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Detection of the Technical-Tactical Pattern of the Scoring Actions in Judo in the Men's Category of –73 kg

Running title: Pattern of the Scoring Actions in Judo

A. Gutierrez-Santiago^{a*}, L.A. Gentico-Merino^a, I. Prieto-Lage^a

^aFaculty of Education and Sport, University of Vigo, Pontevedra 36005, Spain

*Corresponding Author:

PhD Alfonso Gutiérrez-Santiago:

Professor in Faculty of Education and Sport, University of Vigo (Spain).

Mailing Address and Telephone: Facultade de Ciencias da Educación e do Deporte. Campus de A Xunqueira S/N C.P. 36005 Pontevedra (Spain). Telephone: +34 679478689. E-mail address: ags@uvigo.es

Luis Ángel Gentico-Merino

Graduate in Sports Sciences in Faculty of Education and Sport. E-mail:

luisgentico@gmail.com

PhD Iván Prieto-Lage.

Professor in Faculty of Education and Sport, University of Vigo (Spain).

E-mail address: ivanprieto@uvigo.es

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Detection of the Technical-Tactical Pattern of the Scoring Actions in Judo in the Men's Category of –73 kg

The scoring actions determine the judoka winner in a combat. The scientific community has studied them, but these studies are especially descriptive. To this end, the purpose of this study is to discover and analyze the technical-tactical patterns of the scoring actions in judo combat. Ninety-one scoring actions were analyzed (-73kg males, Judo World Championship 2017) using different commonly used analysis techniques within the observational methodology: traditional statistical analysis, T-Patterns detection, sequential analysis delays and polar coordinates analysis. The tendency of scoring with leg and arm projections prevails (seoi-otoshi, ouchi-gari, tai-otoshi and uchi-mata). The more efficient technique on the ground was yoko-shiho-gatame. The waza-ari is three times more frequent than the ippon. The actions score mainly during the final stages of combat. The judokas with favorable scores score more points through immobilizations, with scores equal to leg techniques and with scores against sacrificial techniques. It is important to conduct the combat's initiative because in most the actions, the judoka that scores has no penalties and the one who does not score does. A common pattern is achieving a waza-ari with a direct leg attack technique or a static arm technique.

Key words: judo, technique, score, T-Pattern.

1. Introduction

The scoring actions are decisive to determine the winner of the combat. The analysis and observation of these actions becomes enhanced by the advances in programming and informatic codification (Hernández-Mendo et al., 2014). This development allows us to explain, predict, and even intervene about the factors that condition the sports competition success (Liebermann et al., 2002).

A logical breakthrough is to use analysis techniques that are different from those that are traditional. Therefore, in this study we applied four analysis techniques (traditional statistical analysis, T-Patterns detection and polar coordinates analysis). Even though these are common techniques used in the observational methodology, it is not that common to use them collectively (Tarragó et al., 2017) due to the human and material efforts that they require. New analysis techniques (T-Patterns detection, sequential analysis of delays and polar coordinates analysis) have not been used to analyze judo combat. Using this combination of techniques lies in the fact that the results obtained through an analysis technique are corroborated with the remaining techniques, and also each technique has its particular trait that differentiates it from the rest, providing additional data.

The pretense is within the complementarity of analysis is to identify which are the technical-tactical actions that score in judo. The results of this research will help to improve the training methods and systems, mainly directed to the technical-tactical aspects of combat.

The rules of judo are constantly evolving (Calmet, Pierantozzi, Sterkowicz, Takito, & Franchini, 2017, 2018; Katicips, Júnior, Kons, & Detanico, 2018), where changes in the score, the grabbing and the allowed action techniques, the combat time or the penalties take place. Therefore, the athletes have to change their technical-tactical patterns to adapt to this changing situation. Ito, Hirose, Nakamura, Maekawa and Tamura (2014) identified a change

in the technique's tendency due to the rules modification. Ceylan and Balci (2017), Katicips et al. (2018) and Calmet, Pierantozzi, Sterkowicz, Takito and Franchini (2017) observed that the changes in ruling did not affect the ippon number, but it did raise the number of waza-ari and lower the number of penalties.

The movement prior to the projection is also important. Franchini, Sterkowicz, Meira, Gomes and Tani (2008) assessed that during the period of 1995-2001, most of the judokas used at least four movements before the projection: backwards right, backwards left, forward right and forward left.

The grip is another very important technical-tactical factor. Pierantozzi, Nerozzi, Piras and Lubisco (2009) assessed that in the final phase of the male's World Championship of 2007, the most common grip was lapel-wrist, and the second most common was lapel-sleeve. With changes in the ruling about not allowing a continued grip on the wrist, this grip will transform into gripping the sleeve, as Collins and Challis (2013) demonstrated later.

Knowing when the technique is performed is also important. Sterkowicz and Franchini (2001) assessed that scoring actions mostly happen within the combat's last minute. Probably because of the concentration of lactate in the blood (10-14 Mm/l) and the fatigue accumulation at the end of the combat (Castarlenas & Solé, 1997). If it extends over time, it is understandable that the competitor shows the symptoms, making it easier for the opponent to score.

