SEQUENCES OF ERRORS IN THE JUDO THROW *MOROTE SEOI NAGE* AND THEIR RELATIONSHIP TO THE LEARNING PROCESS

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Abstract
The aim of this study was to identify the most common technical errors, and their behavioural sequences, in the judo throw *Morote Seoi Nage*. Participants (*n*=46; 29 men and 17 women) were physical education students who were systematically observed by means of video recordings taken over a period of five academic years. The results, derived from descriptive statistics and a sequential analysis of T-patterns obtained with the software package *THEME v.5*, showed that a sub-optimal knee bend produces a throw around the side rather than over and towards the front of the shoulder. Furthermore, an inadequate hip and trunk position, caused by prior incorrect placement of the left foot, leads to a failure of weight bearing, which itself is the cause of the side throw. As regards the teaching and learning of judo, these findings enable us to propose motor drills to correct the errors detected, and movement sequences that will ensure a successful throw. Recommendations are also made about the use of feedback.

Keywords: feedback, martial arts, observation instrument, physical education, teaching, T-patterns.

1 INTRODUCTION

Scientific research into combat sports, and particularly judo, has focussed on the physiological adaptation to the workload required by the contest [**1,2**], the training process [**3-5**] and psychological responses [**6**]. However, the processes of teaching and learning have yet to be studied in depth among novice competitors, although sports scientists have recently acknowledged the need to explain, predict or even control the factors that determine whether or not these processes are successful.[7] In this context, knowledge of performance with respect to sports technique [**8,9**], especially in terms of the technical errors committed [**10**], is a valuable and novel tool, since correcting a technical move or gesture from the perspective of error is, when information is available about the nature of those errors, more useful than simply indicating performance outcomes [**11**].

This paper aims to examine knowledge of performance with respect to the judo technique *Morote Seoi Nage*. Specifically, it uses a method of systematic observation to identify the patterns of motor behaviour (in the form of errors and sequences) that remain hidden to the naked eye, the aim being to develop an optimal tool that could be used by professionals as a technical complement to the process of teaching and learning. While such an approach has been described for several sports it has yet to be applied to judo [**12-13**].

2 METHOD

The study was based on observational methodology [**14**], which has been shown to have the rigor and flexibility required to study the episodes that emerge naturally in the process of teaching and learning judo [**15-16**]. The aim of the design was to analyse individual errors and sequences of errors in judo throws performed using the same technique, i.e. *Morote Seoi Nage*. These throws were performed from a static position, in *tobikomi* and without opposition (i.e.

technical work). The various dimensions taken into account by the analysis are reflected in the category system shown in Table 1. On the basis of this design a series of decisions were made regarding the participants, the observation and recording instruments used, and the analytic procedure.

Broadly speaking, *Morote Seoi Nage* is a throw technique performed with the arms spread and in which *Tori* (the person who performs the action) throws *Uke* (the person thrown) in a forward direction. The move begins with the two judokas facing one another and using a normal grip. The thrower then turns in the vertical axis and, without releasing his grip, takes the weight of his opponent's body on his back and throws him over his shoulder.

