which examined the decision-making of referees in football is 88%. He states that this is approximately 25 % higher than the correctness of the assessment of game situations in the match by the referee, i.e., we can conclude that the expert panel is more suitable for the evaluation of these situations than the individual. It should be noted here that the referee in a match does not always have the opportunity to reassess the game situation from the video. Football Video Assistant Referee (VAR) protocol allows this only in certain situations, similar to the futsal tool Video Support (hereinafter VS), which is intended for review only by the referee in the match (FIFA, 2021). Other sports games such as rugby, basketball, etc. do not have the same approach to the issue, see below.

From our data it is possible to detect inconsistency of assessors in certain situations. Gaming situations that can be described as borderline are 12 %. These are situations where the consensus of the expert group had values of 0.4 and 0.6 (according to the Table). We believe that this is a so-called difficult game situation, and we see a strong relationship between this difficulty of the game situation and the correctness of the decisions of the members of the expert group. This is less than 16%, according to Kresta (2018). It can therefore be assumed that our expert group looks better in this respect. We see the reasons mainly in the higher number of researched situations, better video recordings and a more experienced expert group in our case.

Expert assessment, used in the work to detect the qualities of decisions and position, will always be associated with a certain degree of subjectivity of the assessor (Gilis, 2008; Helsen & Bultynck, 2004; Starkes & Ericsson, 2003). In this statement, based on our many years of experience and experience directly from elite referees and match delegates, we agree with the above sources.

Directly here we can see the possibilities in improving the agreement of the judges, especially in the area of unifying the interpretation of the rules of the given sports game in typologically similar game situations, which we examined.

Error rate in decisions

The error rate detected by us in the decisions is therefore 7 % (decisions with a value of 0 or 0.2 or 0.4). Here we approach the results of Kresta, which presents a value 0.5 % lower (2018). There can be many reasons for a wrong decision. However, based on our experience, most errors arise when violating the referee's decision-making process scenario (from stimulus to behavioral response), which we presented in the introduction. The disturbing variables are the stress of the referee, fatigue, reluctance to make unpopular decisions and, last but not least, the wrong position, which makes it impossible to perceive the situation adequately (see below).

However, other scientifically published data on futsal error rates are missing. One of the ways could be to make the referee observer reports in UEFA matches available. However, they are not currently freely accessible and represent a one-person evaluation, albeit using the possibility of video recording.

Comparing our results with other sports games is difficult due to the absence of scientifically published information or due to the differences between these games or the methodology used. However, it is possible to try this in football, where rule XII is analogous to the rules of futsal (i.e., the decision on free kicks). Data on error rates are presented by Catteeuw et al., who reports higher relative values for the main referees when judging a prohibited game when compared to the referee's assistants. (2010). Football referees made 17 % of wrong decisions at the 1986 World Cup (Van Meerbeek et al., 1987).

In the past, research findings applied to practice had made progress in reducing error rates for football referees. The error rate in deciding on offside situations has decreased after the application of the theory of intentional gain of experience - in comparison with world championships 2002 and 2006, error rate 26.1 % versus 10 % (Catteeuw et al., 2010). At present, this error rate in elite competitions is reduced, especially with the use of modern technologies. We believe that, for example, measuring the offside using a calibrated "offside line" in football is technically feasible and with a minimum of errors. However, it still does not seem to be fully and positively received by players.

An extensive study is presented by Spitz et al., where VAR was used in more than two thousand football matches to revise the referee's previous decision on the vicinity of pitch. The predicted probability of increasing the correctness of the decision increases from 92 % to 98 % after the use of VAR. Decision review is relatively fast, averaging 15 seconds for decisions made directly by VAR. In the case of a referee review on the vicinity of pitch at the monitor after a VAR alert, the average review time is around 60 seconds (2021).

Similar systems of "video referee" are also seen at elite matches of basketball, American football, rugby, etc. This is probably one of the future ways of making decisions in sports games, where more and more decisions will be made by some instrument alone (e.g., measuring the offside in football, or the ball outside the playing field in handball) or it will be technical assistance to the referee by video recording, etc. – where, however, the decision is made by the referee himself, but with this support.