It is important to know and understand the techniques used in combat, and because of this, numerous studies have been researched in this field. At the World Championship in 2011 (Stanković, Cuk, Milosevic, & Stamenkovic, 2015) the most used projections were te-waza (35.87%), ashi-waza (34.82%), sutemi-waza (21.94%) and koshi-waza (7.36%). In 2013, after the changes in the ruling (Miller, Collins, Stewart, & Challis, 2015), the most used techniques

were (40%), te-waza (36.25%), sutemi-waza (15%) and koshi-waza (8.75%). In subsequent years (Adam, Klimowicz, & Pujso, 2016) the same dynamic took place among projections (with a variation within percentages), and on the ground the most used were osaekomi-waza (64%), kantsetsu-waza (19%) and shime-waza (17%).

In regard to the category under study (male -73kg), Witkowski, Maśliński and Kotwica (2012) observed at the JJ.OO. in 2008 that 38 combats out of 43 (88.37%) finished thanks to a scoring action. Extrapolating their results to the judo ruling of this research (counting the yuko as waza-ari, and waza-ari-awasete-ippon as two waza-ari) we are able to observe that 46.51% were ippon and 39.53% were waza-ari. From these actions, 69.77% of the combats finished standing and 18.6% on the ground. Only five of the combats were decided by gold techniques (GS). The most used projections were te-waza (34.88%), ashi-waza (20.93%), sutemi-waza (6.97%) and koshi-waza (6.97%), and on the ground osaekomi-waza (16.27%) and kantsetsu-waza (2.32%). In regard to the specific technique, the most used were seoi-nage (9.30%), kata-guruma (9.30%), uchi-mata (6.97%), kesa-gatame (6.97%) and o-soto-gari (4.65%).

With the stated above, the scientific communities are concerned about the understanding the scoring actions in judo. Nevertheless, the problem is that the studies are essentially descriptive. This is the reason why the aim of this research is to discover and analyze the technical-tactical scoring actions in judo combat.

2. Method

In this research we used an observational methodology (Anguera & Jonsson, 2003), that offers the necessary rigor and flexibility to study the behaviors that present themselves naturally in a judo's combat. The performed observation is systematic, open and non-participant (Borrie, Jonsson, & Magnusson, 2002).

2.1 Design

The used observational design (Anguera, Blanco-Villaseñor, Hernández-Mendo, & Losada, 2011) is nomothetic (all the scoring actions in all the participants), follow up (knowing the stability of the behavior performed in different combats) and multidimensional (the dimensions related to the criteria of the observation's instrument). We will highlight these series of decisions from this design.

2.2 Participants

The sample was obtained from the judo World Championship held in 2017 (Budapest, Hungary). All the male competitors from the category -73kg participated. The total of analyzed combats was 76 (in 5 combats there were no scoring actions). The analysis units of this study were the scoring actions ($n = 91$). They were analyzed using public domain audiovisual material, according to Helsinki Declaration principals (Harriss & Atkinson, 2015).

2.3 Instruments

The observational instrument developed *ad hoc* is the Score Action- Judo (SA-JUDO), a combination of format and category system (Gutiérrez-Santiago, Prieto, Camerino, & Anguera, 2011) that contemplates a collective of criteria that will allow to determine the

technical-tactical characteristics of scoring actions in judo combat, and which meets the conditions of thoroughness and exclusivity.

Table 1 near here

All scoring actions were codified and registered by LINCE v.1.4 (Gabin, Camerino, Anguera, & Castañer, 2012).

2.4 Procedure

The sample was obtained from the International Judo Federation's website. According to the American Psychological Association (2002), an observational study in a natural environment with public videos obtained from the media that does not imply an experimentation does not need the informed consent of the competitors.

Behind the design of the observation instrument, the validity of its construct was carried out through its coherence with the theoretical framework and the consult of two experts in observational methodology and judo, who showed their degree in compliance with the instrument to be up to 96%.

After a proper training in the use of the instruments, the data was recorded by expert observers. We guarantee the rigor in the codification process (Blanco-Villaseñor & Anguera, 2000) controlling the quality of the registered data through calculating the intra concordance and inter observers using the Cohen kappa coefficient (Cohen, 1968) calculated through LINCE software. The intra-observer concordance was previously performed on a third of the actions, obtaining a kappa value of 0.99 in first observer and of 0.92 in the second. Subsequently, the calculus of the concordance inter-observer was carried out for the totality of techniques obtaining a kappa value of 0.88.

After registering everything, we get an Excel document with the all the codes of the registered behaviors in a sequential order, with their temporality and expressed duration in frames. The versatility of this file will allow to carry out subsequent transformation for different analysis (Gutiérrez-Santiago et al., 2011).

2.5 Data Analysis

All the statistical analysis was carried out through the IBM- Statistical Package for the Social Sciences, version 20.0 (IBM-SPSS Inc., Chicago, IL, USA). The relation among the different categories was calculated through the test chi-square (χ^2). The statistics materiality was undertaken for $p < 0.05$.

To identify the scoring actions, we calculated the T- Patterns with Theme v.5.0. (Magnusson, Burgoon, & Casarrubea, 2016) with a significance level of 0.005 (the percentage of accepting a critical range due to chance is of 0.5%). First of all, we determined a minimum number of occurrences of five and later, of three occurrences without discarding occurrence patterns greater than or equal to five and three. The reduction of the redundancy was activated to 90% to avoid the occurrence of similar T-Patterns. This software reveals hidden structures and non-observable aspects of the sports technique (Casarrubea et al., 2015). Its implementation is extremely effective in the sport's science (Magnusson et al., 2016). Its graphic representation shows the behaviors subjected to this study, manifesting the existing connections between the different technical-tactical aspects of the scoring actions. It is formed by two parts. The left quadrant represents the connection among behaviors. Its interpretation must be carried out as a tree diagram, from the top to the bottom. The right quadrant indicates how many times such connections occur, through lines that go from the upper part to the lower part.

