

ORIGINAL SCIENTIFIC PAPER

Games Based Learning Influence in Portuguese Referees Motivation to study Laws of the Game and Competition Rules: A Longitudinal Study

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Abstract

The present study aimed to measure Portuguese referees' motivation to study the Laws of the Game and Competition Rules (LGCR). This longitudinal empirical study measured the evolution of referees' motivation, whose study needs are essential for their preparation, evolution and career progression. The study was carried out in two different periods, in the beginning and during the 2017/2018 sports season. 179 referees completed a questionnaire, in order to assess the motivation. The same scale was replicated in the middle of the season, after the referees had used a game called RefereeGame, to evaluate the evolution in motivation over the time. The data were processed using longitudinal Structural Equation Models, estimated in the SPSS/AMOS 27 software. The referees used a Game-Based Learning (GBL) tool to study and test their knowledge. The results showed that Intrinsic Motivation to Know increased between Moment 1 and Moment 2. Intrinsic and extrinsic motivation also presented considerable differences between both moments, showing that GBL can be considered as valid tool, to regulate technical and regulatory preparation of referees. This research may help sports researchers to understand the use of games as strategic tools to involve referees in learning the LGCR.

Keywords: football referees, motivation; GBL, laws of the game, competition rules

Introduction

Football Refereeing is one of the most critical positions concerning all those involved in the game. Its decisions have become increasingly important as team members and spectators' expectations and satisfaction are dependent on them (Wühr, Fasold, & Memmert, 2015).

Guillén and Feltz (2011), showed that football referees realize that mastering the game laws and arbitration technique as well as the understanding the game strategy are key examples about game knowledge to achieve a successful performance. Similarly, e Pina, Passos, Carvalho, and Travis Maynard (2019) through the collection of testimonies of 24

specialists in elite refereeing, showed that three distinct dimensions shape the excellence referee: individual preparation, preparation of the game and game management, with the variable "understand the game", where the theoretical knowledge of laws and regulations may be included.

Decision-making process is mediated by the identification and processing information provided by their visual field promoted by any event (stimulus) produced by the players. Then, the perceived situation must be categorized according to game laws and competition rules (LGCR), integrating all this information in order to make the final decision (Plessner & Haar, 2006). The lack of knowledge and



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negligence of LGCR as well as the regulations can produce wrong decision making and in extreme cases lead to technical errors, which violate the letter and spirit of the law (FIFA, 2020). Thus, and according to the Disciplinary Regulations of the Portuguese Football Federation 2019-2020, may resulting in a game repetition and a disciplinary process to the referee, this outcome being of enormous harm to his career, running the risk of being demoted (FPF, 2020). On the other hand, according evaluation rules and performance of the national refereeing categories (those that give access to the arbitration of professional competitions) of the Portuguese Football Federation 2018-2019, there is a percentage of 2% in the final score, reserved for the media of the three compulsory written tests on Laws of the Game and Competition Rules (LGCR). Thereby, and according to the 2018-2019 Portuguese Football Federation soccer referee rankings, it can mean the difference of several places and in some cases put in risk the promotion or relegation of the respective table, because on a scale from 0 to 10 of the final score, the difference of places is ranked in the thousandths (0.001) (FPF Standards, 2020). As a concrete example and knowing that 2% of 10 values will be 0.2, the difference between a referee who obtains 100% average in the three regular tests and a referee who records only 85% in that same sum will be 0.03, which would thus allow the referee of the C2 board (antechamber of professional soccer) ranked 58th (score 7.734), move to 56th place (score 7.760) and consequently move from a situation of relegation to maintenance in that Portuguese National Division (FPF Standards, 2020).

Therefore, we can consider that one of the most relevant factors, integral to the performance of the referees in the decision making, as well as of real importance in the classification process, will be the domain of the theoretical foundations (LGCR), which should not be neglected in order not to stagnate in the career. Thus, referees must remain motivated for the constant recycling of theoretical knowledge, understanding that motivation is showed by the choice of an individual to get involved in an activity, as well as the intensity and effort that they invest in it (Garris & Ahlers, 2002). This way, motivation ends up being one of the most critical indicators for an individual to succeed in his learning process (Hattie, 2008) because theoretically unprepared referees will be more likely to make mistakes on the field (e Pina, Passos, Araújo, & Maynard, 2018).