However, in our experience, a key issue arises, namely decision-making about human behavior using tools (video) - in our case about the player's activities (e.g., the player fouled). Is it possible to quantify qualitative data such as a player´s foul this way? How can the tool itself implicate, for example, the intensity of contact between two players? In football, this problem is already suggested by Spitz et al., (2021) discussing the negative aspects of VAR. These are delays in the game, return in the game storyline, etc. There is also the problem of real assessment of the game situation in three-dimensional presentation (3D) versus assessment in two-dimensional 2D presentation on the monitor (Put et al., 2014).

Quality of position on decision
The referees took an adequate position in 63 %, bordering adequate position was found in 34%, inadequate position in 3 %. These values are close to the values of similar futsal research where the values are 66 %, 30 % and 4 %, respectively (Kresta, 2018). We are no longer surprised as our predecessors that the value of adequate positions is between 63–66 %, because if we add the values of bordering adequate positions, we get to the values of 96–97 %. We justify it by: certain subjectivity of the assessors of the expert group; not completely strictly defined position according to standards in all game situations; game variability of futsal. Our expectation of a minimum of inadequate positions has been confirmed.

Comparisons with other sports games are not entirely relevant for analogous reasons discussed for error rate. Although this issue has been solved, for example, by football assistant referees, where the position on the offside line is considered to be crucial (Baldo et al., 2002), although there are studies that refute this and place more emphasis on the assistant's experience (Catteeuw et al., 2010). However, modern technology (VAR) shift this aside to the background. Mallo et al. advert to an average 20m distance of the football referee from the ball when judging fouls (2010). We cannot paraphrase futsal, but we can learn from the fact that this distance extends towards the end of the match.

Categorization of positions may seem problematic. The evaluation of futsal referees in the practice of the parties on the vicinity of pitch usually takes place dichotomously - adequately versus inadequately. However, only the bipolar scale did not fully take into account the practical possibility of taking a position. That was one of the reasons why we finally chose the three-point scale. Experience shows that it is not always possible to take an adequate position (e.g., in a rapid counterattack), and this is not usually blamed on the referee, because it was not within his means (in terms of human motor skills). In this case, it is crucial whether the referee decided correctly - here again we come across the experience of the referee, which will help him anticipate, decide (Catteeuw et al., 2009). It is possible to agree with methodological materials (FIFA, 2021) that it is not appropriate to define the position of referees more strictly than the case currently is. Experience shows that it is necessary to take into account the variability of game situations about the position

to decide in connection with them - all this is exacerbated by the need to cooperate with the second referee within the diagonal principle of management.

Relationship between error rate and quality of position

Between the error rate and the quality of the position, the results visually show a trend (see Figure 1) that the error rate decreases with increasing quality of the position. The proven correlation between the two variables shows the interdependence, namely that the position of the referee affects his decision. The total percentage of errors in the decisions of referees standing in adequate positions is less than 2 % - compared to 34 % of the error rate in inadequate positions.

Our results confirm previous futsal research (Kresta, 2018; Kresta et al., 2015), which verify the relationship between the error rate and position with a statistically significant dependence and 99% of correct decisions in adequate positions.

In conjunction with the trend seen in the graph above (Figure 1) and the previous two surveys, these findings can be agreed. We know from our own experience that in the case of inadequate positions, the error rate increases (large or small distance from the game situation; wrong view of the game situation, etc.).

With the absolute agreement of the expert group (5 members rated the position as adequate) on adequate position (n = 235), there were 1% fewer correct decisions, i.e., higher error rate than adequate positions overall. The situation is also paradoxical for inadequate positions (n = 3), for which the expert group unanimously agreed (5 members assessed the position as inadequate). In these referees always decided correctly. These cases can be attributed to the disproportion between the real decision on the pitch in the case of the referee and the assessor in the expert group assessing at the monitor, as well as the complexity of the decision and other influences (even unknown).

Based on the above facts, we state that the correlation between the two variables shows the interdependence *rs* = .32, *p* <.001, that the better position of the referee affects his better decision. Practice and similar research confirm this assumption of a positive relationship between decision and position as correct, but not the only one.

CONCLUSION

From the point of view of the description and explanation of the referees' decisions in connection with their position on the vicinity of pitch and movement activity, it can be stated: that the better position of the referee affects his better decision. We see the assumption of a positive relationship between decision and position as correct, but not the only one.