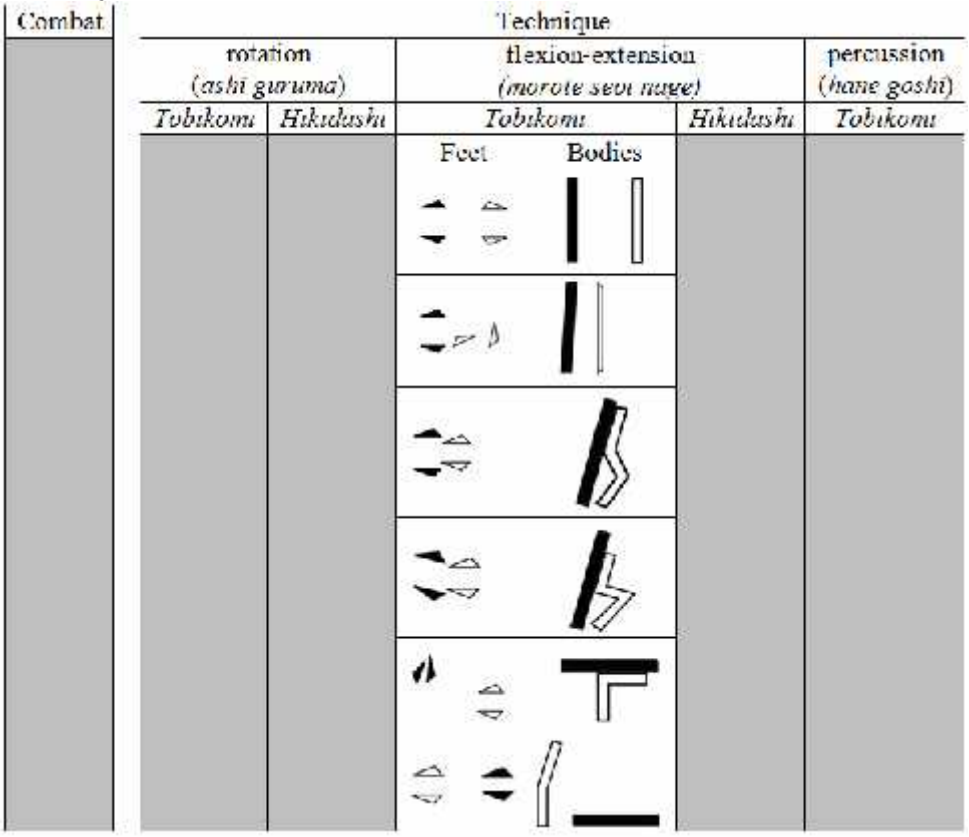

Figure 1. Arborescence of Morote Seoi Nage.
Note. The area highlighted in grey has not been analysed in this study.

Participants were physical education students (n=46, 29 men and 17 women; M=24.56 years; SD=2.73) studied over a period comprising five academic years (from 2003/2004 to 2007/2008). They all gave their written informed consent to be filmed on video. The number of recordings made was distributed equally over the five academic years.

The observation instrument developed for this study was the SOBJUDO-MS (see Table 1), which combines field formats with category systems [**17-18**]. The criteria of the SOBJUDO-MS are consistent with the objectives of the study, i.e. technical errors when performing the throw. The technical model used for both the process of teaching/learning the throw and for its observation was based on the approach of the Kodokan school [**19**].

The SOBJUDO-MS is consistent with the proposed observational design, it being multidimensional and based on the following criteria: grip, off-balance, right foot position, right arm position, hip position, trunk position, left foot position, leg action, load action, throw stage, control stage, rebalancing and global performance. Each of these dimensions gives rise to a system of categories that fulfil the requirements of exhaustiveness and mutual exclusivity (E/ME).

Table 1. The observation instrument SOBJUDO-MS.

