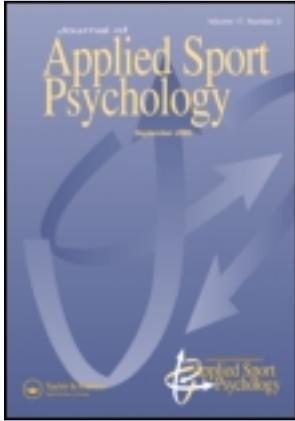


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External Influences on Referees' Decisions in Judo: The Effects of Coaches' Exclamations During Throw Situations

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The present research investigated the influence of coaches' exclamations on referees' decision-making in judo. Under time pressure, 65 judo referees judged identical throw situations played on video. The coaches' exclamations during throws were audible in the experimental condition, whereas no sound was present in the control condition. The throw situations varied in ambiguity (low vs. high) and strength (minor sanctions vs. hard sanctions), while coaches' exclamations interpreted the throws in a manner that was congenial for their own competitor. Results indicated that referees may use an audience response heuristic or a consensus heuristic to help them make decisions.

Several recent studies have investigated factors that influence refereeing decisions in sport (e.g., Plessner & Haar, 2006). However, there are few studies of direct sources of influence on referees' decisions, such as those arising from spectators or coaches (Balmer et al., 2007; Nevill, Balmer, & Williams, 2002; Unkelbach & Memmert, 2010), and no study has to our knowledge directly examined the effect of coaches' exclamations on referees' decisions. The main goal of this research was to test the hypothesis that judo referees' decisions concerning throw situations (which are often highly ambiguous and require interpretation) would be influenced by coaches' exclamations, and that this influence may be moderated both by throw ambiguity and strength.

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Refereeing is a complex decision-making activity that takes place under conditions that prevent detailed cognitive information processing. To facilitate their decisions, referees tend to use judgmental heuristics (Plessner & Haar, 2006), which can be defined as simple ways of reasoning that help one to judge uncertain events in complex environments (Tversky & Kahneman, 1974). However, judgmental heuristics are not always valid. For instance, referees have been found to punish players in black clothing more severely than players in white clothing in American football (Frank & Gilovich, 1988), and to punish female players more severely (i.e., apply more disciplinary sanctions, such as, 2-min exclusions) than male players for equivalent transgressions in handball (Souchon, Coulomb-Cabagno, Traclet & Rasclé, 2004).

Various studies of the determinants of refereeing decisions have focused on the indirect influence of contextual information such as gymnasts' placement in within-team order (Plessner, 1999) or players' aggressive reputation (Jones, Paull, & Erskine, 2002). However, few studies have examined more direct sources of influence, such as those arising from spectators or coaches. The research that does exist has focused solely on the influence of spectator noise, and has led researchers to draw different conclusions on the processes underlying the effect. Some have drawn on a Brunswickian perspective (Brunswick, 1957), which describes how humans learn to make complex judgments of spatial depth from simple cues, such as feature overlap or disparities between the images on both eyes. For example, Unkelbach and Memmert (2010) proposed that, because clear fouls tend to elicit more distinct responses from the audience than less clear fouls, referees could learn that crowd noise tends to indicate that a more severe foul has taken place: therefore, they could use crowd noise as a cue when judging the severity of fouls. In contrast, Nevill et al. (2002) and Balmer et al. (2007) proposed that the explanation is motivational in nature: Referees prefer to avoid displeasing the crowd, especially when there is crowd noise.

Nevertheless, the proposition that coaches' exclamations may represent a similar form of influence to that of crowd noise has not to our knowledge been directly examined. The case for examining the effect of coaches' exclamations is especially strong for sports in which coaches and referees interact in a small area, as in combat sports. For example, in judo or in boxing, coaches are present at each opposing end or corner of the competition area and can exclaim support for their fighters during the contest, within the bounds of the sport's rules. Theoretically, these exclamations are directed at the fighters, but this might also be intended to influence referees. Although referees clearly must try to remain neutral and resist being influenced by coaches, previous research has shown that the influence of external factors (e.g., player gender) may occur implicitly so that referees are not aware of having been influenced (Souchon et al., 2009).

