Chapter 7

Typical Errors and Behavioral Sequences in Judo Techniques: Knowledge of Performance and the Analysis of T-Patterns in Relation to Teaching and Learning the Ouchi-Gari Throw

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Abstract

The aim of the study was to detect the most frequent errors and their associated behavioral sequences in relation to the judo technique Ouchi-gari, the ultimate objective being to propose improvements to the way in which judo is taught. The novice participants ($n = 31$; 15 men and 16 women) were all students from the Faculty of Educational and Sports Science at the University of Vigo (Spain) and they were filmed while performing the technique in the context of a systematic observational study. The results, based on descriptive statistics and the sequential analysis of T-patterns obtained via the THEME v.5 software, revealed that students committed a series of typical technical errors when learning the Ouchi-gari technique that affected the whole throw sequence. These errors were primarily related to an initial failure to put the adversary off balance, the foot and trunk position, the reaping action, and the final action of the arms. As regards the teaching of judo these findings can be used to propose motor tasks and movement sequences for novices that would ensure successful learning of the technique, this process being based on a range of tasks and the use of corrective feedback.

Key words Observation instrument, Observing judo, Sequence learning, T-Patterns

1 Introduction

The first studies of combat sports focused on the physiological demands associated with the effort required by the combat [1–3]. More recently, research, particularly in judo, has considered ways of improving the training process [4–6] and the psychological response of judokas in competitive settings [7, 8]. However, these studies do not examine in detail the factors that affect the teaching and learning process with novices, and knowledge is still lacking regarding the factors that influence the learning and the overall or nonlinear acquisition of a given combat technique [9].

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The model based on knowledge of performance in relation to sports technique [10, 11], and in particular the errors committed during performance [12, 13], is a valuable and novel tool. Correcting a technical movement or gesture from the perspective of errors and knowledge of performance is, when information about the nature of those errors is available, more useful than simply pointing out the outcome of performance [14].

The aim of the present study was to apply the knowledge of performance model to the judo throw Ouchi-gari in order to reveal error sequences which are normally difficult to perceive. This was done by means of a systematic observational analysis, the results of which are used to propose ways of improving the teaching of judo techniques. Such proposals have already been made in relation to other sports [15].

2 Method

The study was based on observational methodology [16, 17], which has the rigor and flexibility required to study the episodes of behavior that emerge naturally during the process of teaching and learning judo. Based on the work of Borrie, Jonsson, and Magnusson [18, 19] the type of observation carried out was systematic, open, and nonparticipant.

2.1 Design

The observational design [20] was nomothetic (i.e. various participants performing the same technique, in this case Ouchi-gari), based on monitoring (a throw technique across five academic years), and multidimensional (different dimensions of the observation instrument). The use of this design implies a series of decisions that are made in relation to the participants, the observational instrument and register, and the procedure of data analysis.

2.2 Participants

Participants were students on a degree course in Physical Activity and Sports Science ($n = 31$; 15 men and 16 women), covering five academic years (from 2003/2004 to 2007/2008) and with an age range of 21–30 years ($M = 24.56$; SD = 2.73). They were all novices in judo and gave their informed written consent prior to being filmed on video. The recordings made were distributed equally across the five academic years (six subjects per year, except for the final year, in which there were seven).

2.3 Observation Instrument

The observation instrument developed for this study was the SOBJUDO-OU (see Table 1), a tool that combines the robustness and flexibility required to observe motor behavior [21, 22]. The criteria of which the SOBJUDO-OU is comprised include the object of the present study: technical errors in performance. The technical model used for both the process of teaching and