Criterion	Code	Description
GRIP	AGR	*Tori* grips *Uke's judogi* with his left hand around the middle section of the arm.
OFF-B.	NOB	*Tori* does not put *Uke* off balance in the first part of the technique. His arms maintain the initial grip and serve only to accompany the action.
	DOB	The frontal off-balancing action and the subsequent displacement are performed in a discontinuous way.
R.F.P.	IRFP	*Tori* positions incorrectly his right foot in the launching of the technique (i.e. the opening move), after turning in the vertical axis. The correct position is on the inside of where *Uke's* foot is placed.
R.A.P.	FAS	While performing the technique *Tori's* forearm is in contact with *Uke's* sternum.
H.P.	IHP	There is a gap (sagittal plane) between the posterior part of *Tori's* left hip and the anterior part of the left-hand side of *Uke's* body during the second stage of the throw.
T.P.	ITP	There is a gap (sagittal plane) between the posterior left-hand side of *Tori's* trunk and the anterior part of the left-hand side of *Uke's* body during the second stage of the throw.
L.F.P.	ILFP	*Tori* positions incorrectly his left foot in the launching of the technique, after turning in the vertical axis. The correct position is on the inside of where *Uke's* foot is placed.
LE.A.	INSQ	*Tori* fails to bend his knees sufficiently in the launching of the technique, as his hip is not located at the level of *Uke's* thighs.
LO.A.	NLHL	*Tori* fails to take *Uke's* weight on his back, or instead does so over his hip.
	NSIM	*Tori* first bends and straightens his knees, and then bears *Uke's* weight with his body, in other words, the two actions are not simultaneous.
T.S.	STH	*Tori* throws *Uke* around the side of his body instead of over the top and toward the front of his shoulder.
	IAT	During the final stage of the throw *Tori's* arms produce insufficient force when throwing *Uke's* body to the floor.
	ITFL	Insufficient trunk flexion at the end of the throw (*Tori* maintains a position of between 10º and 60º).
	ITTU	*Tori* fails to turn his trunk enough in the guiding stage of the technique (i.e. positioning and control of the throw towards the floor).
C.S.	FNC	During the final stage of the technique *Tori* performs no left-hand action and therefore fails to control the fall of his adversary's body.
	KTB	During the final stage of the throw *Tori* bends his trunk between 90º and 110º and maintains this position once the technique is complete.
	FACC	During the guiding stage *Tori* uses his right arm to accompany *Uke's* fall to the floor.
REB.	RRF	After performing the throw *Tori* loses his balance. In order to regain it he steadies himself using his right leg.
	RLF	Upon completion of the technique *Tori* loses his balance, which he regains by steadying himself with his left foot.
GLOB.	SLEX	The throw is executed slowly and without any continuity.

The performance of the technique under study (the *Morote Seoi Nage*) was filmed after a training period lasting approximately four months, involving three hours of practice per week. A total of 17 throws were learnt. Data were gathered by means of two digital video cameras (JVC GZ-MG21E). The recordings of the different throws were then edited using the video editing suite Pinnacle Studio v.12.

The recording instrument used for the observation was the software package *Match Vision Studio Premium v.1.0* [**20**]. This is an interactive multimedia program that enables the user to visualise and register digitalised 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-MS observation instrument, thereby producing a record of their appearance in succession.

After recording all the relevant technical manoeuvres the program produces an Excel file 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). The quality of the data was assessed by means of Cohen's kappa, with values of this coefficient above 0.8 being regarded as indicative of reliability. This test was conducted using the software SDIS-GSEQ v.4.2 [**21**], and yielded a kappa value of 0.89. Having ensured the quality of the recorded

data an initial descriptive analysis of the frequency and percentage of occurrence of technical errors was then conducted. The resulting .xls files, obtained using Excel and which provide frequencies for all the occurrences of recorded codes, were then transformed successively in order to enable various analyses to be carried out. The codes of the SOBJUDO-MS observation instrument were then exported to the THEME software [**22**] with the aim of detecting temporal patterns (T-patterns) [**23**]. A temporal pattern is essentially a combination of events that occur in the same order, with the consecutive time intervals between consecutive pattern components remaining relatively invariant, it being assumed, as a null hypothesis, that each component is independently and randomly distributed over time. Figure 1 illustrates how the temporal relationship between A and B, defined as a critical interval, lies at the heart of the algorithms used to detect T-patterns [**23**]. These T-patterns, which were obtained by means of the algorithm incorporated within *THEME* v.5 [**23**], can help to reveal hidden structures and unobservable aspects in sports techniques. The application of this software has proved to be highly effective for studying team, individual and combat sports [**24-26**].

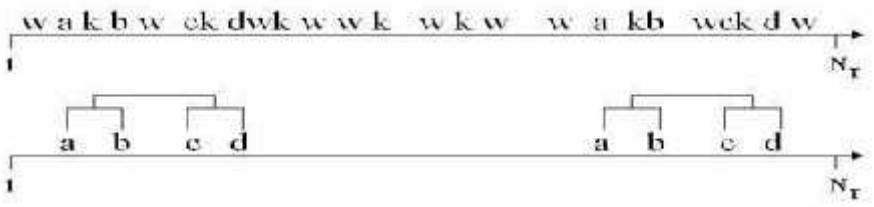

Figure 2. Even with extremely simple data the most regular Tpatterns may be hard to spot. The T-pattern on the lower axis is present in the upper axis, where the occurrences of w and k make it hard to see. The defining characteristics of T-patterns are apparent: fixed order of components occurring with similar distances between them at each pattern occurrence. The binary tree structure indicates the bottom-up detection strategy, which may or may not reflect an inherent hierarchical structure [**23**].