Judo is a combat sport involving two competitors. It is characterized by successive standing and ground phases of combat, in which the former has primacy according to the contest rules. In the standing phase, the competitors mainly attempt to throw one another, while in the ground phases the competitors aim to either obtain a hold down, or to get their opponent to submit by using an immobilization, a strangulation, or an armlock. In response to physically dangerous actions, referees can decide to stop the combat on the ground and to return to a standing phase—a process that can occur several times in a contest. Though contests are officiated by one referee and two judges, it is mainly the referee who administers the decisions and ensures that they are correctly recorded (although the two corner judges or a video judge can sometimes, but uncommonly, overrule the decision of the referee if they both disagree in the same direction). Coaches of the two competitors have a chair at each border of the competition area and have the right to encourage their competitor during the contest, which they typically do through brief exclamations (positive, brief verbal reactions made after, or during an action).

Different scores—Yuko, Waza-ari, and Ippon—can be awarded by the referee to the fighters after a throw or during ground phases. As we focus only on throw situations, we will only outline referees' decisions related to these situations. An Ippon is announced when a contestant executes a controlled throw of his or her opponent on to his or her back with considerable force and speed. A Waza-ari is announced when a contestant throws his or her opponent, but with insufficient technique in one of the three elements necessary for Ippon (i.e., on the back, with considerable force, and with speed). A Yuko is announced when a contestant throws his or her opponent, but with insufficient technique in two of the three elements necessary for Ippon. The referee can also decide not to award a score if a throw either does not conform to a standard technique or does not conform to the strict definition of a Yuko. To win the contest, competitors must obtain an Ippon, two Waza-ari (which both end the contest immediately) or obtain the greatest advantage at the end of the allocated time. For example, a competitor awarded a Waza-ari would defeat an opponent awarded two or three Yuko.

As in other combat sports, judo officiating is a complex decision-making activity. Throw situations are particularly difficult to judge because the referee has to attribute a score to each throw by subjectively judging the control, force, and speed of the throw. These judgments also have to be made very quickly because the action can continue on the mat after each throw. Consequently, although some referees would award a Waza-ari for a particular throw, other referees may view the same throw as deserving a Yuko. We suggest that the complex and subjective nature of these judgments means that environmental influences such as coaches' exclamations can (consciously or unconsciously) shape referees' decisions. Just as crowd noise may serve as a cue as to a foul's severity (Unkelbach & Memmert, 2010), exclamations from coaches within a judo contest may be used as a cue to estimate a throw's quality. One possibility is that referees may use coaches' comments as an audience response heuristic, which occurs when an enthusiastic audience response to a message (e.g., hearty applause) leads observers to positively regard or agree with the message (Axson, Yates, & Chaiken, 1987). For example, a referee influenced by a coach's comment could award a Waza-ari to a throw that would deserve in reality a Yuko.

Developing this hypothesis, we also reasoned that the influence of coaches' exclamations should be moderated both by throw ambiguity and strength. All situations in sports that require subjective officiating are to some extent ambiguous (for a discussion, see Plessner & Haar, 2006). Nevertheless, we reasoned that throw situations may vary in the degree of their ambiguity. If coaches' exclamations do serve as a judgemental heuristic, then their effect should be greater in situations that are more ambiguous. Furthermore, individuals mainly tend to use heuristics when they are not motivated to exhaustively process information. We reasoned that referees would be more motivated to exhaustively process information when faced with stronger throw situations involving a higher potential score (e.g., Ippon vs. Waza-ari) than weaker throw situations involving a lower score (e.g., Yuko vs. no point), because the situations involving a higher score possess greater consequences for the contest outcome (see Chaiken, Liberman, & Eagly, 1989, for a discussion of the role of situational ambiguity and motivation in influence processes). We agree that referees want to get every decision right and would not wish to argue otherwise. Our hypothesis is more about the resource limitations that every referee must possess. Like any human being, referees must find it difficult to think carefully about every single decision. They may wish to be correct, but sometimes opt for quicker routes as a means for achieving correctness. Consequently, we predicted that the effect of coaches' exclamations would be greater in high-ambiguity and weaker throw situations than for low-ambiguity and stronger throw situations.