Table 1
SOBJUDO-OU observation instrument

Criterion	Code	Description
Grip	BGRIP	*Tori* uses his left hand to grip *Uke's judogi* midway up the forearm. The correct position would be at the elbow.
Off-balance	NOB	*Tori* does not put *Uke* off balance in the first part of the technique. His arms maintain the initial grip and only serve to accompany the action.
	DOB	The frontal off-balancing action and the subsequent initial displacement are performed in a discontinuous way.
Left-foot position	ILFP	*Tori* incorrectly positions his left foot after the initial movement.
Right-arm position	ARMP	At the end of the technique, *Tori's* right hand is in the supine position when gripping the left lapel of his opponent, leaving the dorsal part of his body in contact with the mid-level of the opponent's trunk (similar to the grip of Morote-seoi-nage).
Face position	FAP	The position of *Tori's* face is incorrect while performing the technique.
Trunk position	TRP	*Tori* incorrectly positions his trunk before initiating the leg reap.
	CGA	In the *kake* phase of this throw, *Tori's* center of gravity is too high.
Right-arm action	IRAA	In the *kake* of Ouchi-gari, the right-arm action of *Tori* is insufficient.
Left-arm action	ILAA	In the *kake* of Ouchi-gari, the left-arm action of *Tori* is insufficient.
	RAAR	*Tori* raises his left arm during the final phase of the movement, at the moment of pushing off the opponent's body (elbow at the same level as the wrist).
Reaping	SLWR	Instead of performing a circular reap the leg which should perform this action is used for support, thereby failing to carry out the reap.
	KBR	*Tori* bends his right leg while performing the reap, such that his ankle ends up above the imaginary line that would be described by the initial position of his knee.
	BLO	Instead of reaping his opponent's left leg with his own right leg, *Tori* performs a blocking action on it.
	INCR	*Tori* interrupts the reap, which is therefore incomplete.
	INSR	During the final phase of this technique, the position of *Tori's* leg that is performing the reap is insufficient as regards his opponent's leg.
Throw stage	NR	While performing Ouchi-gari, *Tori* fails to reap *Uke's* leg with his own.
Control stage	FACC	During the *kake* stage *Tori* uses his right arm to accompany *Uke's* fall to the floor.
	FNC	During the final stage of the technique *Tori* performs no action with his left hand and therefore fails to control the fall of his adversary's body.

(continued)

Table 1
(continued)

Criterion	Code	Description
Rebalancing	RRF	After performing the throw *Tori* loses his balance. In order to regain it he steadies himself with his right foot.
	RLF	Upon completion of the technique *Tori* loses his balance, which he regains by steadying himself with his left foot.
	RHR	Upon throwing *Uke*, *Tori* loses his balance and uses his right hand in an attempt to maintain him.
	RFR	After the reap, *Tori* uses the leg that had performed the action to regain his balance.
Globality	SLEX	The throw is executed slowly and without any continuity.

learning the throw and for its observation was based on the approach of the Kodokan school [23].

As the SOBJUDO-OU is a multidimensional instrument, it is compatible with the proposed observational design. Each one of its dimensions gives rise to a system of categories that fulfills the conditions of exhaustiveness and mutual exclusivity (E/ME).

2.4 Recording Instrument

The performance of the technique under study (the Ouchi-gari) was filmed after a training period lasting approximately 4 months. Data were gathered by means of two digital video cameras (JVC GZ-MG21E), and the recordings of the throws were subsequently edited using the video editing suite Pinnacle Studio v.12.

The observational register was created using the software Match Vision Studio Premium v.1.0 [24]. This is an interactive multimedia program that enables the user to visualize and register digitalized video recordings on the same computer screen. The program is highly flexible and allowed us to introduce all the codes corresponding to each of the changing criteria of the SOBJUDO-OU observation instrument, thereby producing a register of their appearance in succession.

2.5 Procedure

The performance of the technique under study (the Ouchi-gari) was filmed after a training period lasting approximately 4 months, involving 3 h of practice per week. Overall, a total of 17 throws were learnt. During the video recording each participant performed five of all the techniques that had been learnt, all without opposition from the other judoka and starting from a static position (i.e. it was technical work). Stratified random sampling was used to assign participants and techniques. The quality of the data registered by two observers was assessed by means of Cohen's kappa [25], with values of this coefficient above 0.8 being regarded as indicative of reliability (inter-observer agreement). This test was conducted using the software GSEQ v.5 for Windows [26, 27] and

yielded a kappa value of 0.82. Having ensured the quality of the data, an initial descriptive analysis of the frequency and percentage of occurrence of technical errors was then conducted.