3 RESULTS

In accordance with the above description (Table 1) of the errors observed when participants performed the *Morote Seoi Nage* the following table (Table 2) shows the frequency and percentage of these technical errors in the study sample (*n*=46).

Table 2. Frequency and percentage of technical errors in *Morote Seoi Nage*.

	Error	Frequency	Percentage
Grip	AGR	22	47.8
Off-balance	NOB	29	63
	DOB	3	6.5
Right foot position	IRFP	26	56.5
Right arm position	FAS	9	19.6
Hip position	IHP	11	23.9
Trunk position	ITP	25	54.3
Left foot position	ILFP	33	71.3
Leg action	INSQ	32	69.6
Load action	NLHL	29	63
	NSIM	3	6.5
Throw stage	STH	32	69.6
	IAT	14	30.4
	ITFL	8	17.4
	ITTU	5	10.9
Control stage	FNC	11	23.9
	KTB	10	21.7
	FACC	32	69.6
Regaining balance	RRF	15	32.6
	RLF	5	10.9
Global	SLEX	2	4.3

Table 2 shows that the most common errors were: the lack of an initial action using both arms to put the adversary off balance (NOB); inadequate positioning of the trunk (ITP) and the feet (IRFP and ILFP) after turning in the vertical axis; a sub-optimal leg bend (INSQ); the failure of *Tori* to take *Uke's* weight on his back (NLHL); throwing the adversary's body around the side (STH); and *Tori's* use of his right arm to accompany *Uke's* fall to the floor at the end of the move (FACC). There were no significant differences (p>.05) in the number of errors detected according to the academic year.

The possibility of differences between male and female participants as regards the errors observed when performing the *Morote Seoi Nage* was tested by comparing means with a Mann-Whitney U test. This showed that none of the differences was statistically significant (p>.05).

The errors produced by participants (novices) when performing the *Morote Seoi Nage* were examined in greater depth by means of the *THEME* software (Magnusson, 1996, 2000). This program is able to detect any temporal patterns present in the data, which in this case were sequential. The analysis of these T-patterns revealed a series of important relationships associated with the emergence of sequential errors.