METHOD

Participants and Design

Participants were 65 judo referees (9 women, 56 men) officiating at an intermediate level of competition (age $M = 36.53$, $SD = 15.46$; experience in years, $M = 9.33$, $SD = 8.33$). They evaluated different throw situations in one of two between-subjects conditions. In one condition, 39 referees (age $M = 36.35$, $SD = 14.45$; experience in years, $M = 6.79$, $SD = 7.30$) viewed the situations on a video that included a soundtrack of a coach making exclamations. In the other condition, 26 referees (age $M = 36.80$, $SD = 17.15$; experience in years, $M = 13.15$, $SD = 12.65$) saw the same video, but without the sound. Prior to this, six highly experienced referees (age $M = 50.5$, $SD = 10.93$) from a national or international level of competition (experience $M = 24.18$ years, $SD = 13.65$) completed a pilot study in order to identify and select low- and high-ambiguity throw situations used in the main study. Both the pilot study and the main experiment were conducted in accordance with the ethical guidelines of the American Psychological Association and the British Psychological Society.

Pilot Study

From 4 hr of video, we identified 38 suitable throw situations involving male competitors. These situations included coaches' audible exclamations on their competitor's throw of an opponent. This video material was obtained during regional and interregional championships (intermediate competition level), with a camera placed near the technical officials' table. The situations were videotaped in different gymnasiums in which several contests were underway simultaneously. Despite the simultaneous contests, the events did not typically attract large numbers of spectators. It was consequently only possible to hear spectators as an indistinct background noise that was not at all sufficiently strong or powerful to drown out the coaches' exclamations. Neither the coaches nor the actual referee's decision were visible. The appearance of referees was blurred when they were in the picture.

A video file containing all 38 throw situations was compiled and presented to each of the six highly experienced referees in an isolated room. The first and last image of each throw situation was frozen for 1 s in the video file in order to allow participants to make their decisions, and the sound was omitted so that the referees could not be influenced by coaches' exclamations. The six referees responded individually (no time limit was indicated) to a questionnaire based on the 38 throw situations, with the intention of assessing the ambiguity of each throw situation. We asked each of the referees to respond to questions concerning the quality of the video situation (the way it was recorded; whether each throw was clearly perceptible) in order to avoid considering situations in which making decisions would be too difficult or non-readable. Also, in order to determine the ambiguity of situations, we asked each referee to (a) attribute a score to the throw (i.e., Ippon, Waza-Ari, Yuko or none), and (b) assess the degree of perceived difficulty (easy vs. difficult) of this judgment (in other words, did they take a lot of time and consider several different possibilities before making the decision or did they take little time and consider only one obvious possible decision?). These responses enabled us to select 8 low ambiguity and 8 high ambiguity throw situations. A throw situation was identified as low ambiguity when the six highly experienced referees gave the same evaluation of the throw, and when they rated their judgments of the throw as being easy. A throw situation was identified as high ambiguity if fewer than five highly experienced referees were in agreement and/or at least three judged the decision as being difficult.

Table 1
Experienced Referees' Decisions in the Pilot Study, Ambiguity Level and Coaches' Exclamations for the 16 Situations

N ^a	6 Experienced Referees' Decisions	Ambiguity level	Coaches' exclamations
15	4 no sanction, 1 Yuko, 1 Wazaari	Ambiguous	Great, Great, Great!
18	4 no sanction, 1 Wazaari, 1 Ippon	Ambiguous	Go, Go, Go, well done!
19	3 no sanction, 3 Yuko	Ambiguous	Ippon!
20	3 Ippon, 2 Nothing, 1 Wazaari	Ambiguous	Yep, Yep, Yep! Great!
23	5 no sanction, 1 Yuko	Ambiguous	Yes, Well done! Great!
26	2 Yuko, 4 Wazaari	Ambiguous	Yes, well done! Great!
28	2 Yuko, 2 Wazaari, 2 Ippon	Ambiguous	Yes! Great!
32	3 no sanction, 3 Yuko	Ambiguous	Yes! Great!
13	5 Ippon, and 1 Wazaari	Obvious	Yes, well done! Great!
16	1 no sanction, 5 Yuko	Obvious	Yes, well done!
17	2 Wazaari, 4 Ippon	Obvious	Yes! Yes!
21	1 no sanction, 5 Yuko	Obvious	Yes! Yes!
22	6 no sanction	Obvious	Yes! Yes!
24	1 no sanction, 5 Yuko	Obvious	Yes! Very good!
27	5 no sanction, 1 Yuko	Obvious	Yes! Well done!
29	5 no sanction, 1 Yuko	Obvious	Yes! Yes!

