UNIVERSITY OF BATH

TITLE PAGE

Programme of Study:

☐ Foundation Degree in Sport (Sports Performance)

☑ BSc (Hons) in Sport (Sports Performance) (Work Based Learning)

☐ Other Programme of Study

ASSIGNMENT / ~~PORTFOLIO / PRACTICAL / PRESENTATION~~ [delete as appropriate]

NAME OF STUDENT: Lance Wicks **YEAR OF STUDY: 2**

Unit Code: ED30391 **Unit Title: Work Based Research Project**

Unit Tutor(s): Dr Mike Callan

TITLE: Work Based Research Project: USE OF ATTACK RATE AS A PREDICTOR OF VICTORY IN OLYMPIC LEVEL JUDO

WORD COUNT: 7000
(May not exceed +/- 10% of limit)

DATE SUBMITTED: 11 May 2009
(Late submission may be penalised)

CHEATING AND PLAGIARISM DECLARATION

I confirm the following:

I have read and understood the following sources that explain cheating and plagiarism:
(a) *the University of Bath website at http://www.bath.ac.uk/library/plagiarism*
and
(b) my programme handbook

To the best of my knowledge, my work does not contain plagiarised material.

SIGNATURE: LWICKS

Ensure that you have completed your work as specified by the deadline date.
You should submit your work to the Programmes Coordinator by posting it to the University of Bath address and/or e-mail it to: FDSc - assignments-fdsc-sp-judo@bath.ac.uk / BSc -assignments-bsc-sp-judo@bath.ac.uk well before the deadline time (usually **4pm**).
You must submit **ONE** electronic copy of your work to the relevant e-mail address as outlined in the Submissions Procedure document.
You must keep an electronic and a paper copy of this assessment for your own records.

Note: This TITLE PAGE must form the first page of every piece of work submitted

DEPARTMENT OF EDUCATION

USE OF ATTACK RATE AS A PREDICTOR OF VICTORY IN OLYMPIC LEVEL JUDO

BY

LANCE D.C. WICKS

Supervised by
Mike Callan

A Work Based Research Project submitted in partial fulfilment of a BSc (Hons) in Sport (Sports Performance) (Work Based Learning)

2009

Acknowledgements

Cheating and plagiarism statement

I confirm the following:

I have read and understood the following that explains cheating and plagiarism (a) the University of Bath University web site, and (b) The Handbook for BSc in Sport (Sports Performance) (Work Based Learning).

To the best of my knowledge, this work based research project does not contain plagiarised material.

Name of Student: Lance D.C. Wicks.

Signature of student:

Table of Contents

Chapter 1: Work Based Research Project Proposal:

Student's Name:

Lance D.C. Wicks.

Broad subject area identified as a potential work based research project:

Statistical analysis of the attack rates, scoring rates and victory in matches involving elite Judo athletes. The purpose of this study is to determine if the attack rate of the two players in a Judo match can be used to predict the outcome of the match.

Specific work based issue (title) chosen to study as a work based project:

Use of Attack Rate as a Predictor of Victory in Olympic Level Judo

Justification of using qualitative / quantitative research methods:

Using quantitative research methods is justified as the nature of the research is to examine events that occur within a Judo match and define statistical significance.

Qualitative research methods would not be appropriate as this study does not require understanding of subjective matters, such as athletes emotional states.

A quantitative method is practical in this study as the author is unable to attend the tournament in person (for example to conduct interviews for qualitative research), but will be able to use video footage from the BBC to conduct quantitative data collection.

The proposed notation system is based on the methods used as far back as 1987 (Sikorski, Mickiewicz, Majle, & Laksa, 1987) but modified to include attacks that do not cause a score and also do not meet the criteria used by researchers such as Boguszewski & Boguszewska (2006a)

Suggested data collection techniques:

Data collection will be done via hand notation of video footage of matches from the 2008 Beijing Olympic tournament. If this proves to be too time consuming a computer software would need to be developed to collect the data.

Given the quantity potentially involved this is most likely.

Suggested sample:

The Olympic Judo tournament runs for a week, this makes collecting data on the entire event very time consuming. It is suggested then that a sample of matches be notated and used for the purposes of this study.

The suggested sample is of fights from the second round of matches up to but not including quarter-final, semi-final and finals.

This sample excludes the final rounds, where it is suggested the structure of fights changes as tactics and strategy affect performance. It also excludes the opening round where less capable athletes are knocked out of the tournament.

References:

- Sikorski, W., Mickiewicz, G., Majle, B., & Laksa, C. (1987). Structure of the contest and work capacity of the judoist. Proceedings of the International Congress on Judo ÒContemporary Problems of Training and Judo Contest, 9-11.
- Sterkowicz, S., Lech, G., & Almansba, R. (2007). The course of fight and the level of sports achievements in judo. Archives of Budo, 3, 72-81.
- Hughes, M., & Franks, I. M. (2004). Notational Analysis of Sport: Systems for Better Coaching and Performance in Sport. Routledge.
- Thomas A. Zak, Cliff J. Huang, & John J. Siegfried. (2008, January 21). Production Efficiency: The Case of Professional Basketball. research-article, . Retrieved May 12, 2008, from http://www.jstor.org/pss/2352368.
- Boguszewski, D., & Boguszewska, K. (2006). Dynamics of judo contests performed by finalists of European Championships (Rotterdam 2005). Archives of Budo, 2, 40-44.