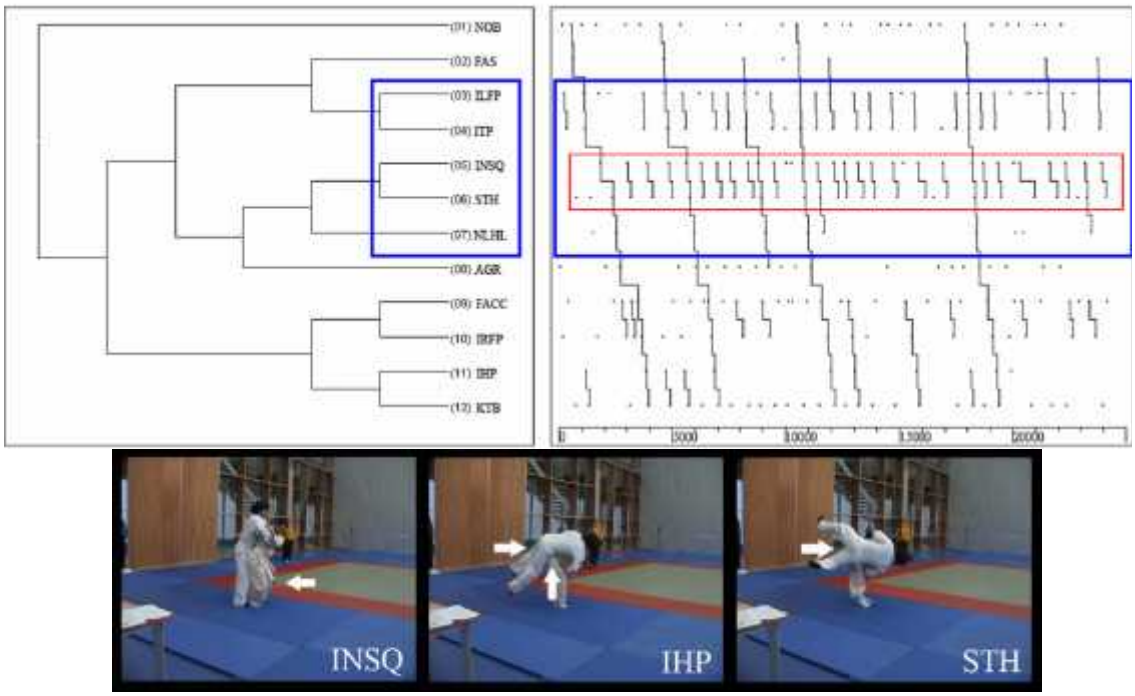

Figure 3. First T-pattern of Morote Seoi Nage.

Firstly, and as the T-pattern shows (Fig. 3), inadequate foot placement (IRFP and ILFP) leads to an incorrect positioning of both the hip (IHP) and the trunk (ITP). Similarly, these two errors are related to a sub-optimal knee bend (INSQ), which in turn is linked to *Tori's* subsequent failure to bear the adversary's weight correctly (NLHL). The inertia of this incorrect action results in *Uke's* body being thrown around the side (STH) rather than over and towards the front of the shoulder. As indicated by the first category of this T-pattern the whole of this manoeuvre begins with an incorrect off-balancing technique at the start (NOB), which is normally associated with a lack of traction of both arms.

Also noteworthy is the strong relationship between a sub-optimal knee bend and the subsequent side throw (INSQ-STH), this being important insofar as it directly influences the motor action of the throw. The results show that this occurred on 28 of the 32 occasions in which a sub-optimal knee bend was observed.

4 DISCUSSION

Common errors among the participants studied were inadequate knee bending in the launching stage of the *Morote Seoi Nage*, a failure to bear *Uke's* weight or doing so over the hip rather than the back, and throwing *Uke's* body around the side. Other typical errors committed by *Tori* were incorrect foot placement after the initial movement or an inadequate hip/trunk position after turning in the vertical axis. Furthermore, many participants failed to grip *Uke's* right sleeve properly in the pre-action (or preparatory) stage of the technique. They also failed to put their opponent off balance in the right way, used their right arm to accompany their rival's fall, and used one or both feet in order to regain their balance after performing the throw.

Despite the lack of scientific research on technical errors in judo it should be noted that the most prestigious authors associated with the sport do, in their descriptions of judo technique, reflect upon the key aspects or the most common errors made. Interestingly, the points they make, which are based on their personal and professional experience, often coincide with the typical errors revealed by the present study.

For example, some authors [**27,28**] have pointed out the importance of using both arms in the direction of the right anterior diagonal in order to perform the initial off-balancing manoeuvre. Similarly, Daigo [**27**] and Ohlenkamp [**29**] both highlight the need for *Tori*, after turning in the vertical axis, to place his feet on the inside of where *Uke's* feet are. With respect to other typical errors associated with this throw a number of authors [**4,27,30,31**] state that when performing the *Morote Seoi Nage* it is essential that *Tori* bends his knees sufficiently.

Another error committed by most of the judokas was the failure to bear Uke's weight, or to do so over the hip rather than the back, which subsequently leads to a throw around the side of Tori's body instead of over and towards the front of the shoulder. Some classic manuals do point out the importance of taking the opponent's weight on the back prior to initiating the final stage of the throw [**4,32,33**]. However, in manuals for novices this skill is rarely described [**34**]. As regards the throw around the side of Tori's body, it should be acknowledged that such errors may simply be due to a lack of experience.