After recording all the throws performed the Match Vision Studio software produces a series of Excel files containing the successive configurations formed by the lines of codes that have changed, with their temporality and duration expressed in frames (25 frames is equivalent to 1 s). These Excel (.xls) files, which provide frequencies for all the registered occurrences of codes, were then transformed successively in order to enable various analyses to be carried out.

The codes of the SOBJUDO-OU observation instrument were then exported to the THEME software [28–30] with the aim of detecting temporal patterns (T-patterns). These T-patterns, which were obtained by means of the algorithm incorporated within THEME v.5 [29], can help to reveal hidden structures and unobservable aspects in sports techniques. The application of the THEME software has proved to be highly effective for studying both team and individual sports [21, 31, 32].

2.6 Data Analysis

The frequency of occurrence of the different errors made when performing the Ouchi-gari throw was determined by means of a descriptive analysis using SPSS 15, the results of which are shown in Table 2. An analysis of temporal patterns among the observed errors was also conducted using THEME, the aim here being to identify the most significant error sequences. The Mann–Whitney U test (in SPSS 15, with significance set at $p<0.05$) was used to analyze the data in relation to the chosen independent variable, in this case the gender of participants.

3 Results

3.1 Statistical Analysis

Following on from the above description of the errors observed during performance of the Ouchi-gari, (Table 1) this section describes the frequency and percentage of occurrence of errors in the study group ($n=31$).

The most common errors detected were related to an initial failure to put the adversary off balance (NOB), an inadequate position of the right arm (ARMP), an incorrect positioning of the face and trunk (FAP and TRP), the height of the center of gravity during the *tsukuri* and *kake* phases of the throw (CGA), insufficient traction effect of both arms in the final phase of the throw (IRAA and ILAA), and an incorrect reaping action (INCR).

Application of the Mann–Whitney U test to compare means and detect possible differences between men and women in their performance of the Ouchi-gari revealed no significant differences ($p>0.05$).

Table 2
Frequency and percentage of occurrence of technical errors made when performing the Ouchi-gari

	Error	Frequency	Percentage
Grip	BGRIP	9	29
Off-balance	NOB	25	80.6
	DOB	8	25.8
Left-foot position	ILFP	13	41.9
Arm position	ARMP	16	51.6
Face position	FAP	23	74.2
Trunk position	TRP	19	61.3
	CGA	17	54.8
Right-arm action	IRAA	28	90.3
Left-arm action	ILAA	29	93.5
	RAAR	2	6.5
Reaping	SLWR	9	29
	KBR	3	9.7
	BLO	2	6.5
	INCR	22	71
	INSR	9	29
Throw stage	NR	7	22.6
Control stage	FACC	4	12.9
	FNC	4	12.9
Rebalancing	RRF	3	9.7
	RLF	6	19.4
	RHR	2	6.5
	RFR	7	22.6
Globality	SLEX	1	3.2

3.2 Detection of Temporal Patterns (T-Patterns)

In order to examine the errors made in greater detail the THEME software [28, 29] was used to analyze temporal patterns (T-patterns) in the observational data. This kind of analysis is able to reveal important links related to the sequences of errors that emerge.