The traditional method of referees in the learning of LGCR consists of reading the International Football Federation (FIFA) game laws book. However, this learning process can become dull and tedious (Yeager et al., 2014). Therefore, referees may not improve enough regarding LGCR if they choose this book as their primary study tool. Consequently, decision-making skills may be insufficient, which leads to debatable decisions during the game. From the year 2010, a new trend emerged, called gamification or Games Based Learning, whose objective was, through the use of game design elements in non-game contexts, increase involvement, motivation and attitude (Deterding, 2012). GBL has had a significant increase in its use in several areas, from the business world to the education systems, and is considered a persuasive technological form (Barr, 2018) capable of creating beneficial attitude changes in its users, essentially at the motivational level (Westera, 2019). Some research has emerged showing the importance of games in teaching, highlighting their potential for promotion and impact on learning supporting the use of GBL

(Anastasiadis, Lampropoulos, & Siakas, 2018).

Several research have addressed the improvement of the referees decision making process in the most varied sports, using computer technology, for example in rugby (Mascarenhas, Collins, Mortimer, & Morris, 2005), in football (Catteeuw et al., 2010) or volleyball (Yang, 2011). Gulec and Yilmaz (2016) applied their study to 54 early career Turkish football referees, based on a board game with questions about the sport's rules. Using a control group (N=27) that could only use LGCR book to study and an experimental group (N=27) authorized to use the game for the same purpose. Then, after a written test about LGCR after and before this tool, they reached very encouraging and positive results, in both groups in the post use of the tool and in the biggest increase of success cases in the experimental group in relation to the control group. These values have shown that the digital teaching platform is more beneficial in learning than LGCR traditional book.

However, no studies have been found that allows us to understand the levels of motivation of soccer referees for the study of LGCR using technological resources, and what impact this process in official written tests, in final classification and consequently in decision making process.

In this sense, we created a GBL tool called RefereeGame, based on textual questions that evaluate participants' knowledge about the rules of football, available at www.refereegame.pt. This tool was developed to make the method of study of referees more interesting and motivating, proposing to be able to change their attitude, engagement and concentration to this area of theoretical knowledge, and facilitate their flow in learning. Thus, the learning provided through playful activities becomes more intense, following the referee/player during his study and recycling process about LGCR, since the knowledge acquired is internalized and, when necessary, expressed interactively.

Obtaining robust information on soccer referees' motivation will allow the sports institutions responsible for their technical and theoretical training to make informed decisions on the strategies they should use to involve these sports agents in learning this area of knowledge. Therefore, this work aims to understand the levels of motivation of the Portuguese referees who perform in the national championships (antechamber of professional soccer) for the study of LGCR before and after using technological resources to support the study.

According to the aforementioned literature, to understand these phenomena and consequently this research gap, we defined the research hypotheses that enable the testing of the model presented in Figure 1 to compare the prevalent motivation levels among Portuguese Referees with and without using GBL alongside the dimensions shaping and producing such motivation. In order to respond to the objectives defined, we set out the following two research question for answering:

(RQ1) What is the motivation of Portuguese referees to study LGCR before and after technological tools to support the study?

(RQ2) What are motivation dimensions that have direct influences on the referees in both moments?

(RQ3) Can technology help referees in the study of LGCR to increase their performance in theoretical tests and consequently in the field?