The analysis of the different throws also revealed that another common error was for *Tori* to accompany *Uke's* body with his right arm until the latter's back hit the floor. The literature consulted makes no mention of this technical defect, although this error is most likely due to *Tori's* lack of confidence about throwing the opponent, since the participants here had limited practical experience in judo.

The tree diagrams show that a sub-optimal knee bend leads *Tori* to bear his adversary's weight over the hip instead of the back, which in turn results in a throw around the side of *Tori's* body rather than over and towards the front of the shoulder. Furthermore, if, when performing the manoeuvre, *Tori* leaves a gap between the posterior part of his left hip/back and the anterior part of the left side of *Uke's* body he tends to bear *Uke's* weight over his hip or even fails to take the load at all.

The most important sequence observed in the tree diagrams is also described in the extant literature. For example, Taira, Herguedas and Román [**30**] state that "the knees should be bent so as to make it easier to take *Uke's* weight over the right shoulder" (p. 207), an idea that is supported by other authors [**27,31**]. In the same vein, Kawaishi [**35**] recommends placing the feet to the inside of where the adversary's are, as a failure to do so will make it very difficult to attain an adequate hip position, which is regarded as essential for a correct performance of the manoeuvre in motor terms. Similarly, Daigo [**27**] states that the manoeuvre as a whole is greatly hindered if there is a gap between the bodies of the two adversaries, as this makes it difficult for *Tori* to take the weight of *Uke's* body and subsequently throw it. These aspects are also illustrated by the most representative tree diagrams of the technique as studied here.

Finally, mention should be made of the sequence described by the judo master Kano [**32**], which concerns one of the most significant error chains detected through the tree diagrams: "put your opponent off balance from the front or along the right anterior diagonal, take his weight on your back and throw him over your shoulder" (p. 67).

5 CONCLUSIONS

In order to avoid the errors detected here there are a number of key points to note when performing the *Morote Seoi Nage*: 1) grip with the left hand *Uke's* right sleeve at the level of the elbow or the forearm; 2) put *Uke* off balance from the front, pulling him towards you with both hands; 3) place both feet inside the adversary's feet (frontal plane) and more or less at the same level (sagittal plane); 4) close contact should be established between the posterior part of *Tori's* hip/trunk and the anterior part of *Uke's*; 5) bend the knees during the launching stage; 6) bear the weight of the adversary's body on the back; 7) throw *Uke* over and towards the front of the shoulder; and 8) control *Uke's* fall with the left arm, maintaining an upright position without moving the feet.

To conclude, the teaching and learning of this judo throw could be improved by paying special attention to the following movement sequences that enable it to be performed correctly: 1) bending the knees makes it easier for *Tori* to take *Uke's* weight on his back, which in turn enables the latter's body to be thrown over and towards the front of the shoulder; and 2) it is easier for *Tori* to take *Uke's* weight on his back if he first ensures that the posterior part of his hip/trunk is in close contact with the anterior part of *Uke's*.

5.1 PRACTICAL IMPLICATIONS

In light of the present results a number of strategies based on knowledge of performance can be proposed to help improve both the teaching and learning of the *Morote Seoi Nage* manoeuvre. For example:

1) When demonstrating the technical aspects of this throw the student's attention should be drawn towards the key points highlighted by this study. From a more theoretical point of view it could be useful for coaches to incorporate the use of video or other images that highlight the fundamental aspects of the technique, as well as the most common errors detected here. At all events, teachers or coaches should focus only on the most relevant aspects.

2) Design tasks or drills that focus the student's attention on the most significant errors and movement sequences detected in this study.

3) Draw up observation/evaluation sheets based on the category system used in this research. Students could work in groups of three, with one of them acting as an observer of the other two, who 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 of the throws performed, thereby enabling the observational analysis to be conducted after the event.

4) Improve the communication between coaches and students by providing more precise feedback after a throw is performed in training. In this regard we recommend that coaches focus initially on the most significant errors and sequences identified in this study, leaving any others for a later stage of training. It is also helpful to focus on the key aspects so as avoid overloading students with information. At all events, the results of this study can serve as the basis for different kinds of feedback (verbal, verbal with a visual demonstration or verbal with tactile help), which should be positive in nature.

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