^a The first column indicates the situation number within the pilot study.

Materials in the Main Study

The main study presented the 16 throw test situations from the pilot study (8 low ambiguity and 8 high ambiguity), but with audible comments from the thrower's coach. The exclamations were solely about the quality of his own competitor's throw (e.g., well done!, great!), and never represented an attempt to deride the opponent. Table 1 describes the sanctions given by the highly experienced referees in the pilot study and the coaches' exclamations made for each test situation. Although it is possible that coaches were unbiased in their exclamations, Table 1 shows clearly that coaches' exclamations were much more sympathetic to their fighters than were the highly experienced referees' judgments.

A further 16 neutral throw situations were interspersed with the test situations on the video files in order to maximize ecological validity and minimize demand characteristics. No coaches' exclamations, but only surrounding noise, were audible in these 16 neutral situations. The 32 throw situations were then each included in two video files. These files were identical, except that one had sound while the other had no sound. Thus, in the video file with sound, participants had to judge 16 test situations with coaches' comments and 16 neutral situations with only surrounding noise. In the video file without sound, participants had to judge exactly the same 32 situations but without sound. The order in which situations were presented was established randomly. Each situation lasted less than 10 s.

Participants' Decisions

Participants were asked for each of the 32 throw situations to rate the certainty with which they would award no score, Yuko, Waza-ari or Ippon. Participants had 10 s after each situation in which to make their decisions on the four options. They responded to each of these four options on a scale ranging from 1 (*absolutely not*) to 7 (*absolutely sure*), resulting in four choices per participant for each situation. Each of these four throw decision options was assigned a notional score (i.e., no score = 0, Yuko = 1, Waza-ari = 2, and Ippon = 3) and then

multiplied by the certainty rating associated with it (i.e., from 1 to 7), in order to construct an overall weighted score reflecting the evaluation of the throw by the expert. As an example, if a participant rated certainty as 1 for no score, 3 for Yuko, 7 for Waza-ari, and 6 for Ippon, the weighted score is $\frac{1 \times 0 \times 3 \times 1 + 7 \times 2 + 6 \times 3}{1 + 3 + 7 + 6} = 2.06$. (The certainty scores are summed in the denominator in order to control for individual differences in tendencies to express high or low certainty regardless of the score.) The rationale for this weighting score strategy can be illustrated by a simple example. Imagine a case in which referees in the “control condition” provide a zero rating on no score, Yuko, and Waza-ari, and a 3.00 rating on Ippon, while referees in the coaches’ comments condition give a 7.00 rating on no score, and zero ratings on all the others. Then, treating each score separately would reveal an uninformative main effect for sound because of higher ratings in the coaches’ comments condition. In contrast, the weighted score reflects the degree of confidence in a higher quality throw rather than a lower quality throw and would not reveal this uninformative main effect.

Procedure

Testing was carried out during a meeting between participants. It was explained that the aim of the study was to better understand referees’ decision-making processes in Judo. We explained that the video situations that they had to judge did not correspond exactly to the real referees’ view in situations, but were videotaped by a video camera of good quality with a camera placed near the technical officials’ table. (Before the study, the situations were examined by several highly experienced referees in order to check that they are readable and that they make sense concerning judo refereeing.) We stated that we did not expect good or bad decisions from the referees. We asked them to take each situation as they arrived and to (a) take the best decisions they can (i.e., the ones that match with the Judo rules, the Judo spirit, and the situations), (b) keep concentrating (do not talk to anybody; do not comment situations), (c) keep the activation level they have when they officiate, (d) make their decisions within the time available (time countdown), and (e) make their decisions personally and individually without searching to know others’ decisions. Participants then made their decisions individually (strictly without verbal or non-verbal communication with other people present) using a questionnaire. To familiarize them with the task and apparatus, participants were shown six example situations. All of the digital video files were projected onto a 1.42 m × 1.88 m display (Jones et al., 2002). After completing the study, which took approximately 20 min, participants were debriefed and probed for suspicion about the purpose of the study. Participants either had no idea at all concerning the aim of the study, or believed that it was to analyze the influence of the control, force, and speed of throws on decisions.