The sequential analysis of delays was carried out through GSEQ5 (Bakeman & Quera, 2011). For the retrospective, we considered from the delay -1 to 9 -. The projectivity was not considered because there were no subsequent behaviors after the focal category. Following Bakeman and Gottman(1986) and Tarragó et al., (2017), it is considered that results greater than 1.96 are significative ($p < 0.05$) and imply an activation connection between the criteria behavior and the conditioned behavior, and the results lower than or equal to -1.96 are significative ($p < 0.05$) and imply a inhibition connection between such behaviors.

The analysis of polar coordinates was calculated with the HOISAN program (Hernández-Mendo, López-López, Castellano, Morales-Sánchez, & Pastrana, 2012), using the analytic technique of Sackett (1980) in the retrospective genuine variant (Gorospe & Anguera, 2000) used in numerous investigations (e.g., Tarragó et al., 2017).The behavioral relationship is determined by the quadrant where the behavior takes place. Thus, Quadrant I indicates that both of the conducts mutually activate in both directions. Quadrant II indicates that the conditioned behavior activates the focal behavior and such, inhibits the first one. Quadrant III indicates that such behaviors mutually inhibits in both directions. And Quadrant IV indicates that the focal conduct activates the conditioned conduct and inhibits the focal.

3. Results

3.1 Statistical Analysis

Table 2 shows the descriptive analysis and Table 3 shows the connection between the categories of scored actions.

*** Tables 2 and 3 near here***

Fighting standing upright produces more scoring actions within the third and fourth minute. It highlights the absence of actions with points of ground work within the first minute

or the Golden Technique. There are no statistical differences among the criteria categories of time, not standing or ground work, but there are on the standing and ground work distributions.

Most of the actions that score standing take place with an even score. Ground work takes place with a lead in the score. Winning the combat means scoring almost three times more with ground work actions than standing actions. There are significant statistical differences among the categories of these criteria in a standing situation and on its distribution standing and ground work.

A judoka that scores tends to have no penalties (63.5%) and the opponent has at least a shido (54.1%). In both judokas, significant statistical differences were identified among the categories of these criteria in a standing situation, ground work, but not in its standing and ground work distribution.

The competitors that score through a projection do it mainly through leg and arm techniques: seoi-otoshi, ouchi-gari, tai-otoshi and uchi-mata. There is a statistical difference between the different projections. Among the ground techniques that score there are also significant statistical differences, scoring mainly with immobilizations. The most used techniques were yoko-shiho-gatame, ude-hishigi-juji-gatame and kuzure-kesa-gatame.

Usually, waza-ari is achieved by fighting upright and an ippon on the ground. Significant statistical differences were verified among the categories of the criteria scoring in a standing situation, on the ground, and by standing and ground work distribution.

There are significant statistical differences ($\chi^2=58.645$; $p=0.000$) in connecting the partial score to the scoring techniques. If the judoka is winning, he achieves more points

through immobilizations, while if the score is balanced, he achieves points with leg techniques, and if he's losing he scores with sacrificial techniques.

3.2 Analysis through T-Patterns

The identification of T-Patterns was carried out from two perspectives: individual and grouped. The individual corresponds to the categories of the observational instrument. This implies that the "technique" criteria is formed by the classification techniques of Kodokan (68 projections and 38 control techniques), with a high dispersion of data, and the possibility of identifying patterns decreases considerably. For this reason, the search of patterns from a grouped perspective was carried out in such a way that the 100 techniques were grouped in the classificatory groups established by Kodokan: arm, leg, hip, sacrifice, immobilizations, and strangling and dislocation techniques. With these strategies, the dispersion of data decreased from 100 possibilities to seven, and the pattern identification was favored. Table 4 shows the descriptive results of the different search combinations.

*** Table 4 near here***

Table 5 shows the selected patterns that relate to our subject of study.

Table 5 near here

Direct Attack Patterns

Arm Techniques (Te waza)

The lower part of the pattern of Figure 1A shows that the judoka achieves waza-ari eight times with a direct attack through seoi-otoshi (js,soo,w) while static/without movement (st). Seventy-five percent the time (six out of eight, Table 5-I.3) both judokas are gripping the lapel of the adversary with just one hand js,l jns,l). In 83% (five out of six, Table 5-I.2), such

circumstance occurs with an even score (even). And from this, 60% (three out of five, Figure 1) take place within the first or second minute of the combat (2m).

Figure 1 near hear

In Table 5 (I.5-6) other seoi-otoshi patterns that provide data from the combat's moment, partial score, penalties and movement can be observed.

We also identified patterns that achieve a waza-ari through the tai-otoshi technique from a static position, where different kinds of grip and the partial situation of the score are shown (Table 5 I.7-8).