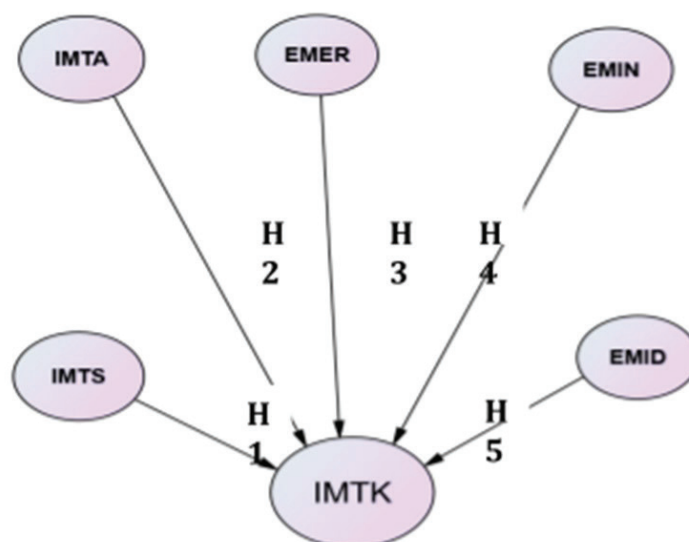


FIGURE 1. Research Model

Methods

Participants

One hundred and seventy-nine referees aged between 20 and 44 years old (72% males/28% females) took part in this study during two different moments. In the Moment 1 referees filled the AMS scale at the beginning of the season during the recycling and evaluation actions, performed every year at the beginning of the season, aiming to evaluate referees’ technical and physical performance. After completing the motivation scale, they played the game for six consecutive months. Hereupon, during the second recycling and evaluation action, they filled the AMS again, basing their response on the motivation obtained through the use game RefereeGame to study. Additionally, referees receive information about the guidelines procedure in order to standardize performance criteria. Informed and written consent was provided to the referees before the beginning of the study. All participants were notified that they could withdraw from the study at any time. The study protocol followed the guidelines and was approved by the Local Institutional Research Ethics Committee and conformed to the Declaration of Helsinki’s recommendations.

Procedures

This investigation was carried out using a quantitative type study, gathering data through a questionnaire survey that applied the AMS scale by Vallerand et al. (1992), adapted for referees (Vasilica, Silva, Costa, Figueira, & Vaz, 2020) (Appendix 1). The proposed research model deployed Confirmatory Factor Analysis (CFA) alongside a structural equations model (SEM), which enabled multi-group analysis through the utilization of the SPSS/AMOS 27 software (Ringle, Wende, & Becker, 2015). We tested the measurement model (validity and reliability of the measures) following the literature, evaluating the meaning of each respective path’s weightings and coefficients (Marôco, 2010).

Validity and Reliability of the Measurement Models

We tested a model with all of the variables to undertake CFA before removing all of those with factorial weightings of below 0.5 (Brown, 2006; Marôco, 2010). The final models tested returned the following statistical findings (Table 1) displaying an adequate suitability level across practically all evaluation indicators (Hair, Black, Babin, Anderson, & Tatham, 2010). Relative to the items and factors’ reliability, we verified an excellent level of total internal consistency for the 179 referees participated in this study.

Table 1. Validity and Reliability of the Measurement Models

Adjustment indexes	Moment 1	Moment 2
χ^2 Satorra Bentler	625.444	658.780
<i>df</i>	215	225
p-value	p<0.001	p<0.001
$\frac{\chi^2}{df}$ Satorra Bentler	2.909	2.928
RMSEA	0.014	0.035
SRMR	0.0495	0.0521
NFI	0.805	0.846
GFI	0.819	0.902
AGFI	0.815	0.827
CFI	0.901	0.894

Legend: χ^2/df - Chi-Squared; Degrees of Freedom; p-value - Probability of obtaining test results; RMSEA - Root Mean Square Error of Approximation; SRMR - Standardized Root Mean Squared Residual; NFI - Normed Fit Index | GFI: Goodness-of-Fit Index; AGFI - Adjusted Goodness of Fit Index; CFI - Comparative Fit Index

As regards the convergent validity of the model (Table 2), we evaluated an additional three metrics: Average Variance Extracted (AVE), Composite Reliability (CR) and Cronbach’s Alpha (α). All of the convergent validity metrics exceeded the benchmarks established in the literature for relevance, with the AVE needing to be over 0.5, CR over 0.7 and α over 0.8 (Hair et al., 2010; Marôco, 2010). The internal consistency for all items that make up the model is

demonstrated by Cronbach’s Alpha (α) higher than 0.9, revealing validity and internal and explanatory reliability. Alfa de Cronbach (α) is a statistical technique widely used and cited by several authors to demonstrate that the tests and scales that were built or adopted are relevant to explain the investigation results (Taber, 2018). Thus, we may conclude that the model meets both the validity and convergent reliability requirements.