Statistical Analysis

To use tests based on the general linear model, researchers have to assume that (a) variances are equal and that all observations are independent, and (b) all variables are fixed effects. The independence and the fixed effect assumptions were violated within our study. For example, participant was a random variable nested within the sound condition. Therefore, a more appropriate technique was to use a nested linear model which takes into account the nested variables (Pantula & Pollock, 1985). Consequently, the final *F* value was not computed by dividing the variance of the dependant variable by the residual variance as in a classical ANOVA or in a general linear model, but using a corrected residual term.

Overall, eight low and eight high ambiguity throw situations (16 tests situations) were judged by 65 participants. The judgments of these throw situations were made either with coaches’ exclamations (sound condition, 39 participants) or in the control condition (without

sound, 26 participants). For each video and for each participant, an overall score summarizing the notation of the participant was computed. Also, to test our hypothesis that the influence of coaches' exclamations may depend on the strength of the throw, the overall score was used to define two types of throw: (a) weak throws had a score below 1.5 (close to no score or to Yuko), or (b) hard throws had a score greater than or equal to 1.5 (near Waza-ari or Ippon). A more formal partitioning technique, the k-means algorithm, created two clusters, one holding the score from 0 to 1.45, the other from 1.45 to 3, but the different cut-offs (1.5 vs. 1.45) did not change the subsequent analysis.

We then elaborated a nested linear model in which (a) sound and strength of throw variables were both fixed effects, (b) ancillary control variables (sex, years of experience, age, and situation video) were considered as fixed effects, and (c) participant was a random variable nested in condition. Although the dependant variable was the overall score, the general model was a 2 (sound vs. not sound) \times 2 (low ambiguous situation vs. high) \times 2 (weak throw vs. hard throw) nested linear mixed-effect design. Specifically, we tested whether sound interacted with ambiguity. Also, we elaborated two sub-models by dividing situations according to the strength of the throws (i.e., a model only with weak throw situations and a model only with hard throw situations). These sub-models were a 2 (sound vs. not sound) \times 2 (low ambiguity vs. high) nested linear mixed-effect design with each variable within the sub-models defined as in the general model. The statistical analysis was conducted with R software (R Development Core Team, 2011).

RESULTS

Concerning the general model, we initially tested the effect of sound on the overall weighted score ($M = 0.96$, $SD = 1.01$). As shown in Table 2, the model regressing the throw scores on the presence of sound (fixed), the situation video (fixed), the participant (random nested in the condition), and the strength of throw (fixed) revealed a significant effect of the presence of sound on the throw scores ($\beta = 0.11$, $p < .02$). Referees attributed a better score to the throws when they heard the coaches' exclamations than when they could not (control condition).

Table 2
Global and Weak Throw Linear Model

Variables	Global model		Effect Size <i>r</i>	Weak throw model	
	Reference	β		β	Effect size <i>r</i>
Main Effect:					
Sex	Male	-0.08 ^{ns}	-.16	-0.12*	-.21
Referee level		-0.02 ^{ns}	-.11	-0.02 ^{ns}	-.13
Referee experience		0.001 ^{ns}	.00	-0.001 ^{ns}	.00
Age		0.001 ^{ns}	.03	0.001 ^{ns}	.00
Sound condition	With sound	0.11*	.26	0.19**	.34
Ambiguity	Obvious	-0.04 ^{ns}	-.14	-0.002 ^{ns}	-.04
Strength throw	Weak	-1.95***	-.37	N.A	
Interaction:	With sound x Obvious	-0.05	-.03	-0.13*	-.19
Sound X Ambiguity					

The simplified version of the model presented is the same as the previous model retaining only the important variables and eliminating the not significant adjustment variables. *** $p < .001$; ** $p < .01$; * $p < .05$; *ns* = non significant.