If the arm techniques are grouped, the lower part of Figure 1B indicates that the judoka scores waza-ari (js,tewz,w) 13 times when static (st). Thirty-eight percent of this (five of 13) happens when the score is even (even) and when both competitors (js and jns) have one hand grabbing the opponent's lapel (l). Table 5 (I.18) shows projections while static and with a crossed grip.

Table 5 (I.19 to 24) shows arm technique patterns that score where the judoka grip indicates, combat's moment, partial score and movement.

Leg Techniques (Ashi waza)

The lower part of Figure 1C shows that the competitor achieves waza-ari five times with the ouchi-gari technique (js,oug,w) while static (st). Eighty percent of these (four out of five) happen when the adversary has two shido on the score (s2,jns). Sixty percent are achieved with a back-sleeve grip (Table 5-I.9). On four occasions, waza-ari is scored through this technique during the combat's last minute (Table 5-I.12). The judoka is also able to score waza-ari while static with uchi-mata (Table 5-I.13).

If we group the leg techniques, the pattern identification increases considerably, achieving to score nine times with ippon (js,ashiwz,ip). Sixty-six percent of this (Table 5-I.25) is achieved when the adversary has a lapel-sleeve grip and the score is even. Forty-four percent of the time, the judoka that scores also has the same grip (Figure 1D) and it has a back-sleeve grip four times (Table 5-I.27).

When the competitor achieves waza-ari with a leg technique (js,ashiwz,w) up to 30 times, a large number of patterns can be observed (Table 5-I.28 to 47) that reveal technical-tactical aspects of the grip of both competitors, penalties, combat's moment, partial score and movements.

Sacrifice Techniques (Sutemi waza) and Hip Techniques (Koshi waza)

Table 5 (I.14) shows that the judoka scores waza-ari with sumi-gaeshi three times when he has a crossed grip. From a grouped perspective, we observe this same circumstance with other grips (Table 5-I.49 to 52).

Hip patterns were only identified when the techniques were grouped together. Table 5 (I.48) shows that the judoka scores waza-ari four times with these techniques when static.

Counterattacks and Combinations

Counterattacks and combinations are only identified when we group the techniques. Table 5 (I.53) shows a pattern that indicates that when the opponent performs a leg technique that does not score, the competitor that scores counterattacks with another leg technique that achieves waza-ari up to nine occasions. Table 5 (I.54 to 57) shows counterattack patterns that reveal the grip of judokas, partial scores and the combat's moment and movements.

Table 5 (I.58-59) shows two patterns where the competitor combines a leg technique that initially does not score to perform other or the same leg technique achieving ippon up to four occasions.

3.3 Analysis through Polar Coordinates

This analysis confirms some of the previously obtained results and provides some other new ones. In the center of the diagram there is the focal category (ip, w o sa). The rest of the categories of the study (conditionate categories) have been connected with the focal category.

When the judoka fights on the floor, they have a lead on the score favors the point (Figure 2.A.3). When the fight takes place standing up, the ippon is not favored during the first and second minute (Figure 2.A.1), the point is favored on the ground between the first and third minute, and within the last minute of the combat, the point is not favored(Figure 2.A.3). Having one or two penalties fighting standing up favors the opponent achieving a waza-ari (Figure 2.A.2). On the contrary, having one shido fighting on the ground does not favor the opponent scoring (Figure 2.A.3).

Figure 2 near hear

The point gets favored (Figure 2.B.3 black) when the judoka has a lapel-sleeve grip, or with a single hand on the back, to the lapel or when the opponent has a sleeve-sleeve grip or a lapel-sleeve grip-. The ippon takes place when the judoka performs a bear hug or when the opponent grips the adversary's lapel with a single hand (Figure 2.B.1 black), and the waza-ari when the judoka has a sleeve-sleeve grip or when the opponent has the same grip (Figure 2.B.2 black).

The ippon takes place when the judoka moves backwards, forward or backward right (Figure 2.B.1 red). The waza-ari takes place when the judoka is static or when the opponent

moves backwards or remains static (Figure 2.B.2 red). Figure 2.B.3-red shows two new movements that favor the score, to the right or forwards and to the right.

The projections that favor the waza-ari are (Figure 2.C.2, from lowest to highest significance): kouchi-gari, uchi-mata-sukashi, tsuri-goshi, sumi-otoshi, tai-otoshi, sumi-gaeshi, osoto-gari, kata-guruma, uchi-mata or seoi-otoshi. The projections that favor the ippon are (Figure 2.C.1, from lowest to highest significance): uchi-mata, soto-makikomi, ouchi-gaeshi, harai-goshi, ura-nage, ouchi-gari, sasae-tsurikomi-ashi and kosoto-gake. When the opponent performs sasae-tsurikomi-ashi or ura-nage, it favors the ippon, which implies that there is a counter attack situation. We assess, from lowest to highest significance, that when judoka performs kuzure-kesa-gatame, ude-hishigui-juji-gatame or yoko-shiho-gatame, he achieves ippon (Figure 2.C.3).

4. Discussion

We verified that 68.6% of the scoring actions achieve waza-ari and 31.4% ippon, data that does not agree with Ceylan and Balci (2017) -waza-ari 56.14% and ippon 43.86%- , and neither with Witkowski, Maśliński and Kotwica (2012) in the category of -73Kg -waza-ari 39.53% and ippon 46.51%-. This situation has led to an increase in the combat's duration, increasing the gold's technique for the combats that end within the time: 11.62% (Witkowski et al., 2012), 25.11% (Calmet et al., 2017), and 20% in the current research.