Table 2. Validity and Reliability

Constructs	Items	Loadings	CR	AVE	α	Constructs	Items	Loadings	CR	AVE	α
IMTK	IMTK1	0.706	0.782	0.47	0.850	IMTK	IMTK1	0.510	0.742	0.423	0.812
	IMTK2	0.729					IMTK2	0.654			
	IMTK3	0.691					IMTK3	0.721			
	IMTK4	0.626					IMTK4	0.697			
IMTA	IMTA1	0.845	0.812	0.523	0.808	IMTA	IMTA1	0.741	0.850	0.590	0.842
	IMTA2	0.597					IMTA2	0.828			
	IMTA3	0.757					IMTA3	0.628			
	IMTA4	0.671					IMTA4	0.857			
IMTS	IMTS1	0.703	0.834	0.557	0.833	IMTS	IMTS1	0.691	0.800	0.500	0.799
	IMTS2	0.756					IMTS2	0.740			
	IMTS3	0.811					IMTS3	0.715			
	IMTS4	0.713					IMTS4	0.683			
EMER	EMER1	0.330	0.723	0.419	0.710	EMER	EMER1	0.351	0.690	0.372	0.670
	EMER2	0.543					EMER2	0.693			
	EMER3	0.849					EMER3	0.743			
	EMER4	0.744					EMER4	0.578			
EMIN	EMIN1	0.635	0.791	0.488	0.787	EMIN	EMIN1	0.639	0.791	0.491	0.787
	EMIN2	0.701					EMIN2	0.595			
	EMIN3	0.710					EMIN3	0.818			
	EMIN4	0.744					EMIN4	0.731			
EMID	EMID1	0.809	0.864	0.615	0.863	EMID	EMID1	0.825	0.861	0.610	0.857
	EMID2	0.787					EMID2	0.813			
	EMID3	0.749					EMID3	0.623			
	EMID4	0.792					EMID4	0.845			

Legend: EMER-Extrinsic Motivation External Regulation; EMIN-Extrinsic Motivation introjection; EMID-Extrinsic Motivation Identification; IMTS-Intrinsic Motivation to Stimulate; IMTA-Intrinsic Motivation to Accomplish; IMTK-Intrinsic Motivation to Know; CR-Composite Reliability; AVE-Average Extracted; α -Cronbach Alpha

Results

Tested research model – Multi-group Analysis

In Table 3, we may observe the summary of the hypotheses tested in accordance with the best research model for each stage of the multi-group analysis carried out (moment 1 and moment 2) as well as the results obtained conclude that the variation that occurred in IMTK differs in both of the tested models (Figure 2 and Figure 3). The structural results point to the dimensions of IMTS, IMTA, EMIN and EMID as holding direct statistically significant influences over the IMTK of Portuguese referees’ motivation in Moment 1 and the same dimensions in Moment 2, validating the formulated research hypotheses H1, H2, H4 and H5 in both models after and before the use of the RefereeGame. Thus, for H3, Portuguese referees do not attribute statistical significance ($p>0.05$) and thus failing to back the hypothesis of EMER influencing the IMTK in both motivation measure moments.

Models present below (Figure 2 and Figure 3) represents the motivation dimension influence in Intrinsic Motivation of Portuguese Referees before using RefereeGame like a learning tool (Moment1) and after using RefereeGame

(Moment 2) to know Laws of the Game and Competition Rules during football seasons. Following analysis of the structural model in Moment 1, we may report that the Extrinsic Motivation (EMOT) dimension with EMID ($\beta=0.220$; $p<0.001$) and EMIN ($\beta=-0.103$; $p<0.05$) held a greater impact in Intrinsic Motivation to Know LGCR. The same impact was obtained in Intrinsic Motivation (IMOT) dimension with IMTA ($\beta=0.296$; $p<0.001$) and IMTS ($\beta=0.615$; $p<0.001$). Regarding the structural model, we may state that the EMOT dimensions like EMER ($\beta=-0.029$; $p>0.05$) did not achieve statistical significance.

Following analysis of the structural model in Moment 2, we may report that the Extrinsic Motivation (EMOT) dimension with EMID ($\beta=0.321$; $p<0.001$) and EMIN ($\beta=-0.098$; $p<0.05$) held a greater impact in Intrinsic Motivation to Know LGCR. The same impact was obtained in Intrinsic Motivation (IMOT) dimension with IMTA ($\beta=0.249$; $p<0.001$) and IMTS ($\beta=0.339$; $p<0.001$). Regarding the structural model, we may state that the EMOT dimensions like EMER ($\beta=-0.124$; $p>0.05$) did not achieve statistical significance.