We recommend for practice: to unify the interpretation of the rules of a given sports game in typologically similar game situations that we have investigated; to focus on the position of a referee on the pitch. We recommend that the issue be further scientifically researched in the areas: gathering data on the referee's error rate; quantification of unobservable decisions; difficult game situations for referees; subjectivity of judges and referees; the problem of real assessment of the game situation in 3D versus 2D.

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REFERENCES

Abernethy, B. (1986). Enhancing sports performance through clinical and experimental optometry. *Clinical & Experimental Optometry, 69*(5), 189-196.

Ahmed, H., Davison, G., & Dixon, D. (2017). Analysis of activity patterns, physiological demands and decision-making performance of elite Futsal referees during matches. *International Journal of Performance Analysis in Sport, 17*(5), 737–751. https://doi.org/10.1080/24748668.2017.1399321

Aragao e Pina, J., Passos, A. M., Travis Maynard, M., & Sinval, J. (2021). Self-efficacy, mental models and team adaptation: A first approach on football and futsal refereeing. *Psychology of Sport and Exercise, 52*, 101787. https://doi.org/10.1016/j.psychsport.2020.101787

Baldo, M. V., Ranvaud, R. D., & Morya, E. (2002). Flag errors in soccer games: the flash-lag effect brought to real life. *Perception, 31*, 1205–1210.

Balkó, Š., Borysiuk, Z., & Šimonek, J. (2016). The influence of different performance level of fencers on simple and choice reaction time. *Revista Brasileira de Cineantropometria & Desempenho Humano, 18*(4), 391–400.

Bless, H., Fiedler, K., & Strack, F. (2004). *Social cognition—How individuals construct social reality.* New York: Psychology Press.

Bolotin, A., & Bakayev, V. (2017). Success criteria of the pedagogical pattern of physical training on self-guide basis with individual assignments among futsal referees. *Journal of Human Sport and Exercise, 12*(3), 607–615. https://doi.org/10.14198/jhse.2017.123.05

Bompa, T. O. (1999). *Theory and methodology ot training* . Champaign: Human Kinetics.

Button, C., O'Hara, D., & Mascarenhas, D. R. (2009). *Developing a method to examine decision-making and physical demands of football refereeing*. University of Otago Dunedin.

Catteeuw, P. (2010). *Expert Performance in Association Football Refereeing:The Acquisition and Fine-Tuning of Perceptual-Cognitive Skills in Offside Decision Making.* Leuven: Katholieke Universiteit Leuven

Catteeuw, P., Gilis, B., García-Aranda, J. M., Gracia, F. T., Wagemans, J., & Helsen, W. (2010). Offside Decision Making in the 2002 and 2006 FIFA World Cups. *Journal of Sports Sciences, 20*(10), 1027–1032.

Czech Television. (2022, April 20). *Czech Television.* https://www.ceskatelevize.cz/

Elliott, B. (1999). *Trainning in sport.* Chichester: John Wiley & sons Ltd.

Ericsson, K. A., & Lehman, A. C. (1996). Expert and exceptional performance: Evidence on maximal adaptations on task constraints. *Annual Review of Psychology, 47*, 273–305.

Ferreira, H. C., Simim, M. A., Noce, F., Samulski, D. M., & Costa, V. T. (2009). Análise do estresse em árbitro de futsal. *Coleção Pesquisa em Educação Física, 8*(1), 43–48.

FIFA. (2021). *Futsal: Laws of the game.* Zurich: FIFA.

FIFA. (2022, January 21). *FIFA.* https://www.fifa.com/

Gilis, B. (2008). *The Acqusition and application of expert performance in Association football refereeing.* Leuven: Katholieke Universiteit Leuven.

Helsen, W., & Bultynck, J. (2004). Physical and perceptual-cognitive demands of top-class refereeing in association football. *Journal of Sports Sciences, 22*, 179-189.

Helsen, W., Gilis, B., & Weston, M. (2006). Errors in judging "offside" in association football: Test of the optical error versus the perceptual flash-lag hypothesis. *Journal of Sports Sciences, 24*(5), 521–528.

Hendl, J. (2005). *Kvalitativní výzkum: základní metody a aplikace.* Praha: Portál.

Knudson, D. V., & Morrison, C. S. (2013). *Qualitative analysis of human movement*. Champaign: Human Kinetics.