We assess that the judoka that scores has no penalties (63.5%) and the opponent does (54.1%). Based on these results and taking into account that shidos are three times more frequent in the losers than in the winners (Escobar-Molina, Courel, Franchini, Femia, & Stankovic, 2014), having a lead in combat is considered to be very important.

The most efficient projections were ashi-waza (43.5%) and te-waza (31.8%); on the ground the osaekomi-waza reaches 70%, kantsetsu-waza 20% and shime-waza 10%. This matches other studies (Adam, Klimowicz, & Pujszo, 2016; Miller, Collins, Stewart, & Challis, 2015; Stanković, Cuk, Milosevic, & Stamenkovic, 2015; Witkowski, Maśliński, & Kotwica, 2012) where the techniques te-waza and ashi-waza are the most used, and with a similar distribution for the techniques on the ground. Nevertheless, if we focus on the particular performed technique, there are discrepancies with Witkowski, Maśliński and Kotwica (2012), where the most efficient projections were (9.30%), kata-guruma (9.30%), uchi-mata (6.97%), kesa-gatame (6.97%) and o-soto-gari (4.65%), while in this research they were (14.1%), ouchi-gari (11.8%), tai-otoshi and uchi-mata (8.2%).

The connection between the score's situation and the scoring form has not been studied in judo's doctrine, an aspect we consider important to address combat and plan the trainings. We assert that the judokas that have a lead in the score get more points through the immobilizations, if the score is even with leg techniques, and if they are losing with sacrifice techniques.

Franchini, Sterkowicz, Meira, Gomes and Tani (2008) observed that most of the judokas used four movements to project: backwards right, backwards left, forward right and forward left. We verified that the judoka that scores never moves forwards and to the left, furthermore, a lot of the scoring actions were performed from a static position (48.2%). This implies that nowadays judo is evolving towards explosive actions, seeking impromptu actions.

Pierantozzi, Nerozzi, Piras and Lubisco (2009) and Collins and Challis (2013) assert that the most used grip is the lapel-sleeve. We noticed the same tendency in both the judoka that scores (34.1%) and in the opponent (29.4%). The polar coordinates made it evident that

having this grip favors the point. The grip sleeve-sleeve favors the waza-ari, probably because this grip used actively (seeking to perform an action) allows the performance of techniques indistinctively from left or from right, on the contrary, if it is used defensively, it provides less control over the opponent.

We agree with Sterkowicz and Franchini (2001) on the fact that most of the projections that score take place during the final minutes of the combat, up to 40% of such. We asserted that all the actions that take place on the floor and score usually take place between the first and the fourth minute of the combat. It is likely due to the fact that during the first minute, there is equality among the physical capacities of the judokas, and from the third minute on, as Castarlenas and Solé (1997) point out, the accumulation of fatigue may prevent the judokas from keeping the necessary control over the opponent to finalize with an action on the floor.

Ascertaining the complementarity of the analyzed techniques used to determine the technical-tactical technique of the scoring actions and, taking into account that this study was based on the male category -73kg, we consider it necessary to carry out this investigation in the rest of the female and male categories to verify that there are differences between the weight categories in men and women.

5. Conclusions

It is important for the athlete to have the lead on the opponent because the opponent that scores does not have penalties, and the one who does not, does. The judokas with the leading score get more points through the immobilizations; if the score is even, they do it through leg techniques and if they are losing through sacrifice techniques. The projections score, mainly, in the final phases of the combat, and the floor actions do not take place throughout the first minute or throughout the time of golden score.

The projections mostly score from a static position. A common pattern is to achieve waza-ari with a direct leg or arm attack in a static position. The most effective projections were seoi-otoshi, ouchi-gari, tai-otoshi and uchi-mata. The most effective immobilization was yoko-shiho-gatame. The waza-ari is three times more frequent than the ippon. It is common to get waza-ari by standing and ippon by fighting on the ground.

The most used grip is the lapel-sleeve. The scoring is favored with this grip, with a single hand on the back or on the lapel, or when the opponent has a sleeve-sleeve grip or a lapel-sleeve grip.

6. Disclosure statement

The authors report no conflict of interest.

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Table 1. *Observational Instrument Description*