Table 3. Research hypotheses and statistical results – Moment 1 and Moment 2

Hypotheses	Relationship	Regression Coefficient	Standard Error	t	p-value	Result
H1	IMTS → IMTK	.615	.070	8.731	<0.001	Supported
H2	IMTA → IMTK	.296	.041	7.270	<0.001	Supported
H3	EMER → IMTK	-.029	.054	-.534	>0.05	Non Supported
H4	EMIN → IMTK	-.103	.037	-2.812	<0.05	Supported
H5	EMID → IMTK	.220	.041	5.321	<0.001	Supported
Portuguese Referees Motivation (Moment 1)						
H1	IMTS → IMTK	.339	.080	4.211	<0.001	Supported
H2	IMTA → IMTK	.249	.059	4.233	<0.001	Supported
H3	EMER → IMTK	-.124	.055	-2.256	>0.05	Non Supported
H4	EMIN → IMTK	.098	.043	2.250	<0.05	Supported
H5	EMID → IMTK	.321	.076	4.213	<0.001	Supported
Portuguese Referees Motivation (Moment 2)						

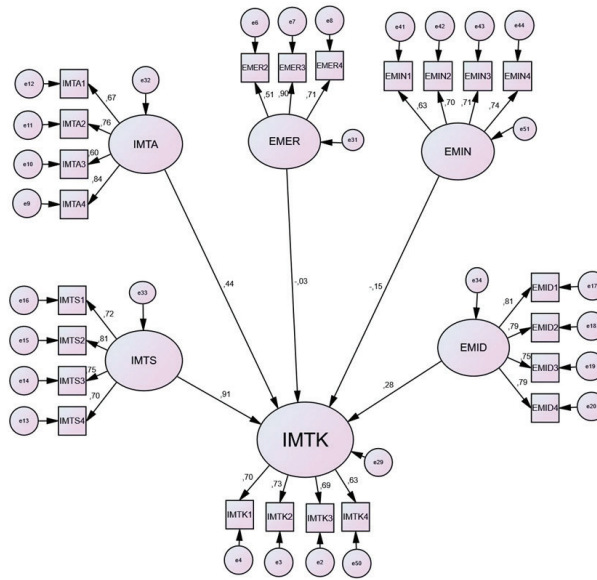


FIGURE 2. Structural Model – Moment 1

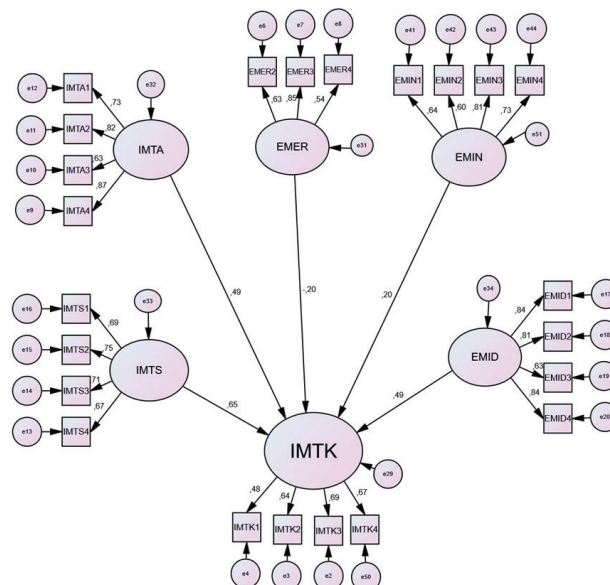


FIGURE 3. Structural Model – Moment 2

Both models reported that Portuguese referees are both intrinsically and extrinsically motivated to study LGCR even while the results identify a greater motivation level using GBL RefereeGame like a learning tool.