Kresta, J., Suss, V., & Gál, M. (2015). Notační analýza výkonu rozhodčích futsalu v utkání. Česká kinantropologie, 19(2), 59–70.

Kresta, J. (2018). *An analysis of futsal referees' performance in matches*. Jan Evangelista Purkyne University in Ústí nad Labem.

MacMahon, C., Starkes, J., & Deakin, J. (2007). Referee Decision Making in a Video-Based Infraction Detection Task: Application and Training Considerations. *International Journal of Sports Science & Coaching, 2*(3), 257–265.

Mallo, J., Veiga, S., López de Subijana, C., & Navarro, E. (2010). Activity profile of top-class female soccer refereeing in relation to the position of the ball. *Journal of Science and Medicine in Sport, 13*, 129–132.

Plessner, H., & Haar, T. (2006). Sports performance judgments from a social cognitive perspective. *Psychology of Sport and Exercise, 7*, 555–575.

Put, K., Wagemans, J., Spitz, J., Gallardo, A., Mark Williams, A., & Helsen, W. (2014) The use of 2D and 3D information in a perceptual-cognitive judgement task. *Journal of Sports Sciences, 32*(18), 1688-1697, https://doi.org/10. 1080/02640414.2014.912760

Rebelo, A., Ascenacao, A., Magalhaes, J., & Krustrup, P. (2007). Activity profile, heart rate and blood lactate of futsal referees during competitive games. *Journal of Sports Science and Medicine, 6*(10), 94–102. http://www.jssm.org

Rebelo, A., Ascenacao, A., Magalhaes, J., & Krustrup, P. (2009). Activity profile, heart rate and blood lactate of futsal referees during competitive games. In T. Reilly, & F. Korkusuz (Eds.), Science and Football VI (pp. 191–196). Taylor & Francis.

Rebelo, A., Ascensão, A., Magalhães, J., Bischoff, R., Bendiksen, M., & Krustrup, P. (2011). Elite futsal refereeing: activity profile and physiological demands. *Journal of Strength and Conditioning Research, 25, 4,* 980–987.

Ribeiro, M. V., & Alvarez Pires, D. (2019). Percepção da síndrome de Burnout em árbitros de futsal. (Portuguese). *Caderno de Educação Física e Esporte, 17*(2), 65–69. https://doi.org/10.36453/2318-5104.2019.v17.n2.p65

Sanmiguel-Rodríguez, A., & Giráldez, A. (2021). Futsal in children and adolescents - a systematic review 2015-2020. *Physical Activity Review, 9*(2), 27–39. https://doi.org/10.16926/par.2021.09.19

Serrano, C., Sánchez-Sánchez, J., Felipe, J. L., Hernando, E., Gallardo, L., & Garcia-Unanue, J. (2021). Physical Demands in Elite Futsal Referees During Spanish Futsal Cup. *Frontiers in Psychology*, *12*, 625154. https://doi. org/10.3389/fpsyg.2021.625154

Sinval, J., Aragão e Pina, J., Sinval, J., Marôco, J., Santos, C. M., Uitdewilligen, S., Maynard, M. T., & Passos, A. M. (2020). Development of the Referee Shared Mental Models Measure (RSMMM). *Frontiers in Psychology*, *11*, n.p. https://doi.org/10.3389/fpsyg.2020.550271

Souchon, N., Coulomb-Cabagno, G., Traclet, A., & Rascle, O. (2004). Referees' Decision Making in Handball and Transgressive Behaviors: Influence of Stereotypes About Gender of Players? *Sex Roles, 51*(7-8), 445–453.

Spitz, J., Wagemans, J., Memmert, D. A., Williams, M., & Helsen, W. (2021) Video assistant referees (VAR): The impact of technology on decision making in association football referees, *Journal of Sports Sciences*, 39:2, 147–153. https://doi.org/10.1080/02640414.2020.1809163

Starkes, J. L., & Ericsson, K. A. (2003). *Expert performance in sport: Advances in research on sport expertise.* Champaign: Human Kinetics.

Van Meerbeek, R., Van Gool, D., & Bollens, J. (1987). Analysis of the refereeing decisions during the world soccer championship in 1986 in Mexico. In T. Reilly, K. Lees, & K. Davids (Eds.), Science and football (pp. 377–382). E & FN Spon.