Criteria	Code	Description	Code	Description
Time	1M	1 st min: 0'00" - 1'00"	3M	3 rd min: 2'01" - 3'00"
	2M	2 nd min: 1'01" - 2'00"	4M	4 th min: 3'01" - 4'00"
	GS	Golden Score: extra time – tiebreaker		
Partial Score	WIN	The judoka that achieves the scoring actions is winning		
	EVEN	The judoka that achieves the scoring actions has an even score		
	LOSE	The judoka that achieves the scoring actions is losing		
Penalties	S1	When a scoring actions is achieved the judoka has a shido		
	S2	When a scoring actions is achieved the judoka has two shido		
Fighting Situation	UPF	The scoring action is achieved standing up		
	GRF	The scoring action is achieved on the ground		
Judoka	JS	Judoka that scores	JNS	Judoka that does not score
Grip	LS	Lapel - Sleeve	SB	Sleeve-Back
	SS	Sleeve - Sleeve	CG	Crossed Grip
	LL	Lapel - Lapel	BH	Bear Hug
	S	Grip performed with a hand over sleeve of the opponent		
	L	Grip performed with a single hand over the lapel of the opponent		
	B	Grip performed with a single hand over the back of the opponent		
Movement	FW	Direction of the movement prior the scoring action: Forward		
	FWR	Idem: Forward Right	BWL	Idem: Backwards left
	FWL	Idem: Forward Left	R	Idem: Right
	BW	Idem: Backwards	LFT	Idem: Left
	BWR	Idem: Backwards Right	TS	Tai Sabaki
	ST	Static		
Score	SA*	Scoring Action. It is the same if it is Ippon or Waza-Ari		
	IP	Ippon	W	Waza-Ari
Techniques	TEWZ*	Te-Waza	TOS	Tai-otoshi
	KGU	Kata-guruma	SON	Seoi-nage
	SOO	Seoi-otoshi	UMT	Uchi-mata-sukashi
	KOSHIWZ*	Koshi-Waza	OGO	O-goshi
	HRG	Harai-goshi	STG	Sode-tsure-komi-goshi
	KOG	Koshi-guruma	TSG	Tsure-goshi
	ASHIWZ*	Ashi-Waza	STA	Sasae-tsure-komi-ashi
	DAB	De-ashi-harai	UMA	Uchi-mata
	KSG	Ko-soto-gake	UMG	Uchi-mata-gaeshi
	KUG	Ko-uchi-gari	OSGA	O-soto-gaeshi
	OSG	O-soto-gari	HGA	Harai-goshi-gaeshi
	OSO	O-soto-otoshi	OUGA	O-uchi-gaeshi
	OUG	O-uchi-gari		
	SUTWZ*	Sutemi-Waza	UNA	Ura-nage
	SUG	Sumi-gaeshi	SMK	Soto-makikomi
	TNG	Tomoe-nage	TNO	Tani-otoshi
	SOT	Sumi-otoshi	YOT	Yoko-otoshi
	OSAEWZ*	Osaekomi-Waza	KKG	Kuzure-kesa-gatame
	TSHG	Tate-shiho-gatame	SAG	Sankaku-gatame
	YSG	Yoko-shiho-gatame		
	SHIMEWZ*	Shime-Waza	SGJ	Sode-guruma-jime
	OEJ	Okuri eri-jime		
	KANSETWZ*	Kansetsu-Waza	UGR	Ude-garami
	JGT	Ude-hishigi-juji-gatame		

*Grouped Category

Table 2. The frequency and percentage of the categories in relation with scoring actions.

FIGHT STANDING UP									
Criteria	Category	Frequency		%		Criteria	Category	Frequency	%
Time	1M	13		15.3		Technique			
	2M	17		20		Te-Waza	TEWZ*	27	31.8
	3M	21		24.7			KGU	5	5.9
	4M	17		20			SOO	12	14.1
	GS	17		20			TOS	7	8.2
Partial	WIN	10		11.8			SON	1	1.2
Score	EVEN	66		77.6			UMT	2	2.4
	LOSE	9		10.6		Koshi-Waza	KOSHIWZ*	6	7.1
Penalties		JS	JNS	JS	JNS		HRG	1	1.2
	S1	27	32	31.8	37.6		KOG	1	1.2
	S2	4	14	4.7	16.5		OGO	1	1.2
	No shido	54	39	63.5	45.9		STG	1	1.2
Grip		JS	JNS	JS	JNS		TSG	2	2.3
	LS	29	25	34.1	29.4	Ashi-Waza	ASHIWZ*	37	43.5
	SS	9	9	10.6	10.6		DAB	2	2.3
	LL	1	3	1.2	3.5		KSG	5	5.9
	SB	19	15	22.4	17.6		KUG	2	2.3
	CG	8	4	9.4	4.7		OSG	4	4.7
	BH	6	6	7.1	7.1		OSO	1	1.2
	S	2	2	2.4	2.4		OUG	10	11.8
	L	10	15	11.8	17.6		STA	2	2.3
	B	1	1	1.2	1.2		UMA	7	8.2
Movement		JS	JNS	JS	JNS		UMG	1	1.2
	FW	9	10	10.6	11.8		OSGA	1	1.2
	FWR	6	2	7.1	2.4		HGA	1	1.2
	FWL	0	5	0	5.9		OUGA	1	1.2
	BW	10	9	11.8	10.6	Sutemi-Waza	SUTWZ*	15	17.6
	BWR	5	0	5.9	0		SUG	4	4.7
	BWL	2	8	2.4	9.4		TNG	1	1.2
	R	7	3	8.2	3.5		SOT	2	2.3
	LFT	3	8	3.5	9.4		UNA	4	4.7
	TS	0	1	0	1.2		SMK	2	2.3
	ST	41	5	48.2	5.9		TNO	1	1.2
	No	0	34	0	40		YOT	1	1.2
						Score	Ippon Waza Ari	16 69	18.8 81.2
FIGHT ON THE GROUND									
Criteria	Category	Frequency		%		Criteria	Category	Frequency	%
Time						Technique			
	2M	6		30		Osaekomi-Waza	OSAEWZ*	14	70
	3M	6		30			TSHG	1	5
	4M	8		40			YSG	9	45
Partial	WIN	17		85			KKG	3	15
Score	EVEN	3		15			SAG	1	5
Score	Ippon	17		85		Shime-Waza	SHIMEWZ*	2	10
	Waza-Ari	3		15			OEJ	1	5
Penalties		JS	JNS	JS	JNS		SGJ	1	5
	S1	3	12	15	60	Kansetsu-Waza	KANSETWZ*	4	20
	S2	1	1	5	5		JGT	3	15
	No shido	16	7	80	35		UGR	1	5