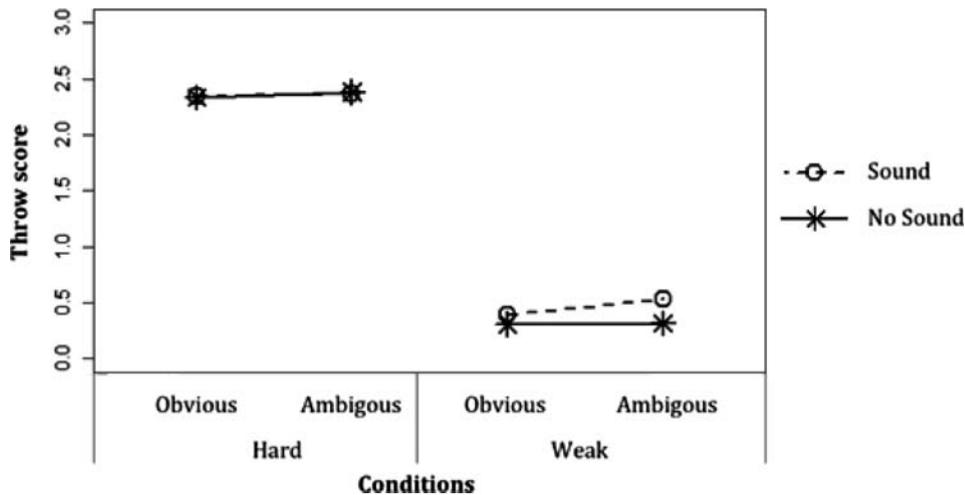


Figure 1. Interaction effects between sound condition and throw ambiguity for both the hard throw and the weak throw models.

None of the ancillary variables (sex, level, experience, age) interacted with the score ($p > .05$). Also, sound did not interact with ambiguity ($p > .05$).

Concerning the weak throw sub-model, results presented in Table 2 indicated a significant and stronger relation between sound and score than in the general model ($\beta = 0.19, p < 0.01$). Faced with weak throw situations involving minor sanctions, referees tended to attribute a better score to the throw situations in the condition where they could hear coaches' exclamations than in the control condition. Also, the weak throw sub-model included an interaction between sound and ambiguity, which revealed that the effect of sound on throw scores was greater in ambiguous situations (see Figure 1). Sound and ambiguity did not interact in the hard throw sub model.

DISCUSSION

The aim of this research was to improve our understanding of the diverse determinants of refereeing decisions. Past research has shown that various factors can indirectly influence referees' decisions through the activation of prior knowledge or stereotypic expectations (e.g., Jones et al., 2002), but few experimental studies have examined the more direct influence that spectators or coaches might have on referees' decisions (Balmer et al., 2007; Nevill et al., 2002; Unkelbach & Memmert, 2010). We tested the hypothesis that judo referees may be influenced directly by exclamations made by coaches during a contest and that the effect of coaches' exclamations would be greater in high-ambiguity throw situations than low-ambiguity throw situations and in weaker throw situations (involving less serious consequences) than harder throw situations (involving greater consequences). The results supported our hypotheses. Overall, referees awarded a higher score when coaches' exclamations were audible. Moreover, the influence of coaches' exclamations was greater when referees faced weak (involving minor sanctions) and highly ambiguous throw situations.

Although these results need to be replicated using different methodologies, they provide an important extension of research showing that crowd noise tends to influence referees' decisions

in soccer (Balmer et al., 2007; Nevill et al., 2002; Unkelbach & Memmert, 2010). The processes mediating the effects of crowd noise and the effects of coaches' exclamations may be similar. Although some researchers argue for a purely motivational process whereby soccer referees seek not to displease the crowd because crowd reaction is an important stressor (Balmer et al., 2007; Nevill et al., 2002), other researchers argue for a purely cognitive explanation, which postulates that soccer referees after a foul may use the crowd reaction as valid information to judge foul severity, because they may have learned that the crowd reacts emotionally after a clear, severe foul (Unkelbach & Memmert, 2010). Similarly, at this point, it is not possible to explain our results purely in terms of motivational processes or cognitive processes alone. Referees may be motivated to reduce stress from disagreement with coaches, and coaches' exclamations may serve as an automatic signal of throw strength. Future research is needed to disentangle these possibilities.