Figure 1 shows the sequence of errors detected. The left-hand box represents the relationship between the different categories (i.e. the technical errors, as listed in the SOBJUDO-OU observation

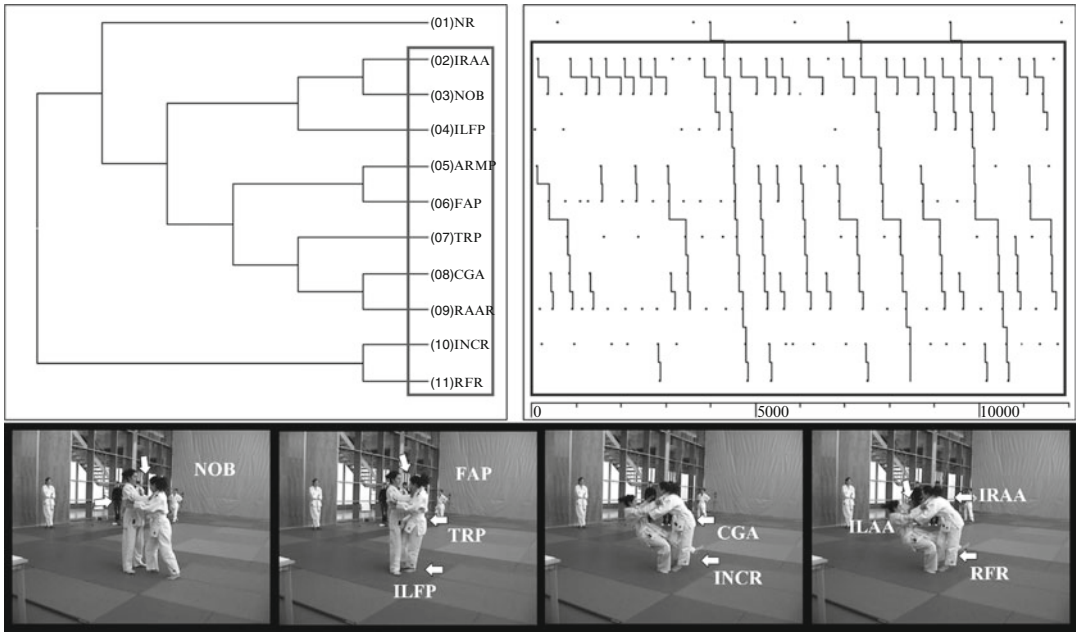

Fig. 1 The most representative tree diagram for Ouchi-gari

instrument). This tree diagram should be read from top to bottom, i.e. the first category to appear is at the top (red rectangle). The right-hand box shows how many times each of these relationships occurs, by means of lines that run from top to bottom (blue rectangle).

These results show that the initial failure to put the adversary off balance (NOB) precedes an incorrect positioning of the left foot (ILFP), which in turn leads to an incorrect trunk and face position (TRP-FAP). As a result of this foot position, *Tori* fails to achieve the optimal lowering of her center of gravity (CGA), which prevents an appropriate reaping action from being performed (INCR) and leads to an insufficient arm action (ILAA-IRAA). Finally, she has to use her right leg in order to regain her balance (RFR).

4 Discussion

Although there is a lack of scientific research on technical errors in judo, a review of the literature reveals that the most prestigious practitioners of the sport do, in their publications, reflect upon key aspects of technique or the most common errors made [33–36]. Interestingly, the points they make, which are no doubt based on their personal and professional experience, often coincide with the typical errors revealed by the present study.

For example, most of the authors consulted recommend that in the first part of the Ouchi-gari, which involves putting the

adversary off balance, the direction of the force should be towards the left posterior diagonal, such that *Uke's* weight falls on his/her heels or solely on the left foot [33, 37]. The literature notes that this is one of the most common errors made by novices who are learning this throw [34].

As regards the position of *Tori's* supporting foot [37] specifically recommends that this foot is placed between *Uke's* feet, in the frontal plane, albeit a few centimeters away from them in the sagittal plane, thereby forming a kind of triangle.

The technical literature also highlights the importance of lowering the center of gravity [37, 38], of turning one's body to the side [39, 40] and of looking to the right [37, 39, 41] just prior to performing the reaping action.

Another of the most common errors observed in the present study was related to an insufficient and misdirected arm action. In this regard the experts recommend that *Tori* should aim to shift *Uke* backwards and towards the left posterior diagonal in the final phase of the technique [34, 35, 39], continuing the action that was begun with the initial off-balancing maneuver [38] but using in addition one's body weight to favor this off-balancing [37].