*Grouped Category; JS=Judoka that scores; JNS=Judoka that does not score

Table 3. *Connection among the technical-tactical categories of scoring actions.*

		Standing	Ground	Standing-ground Distribution
Time	χ^2	1.882	0.400	10.694*
	sig.	0.757	0.819	0.030*
Partial Score	χ^2	75.129**	9.800**	45.557**
	sig.	0.000**	0.002**	0.000**
Penalties				
JS	χ^2	44.212**	19.900**	2.254
	sig.	0.000**	0.000**	0.324
JNS	χ^2	11.741**	9.100*	3.859
	sig.	0.003**	0.011*	0.145
Techniques	χ^2	28.271**	12.400**	
	sig.	0.000**	0.002**	
Score	χ^2	33.047**	9.800**	32.900**
	sig.	0.000**	0.002**	0.000**

χ^2 = chi square; sig.: significance; * $p \leq 0.05$; ** $p \leq 0.01$

Table 4. Amount and types of patterns according to different search strategies.

	Individual		Grouped	
	Search 5 O	Search 3 O	Search 5 O	Search 3 O
Total Patterns	142	301	164	353
Discarded Patterns	135	269	138	273
Scoring Actions Patterns	7 / 4.9%	32 / 10.6%	26 / 15.8%	80 / 22.6%
Direct Attacks in Standing Position	6	27	18	56
Ippon	0	0	3	7
Waza Ari	6	27	15	49
Combination	0	0	0	2
Ippon	0	0	0	2
Waza-Ari	0	0	0	0
Counter-Attack	0	0	2	6
Ippon	0	0	0	0
Waza-Ari	0	0	2	6

O: Occurrences

Table 5. Scoring actions selected T-Patterns.

DIRECT ATTACKS			DIRECT ATTACKS		
INDIVIDUAL PERSPECTIVE			GROUPED PERSPECTIVE		
Direct Attacks in Standing Position			Direct Attacks in Standing Position		
Seoi-otoshi	O	I	Ashi waza	O	I
(2m (((even upf) js,l) jns,l)(js,st js,soo,w))	3	1	((even (upf jns,ls)) js,ashiwz,ip)	6	25
((even upf)((js,l jns,l)(js,st js,soo,w)))	5	2	((((even upf)(jns,ls js,ls)) js,ashiwz,ip)	4	26
((js,l jns,l)(js,st js,soo,w))	6	3	((even upf)(js,sb js,ashiwz,ip))	4	27
(js,st js,soo,w)	8	4	(js,st js,ashiwz,w)	15	28
((gs even)(s1,js upf) js,soo,w)	3	5	((s2,jns upf)(js,st js,ashiwz,w))	7	29
(js,bw js,soo,w)	3	6	(even ((s2,jns upf)(js,st js,ashiwz,w)))	5	30
Tai-otoshi			(gs (even ((s2,jns upf)(js,st js,ashiwz,w))))	3	31
((even (upf jns,ls))(js,st js,tos,w))	3	7	(even ((s2,jns upf js,ls))(js,st js,ashiwz,w))	3	32
(jns,sb js,tos,w)	3	8	((((even s1,jns)(upf js,ls)) js,ashiwz,w)	6	33
Ouchi-gari			((((even s1,jns)(upf jns,ls)) js,ashiwz,w)	6	34
(upf (js,sb (js,st js,oug,w)))	3	9	((((even s1,jns)(upf jns,ls) js,ls)) js,ashiwz,w)	4	35
((s2,jns upf)(js,st js,oug,w))	4	10	((((even (s1,js s1,jns))(upf jns,ls) js,ls)) js,ashiwz,w)	3	36
(js,st js,oug,w)	5	11	((s1,js upf)(js,sb js,ashiwz,w))	4	37
((4m upf) js,oug,w)	4	12	((gs even)((s1,js s1,jns)(jns,sb js,ashiwz,w)))	3	38
Uchi-mata			(js,sb js,ashiwz,w)	5	39
(js,st js,uma,w)	3	13	(js,ts js,ashiwz,w)	4	40
Sumi-gaeshi			(jns,ts js,ashiwz,w)	7	41
(js,cg js,sug,w)	3	14	(jns,fw js,ashiwz,w)	4	42
GROUPED PERSPECTIVE			(jns,bh js,ashiwz,w)	3	43
Direct Attacks in Standing Position			(jns,sb js,ashiwz,w)	4	44
Te waza	O	I	((jns,sb js,st) js,ashiwz,w)	3	45
((((even upf) js,l) jns,l)(js,st js,tewz,w))	5	15	(jns,ss js,ashiwz,w)	5	46
((js,l jns,l)(js,st js,tewz,w))	5	16	(jns,ss (js,ts js,ashiwz,w))	3	47
(js,st js,tewz,w)	13	17	Koshi waza		
(js,cg (js,st js,tewz,w))	3	18	(js,st js,koshiwz,w)	4	48
(jns,sb js,tewz,w)	4	19	Sutemi waza		
(js,ss js,tewz,w)	7	20	(js,sb js,sutwz,w)	3	49
((3m upf)(js,ss js,tewz,w))	3	21	(js,bh js,sutwz,w)	3	50
((1m even)(js,ss js,tewz,w))	3	22	(js,cg js,sutwz,w)	4	51
(js,ss (js,bw js,tewz,w))	3	23	(js,b js,sutwz,w)	4	52
(js,bw js,tewz,w)	4	24			
COUNTERATTACKS	O	I	COMBINATIONS	O	I
GROUPED PERSPECTIVE			GROUPED PERSPECTIVE		
(jns,ashiwz js,ashiwz,w)	9	53	(js,ashiwz js,ashiwz,ip)	4	58
(jns,st (jns,ashiwz js,ashiwz,w))	5	54	((((3m even)(upf jns,ls))(js,ashiwz js,ashiwz,ip))	3	59
(jns,ashiwz (js,st js,ashiwz,w))	4	55			
((js,ls jns,ls)(jns,ashiwz js,ashiwz,w))	3	56			
((gs (even upf)(jns,ashiwz js,ashiwz,w))	3	57			