Discussion

This research study brought some interesting insights about Portuguese Referees motivation to study Laws of the Game and Competition Rules and the motivation dimensions that influence their will to study. The study incorporated a total of 179 referees who participated in the recycling and training actions throughout a sports season. The referees filled out a questionnaire, adapted of the AMS proposed by Vallerand et al. (1992), to assess the two dimensions that are part of motivation (EMOT and IMOT, which, in turn, subdivided into various constructs that enable the evaluation of motivation according to SDT). The application of these theoretical constructs to students provided evidence that original research applying the Self Determination Theory (SDT) is eligible for application to analyzing the motivational aspects interrelated with learning this field of knowledge (Taylor et al., 2014). In a general way, in both moments, with and without Games Based Learning tools, like RefereeGame, showed positive indices for extrinsic and intrinsic motivation, however, we also found an EMOT dimension that was not statistically significant and, for that reason, it was not possible to measure the Extrinsic Motivation External Regulation (EMER) of the referees at both times. In this sense, it was verified that this type of motivation did not influence the Intrinsic Motivation to Know (IMTK) of the referees before and after using Refereegame as a Learning Tool. We found that from Moment 1 to Moment 2 the referees felt less intrinsically motivated, however, their extrinsic motivation was superior. Probably, these results were due the interest that RefereeGame has aroused them. In fact, we may report that Moment 2 hold greater study related motivations than Moment 1. Thus, referees showed higher values of intrinsic and extrinsic motivation after using this tool, demonstrating a greater capacity to be self-motivated, and in addition to simultaneously experiencing influences from games using. These results revealed how extrinsic motivation does not affect the need for personal or intrinsic motivation (Ryan & Deci, 2000a). The study's results demonstrate a higher rating for EMOT than for IMOT, previous corroborating studies applying AMS to evaluate motivations for studying (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007; Stover, de la Iglesia, Boubeta, & Liporace, 2012). On the other hand, we verify how the levels of motivation increase along the Self-Determination Continuum course proposed by Ryan and Deci (2000b), with the EMOT and IMOT dimensions of referees in Moment 2 higher than in Moment 1. At the individual level, we verify that in both moments, EMOT is higher than IMOT, which reflects higher levels of extrinsic motivation when compared to intrinsic motivation (Vansteenkiste, Lens, & Deci,

2006). Also, we verified that Extrinsic Motivation Introjection that was negative in the first moment, and after Refereegame use by the referees, became positive. In other words, the use of Games Based Learning given rise positive influences, increasing the Intrinsic Motivation to Know (Anastasiadis et al., 2018; Guillén-Nieto & Aleson-Carbonell, 2012).

The multi-group analysis carried out (Hair et al., 2010; Marôco, 2010) enabled the estimation of the construction of IMTK for both groups and immediately identifying how some of the variables in the initial model do not attain statistical significance and correspondingly removing all variables with factorial weightings of below 0.5 (Brown, 2006) to result in a more robust and significant model able to explain a right percentage proportion of IMTK.

The results obtained are in line with the theoretical basis of SDT, regarding its position that whenever meeting the basic psychological needs, intrinsic and extrinsic motivations are susceptible to enhancement while reducing demotivation (Black & Deci, 2000).

This study also demonstrated the existence of motivational differences over the study of LGCR between two different referees study moments and identifying the need to design measures able to nurture the motivations of this kind of athletes and, whenever possible, maintaining and/or boosting the motivations of those expressing a desire to study. The introduction of new forms of studying that move on from traditional methods might contribute to developing a significant increase in the future results of learning for this type of sports group. Therefore, when seeking to increase the motivations in effect to facilitate learning, we might need to consider the deployment of new tools within the near future as the best means of enhancing the referees from all categories learning process.

Limitations and future research proposals

The present research incurs certain limitations. From the outset, students evaluate their motivations and, given this self-reporting facet, there is the scope for them to evaluate their realities incorrectly due to the scope for lack of self-awareness about the content studied. As in this case, we evaluated motivation, different aspect, whether of a personal or professional nature, might eventually have interfered and influenced the results obtained.

Concerning future research proposals, we would recommend replicating this study in other countries to understand the difference in motivation between distinctive groups. Other crucial future research is to evaluate referees' motivations with personal interviews to make a better evaluation without lack of self-awareness. Another proposal would be to assess motivation levels but differentiating the results by gender, age and referee category to evaluate whether socio-demographic differences bias over the motivations for studying Laws of the Game and Competition Rules.

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Conflict of interests

The authors declare that there are no conflicts of interest.

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