Nonetheless, our findings are also consistent with a study showing that referees in soccer are likely to take more deliberative care when awarding a penalty kick than for a less consequential free-kick in the middle of the pitch (Plessner & Betsch, 2002). When faced with a throw that potentially involves major sanctions (Waza-ari, Ippon), referees may be naturally motivated to process information carefully and, consequently, are less likely to be influenced by external information or heuristic cues. In contrast, when faced with a weaker throw situation (involving lesser sporting consequences), referees may use heuristic processing, which occurs when a person has less capacity or motivation to deliberate carefully (Giner-Sorolla & Chaiken, 1997). Referees may have used something akin to an audience response heuristic (Axsom, Yates, & Chaiken, 1987). This heuristic, studied primarily in the context of persuasion, occurs when an enthusiastic audience response to a message leads observers to positively regard or agree with the message. It is closely related to the consensus heuristic, which contends that "if other people think the message is correct, then it is probably valid" (Giner-Sorolla & Chaiken, 1997). In our study, it is likely that the coaches' positive exclamations toward the throws led the referee to regard these throws more positively, and then attribute a better score, but only in ambiguous and weak throw situations, which provide a cognitive and motivational impetus for its use. In real sport combat situations, referees may be particularly prone, for example, to award a Yuko to throw situations that deserve no score. Moreover, the influence of coaches' comments was not moderated by referees' experience (i.e., years of experience and level; see Table 2), suggesting that this effect of coaches' exclamations is pervasive and important.

One limitation of this research concerns the way in which we have defined ambiguity. Another way in which situation ambiguity may be meaningfully defined would be to ask referees in a pilot study to make their decision under real conditions (i.e., watching each situation only once and having only a few seconds to decide), as opposed to the less demanding conditions employed in the present study. It would also be possible to supplement the present approach by testing these hypotheses using more controlled, experimentally created situations (e.g., recording and elaborating scenarios with fighters and coaches during training). Another limitation of this research concerns the way in which participants had to make their decisions; namely, having 10 s to award four scores (no score, Yuko, Waza-ari, and Ippon) on a continuous scale using a paper-and-pencil method. A better way to proceed may be to use a psychology software tool to generate response formats that reflect more closely the modes of response in real sport combat situations.

In addition, future research should investigate the underlying process that best explains why judo referees are influenced by coaches' exclamations. Such research could follow a path analogous to Unkelbach and Memmert's (2010) suggestion in relation to crowd influence on soccer referees' decisions. Specifically, follow-ups to the present research could create several throw situations in which a coach's exclamation is not at all a valid cue, or even correlates

inversely with the best decisions. Then, based on successful cases of learning and relearning cues (e.g., Unkelbach, 2006, 2007), we could train or condition some referees not to treat coaches' exclamations as a valid cue. If this (re)learning is successful, it would provide strong evidence for the cue learning hypothesis over the motivational hypothesis. Future research could also examine the influence of coaches' comments on referees' decision-making in other sports. Specifically, the possibility that referees in combat sports use different heuristics than referees in team contact sports, or sports based on artistic display (e.g., dance, ice skating, or gymnastics; Plessner & Haar, 2006) should also be investigated.

In summary, the present findings constitute the first direct evidence that referees may be influenced by comments made by coaches during sporting contests. We hope that this investigation stimulates further research on these issues, contributes to a wider appreciation of the cognitive challenges that referees face, and assists training of officials. In particular, the sports federations that govern combative sports may need to prepare referees to resist the influence of coaches during contests. A first step towards achieving this is to increase our knowledge of the influence process. It may also be important during training for referees to analyze both real and simulated contests in order to help them detect how coaches' actions may influence them, and the best ways to overcome these influences (e.g., by issuing a warning to the coaches). It would be particularly important that referees learn to make their decisions under stressful conditions (e.g., noise of the crowd and coaches' comments) and receive feedback about the accuracy of their responses and how they may be influenced by external influences.

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