O: Occurrences I: Identifier on the text

Figure 1. Examples of direct attack patterns with leg and arm projections

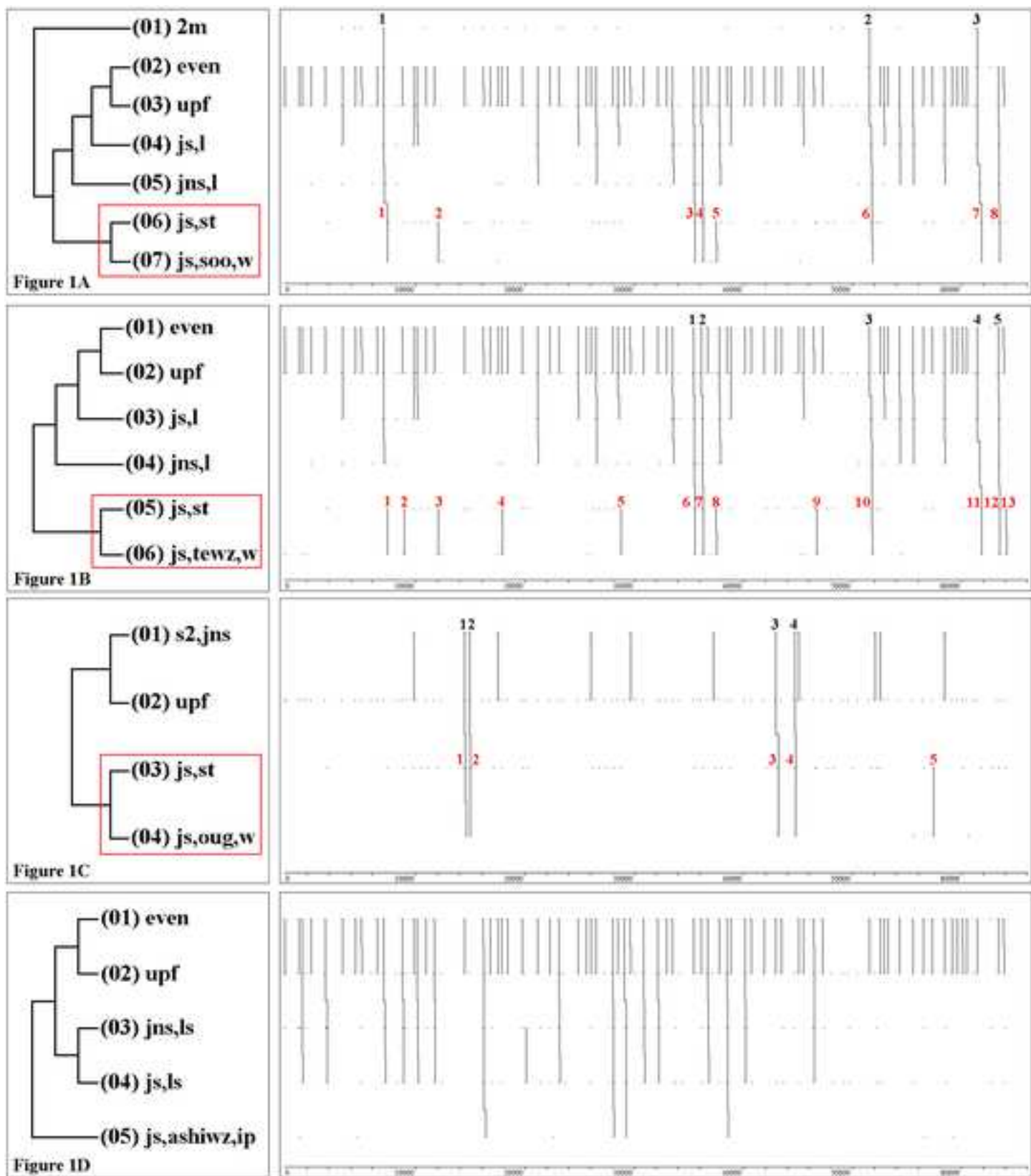


Figure 2. Polar Coordinates