As regards the reaping action the recommendations are clear. For example, Taira [32] states: "The reap is performed with the Achilles tendon in contact with the same part of *Uke's* body, with the tip of the foot remaining in contact with the *tatami* throughout the action and reaping in a circular direction" (p. 267). This point of view is shared by authors such as [33, 36, 40, 41], among others.

The tree diagrams reveal a clear sequence of errors, whereby the initial failure to put the adversary off balance subsequently prevents the left foot from being correctly positioned, which means that the body is not facing the right way during the *tsukuri*. This makes it impossible to execute a sufficient arm action and an effective reaping action during the *kake* phase of the technique.

These sequences are not explicitly referred to in the technical manuals consulted, but the descriptions they contain do refer to aspects of the most representative tree diagram. For example, Uzawa [41] highlights the importance for *Tori* of using his left leg to put *Uke* off balance at the start, so as to be subsequently able to execute a more effective reap (NOB–INCR). Daigo [33] notes that if *Tori* does not bend his knees and lower his center of gravity (CGA) during the *tsukuri* phase he will not be able to execute a sufficient arm action (IRAA–ILAA) or, subsequently, an effective reap. This sequence of errors can be clearly seen in the tree diagram. Finally, Taira [37] stresses that the reaping and arm actions should be performed simultaneously and in a synchronized way, suggesting that the two are complementary as regards the correct execution of each (IRAA/ILAA–INCR).

5 Conclusions

With the aim of avoiding the errors detected here a number of recommendations can be made regarding execution of the Ouchi-gari technique: (1) use your left hand to grip *Uke's* right sleeve at the level of the elbow; (2) put *Uke* off balance in the direction of the left posterior diagonal, such that your body weight falls solely on your left foot; (3) place your left foot between *Uke's* feet (in the frontal plane); (4) turn your hip and head to the right, lowering your center of gravity by bending your knees; (5) reap the adversary's leg with a circular motion, such that he is thrown backwards (specifically, the reap should be centered over the area of *Uke's* Achilles tendon and with the ankle extended); and (6) the reap should be accompanied by a strong arm action.

The teaching and learning of this judo technique could be improved by paying special attention to the following movement sequences, which will ensure that the throw is correctly executed: (1) correctly putting the adversary off balance increases the likelihood that the feet and body will subsequently be in the correct position; and (2) correct positioning of the supporting foot and ensuring that the face and trunk are adequately positioned favors the required arm action (traction) and makes it easier to execute the reap during the throw phase of the technique.

5.1 Practical Implications Based on Knowledge of Performance

The results of this study also enable a number of strategies based on knowledge of performance to be proposed with the aim of improving the teaching and learning of the Ouchi-gari technique:

1. When demonstrating the technique the student's attention should be drawn towards the key points highlighted by this study. In relation to the theoretical aspects of the throw, coaches may wish to incorporate the use of video or other images that illustrate its fundamental features, as well as the most common errors detected here. At all events, teachers or coaches should focus only on the most relevant aspects.
2. Instructors could design tasks or drills that focus the student's attention on the most significant errors and sequences of behavior detected.
3. After a throw is performed in training the subsequent communication between coaches and students could be improved by providing more precise feedback. Coaches should begin by focusing on the most significant errors and sequences identified in the present study, leaving any others for a later stage of training. It is also helpful to focus on a few key aspects so that students do not become overloaded with information. At all events the results of this study can provide a platform for dif-

ferent kinds of feedback (verbal, verbal with a practical demonstration or verbal with hands-on assistance), which should always be positive in nature.

4. Coaches could draw up observation/evaluation sheets based on the category system of the observation instrument used in this study. One model would be for students to work in groups of three, with one of them observing the other two while they perform the throw. The former student would therefore conduct an observational analysis using the evaluation sheet, noting the errors made and providing immediate feedback. The same approach could also be used with video recordings, thereby enabling the observational analysis to be conducted after the throw has been performed.

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