- Degoutte, F., Jouanel, P., & Filaire, E. (2003). Energy demands during a judo match and recovery. Br J Sports Med, 37(3), 245-249. doi: 10.1136/bjsm.37.3.245.
- Kalina, R. M., Kulesza, A., Myslowski, B., Wolkowicz, B., Jagiello, W., Gabrys, T., et al. (2004). Dynamics of Judo, Boxing and Taekwon-do Contests Performed by Finalists of Olympic Games in Sydney. Sport Training in Interdisciplinary Scientific Researches. Czestochowa.

Signed (student): _____

Chapter 2: Project Strategy and Plan

Outside the sport of Judo, considerable research has been conducted into the efficacy of attacking actions. For example the 2004 European Cup Soccer Tournament was analysed in detail with the focus being on descriptive statistics and efficacy of aspects of team play (Carmichael & Thomas, 2005). Football and Baseball have had considerable research into this area conducted (Act, 2004; Papahristodoulou, 2006, 2007; Schwarz, 2005).

In sports that have gambling opportunities, more research has been put into the study of predictive probabilities than in minority sports such as Judo. Tennis for example has had examinations into predicting results (Forrest, 2007). Research into greyhound and horse racing has also been conducted (Clarke, Bailey, & Yelas, 2008; Hausch, Ziemba, & Rubinstein, 1981; Snyder, 1978; View, 1994) which extends firmly into predicting outcomes based on a variety of performance indicators.

The works of Papahristodoulou (2006, 2007) are interesting in relation to this study as his conclusions suggest a relationship between “shots at goal” and “victory”; as this study proposes a relationship between “attacks” and “victory” in Judo.

Heinisch presented research at the 5th International Judo Federation World Research Symposium (Emerson Franchini & Boscolo Del Vecchio, 2007) that supports the argument that attacking more results in victory.

The influential Judo researcher Stanislaw Sterkowicz examined activity rate and compared medallist and non-medallists (Sterkowicz, Lech, & Almansba, 2007). This study suggests that higher attack rates result in victory.

Within Judo there is not a standard set of performance indicators that can be analysed statistically to determine probabilities. By following the examples from Basketball (Kubatko, Oliver, Pelton, & Rosenbaum, 2007), Rugby (Bracewell, 2002) and American Football (Harville, 1980), and from research in other sports, this project aims to determine if the elements being analysed are useful performance indicators within a Judo match.

Unlike previous studies, this project aims not to describe Judo matches, rather decide if the data being analysed is able to predict the result of the match. This may, as with Bailey & Clarke (2006), allow coaches and team managers, etc. to predict the winner of matches whilst the match is in progress.

A paper-based hand notation form, based on the work of Hughes & Frankes (2004) and the lectures by Simon Hicks (2005), was designed and will be used in this research. One form per match will be used to record the attacks, scores and eventual winner of the match.

During the research process, the hand notation system was replaced by a software-based notation system that was found to be both more accurate and quicker to use. This is discussed in the project report later in this document. For the purposes of this project strategy the methodology used on the paper based forms is described. This notation method is replicated in the software version, with key presses replacing hand written notations (source code for the software is included in the appendices).

In reviewing the design of previous research (Boguszewski, 2006; Boguszewski & Boguszewska, 2006b; Sterkowicz et al., 2007; Sterkowicz & Maslej, 1999) it became apparent that the earlier designs had solved the design problem of deciding what was or was not an attack. These earlier studies either ignored all non-scoring attacks or found objective definitions of a non-scoring attack. For example, deciding an effective (though non-scoring) attack was any occasion where the opponent touched the ground with any part of the body except the feet.

Within Judo there are non-scoring attacks that do not force the opponent to touch the floor which could be considered valid attacks. Excluding these attacks from an examination of Judo could lead to inaccuracies that would be expected to affect the inferences possible from the data collected (Mike Hughes & Ian M. Franks, 2004).

To address this design limitation, the author developed a method of notation that includes all three types of attack. These are explained and detailed on the following pages.

On the paper based hand notation form each attack will be recorded as a vertical line "|" if the opponent does not touch the floor with another part of the body other than the feet. These attacks include any attacking action where the attacker turns their body past 45 degrees and any attacking movement where they "grab" the opponent whilst facing forward. It also includes any attacking movement where the players feet touch the opponent.
These attacks are recorded as a "|" on the notation forms.

A "+" will be recorded if the attack causes the opponent to touch the floor with any part of their body other than their feet, but no score is given.

If a score is given, no "|" or "+" is marked, rather a letter indicating the score is written instead. These are K for Koka, Y for Yuko, W for Wazari, I for Ippon and P for a penalty. Penalties are recorded against the player being penalised, not the player benefiting.

When Matte is called, the recorder moves down one line on the notation form. If no attack has been made a horizontal line is recorded "-", if neither player has attacked, then both columns have a "-" recorded.

The final score and duration of the match shall be recorded on the form from the official results ("The official website of the BEIJING 2008 Olympic Games," n.d.).

Inter and Intra Operator reliability is considered important (Mike Hughes & Ian M. Franks, 2004; A.M. Nevill, G. Atkinson, M.D. Hughes, & S.M. Cooper, 2002; M. Hughes, S. M. Cooper, A. Nevill, & S. Brown, 2003; G Atkinson & A M Nevill, 1998) , so within this study both types of reliability shall be tested. This will be done with multiple notations of a set of fights by the author and also by teaching the notation methodology to a group of students who will notate the same fight.

Chapter 3: Project Log

Data collection phasing

When comparing the available video footage (8 X 8 hour DVDs) and the resources available (1 X Person) consideration as to scheduling of the data collection was important. A second factor was the author's ability to collect data accurately during extended notation periods. The author found that when notating on paper based forms only two Judo matches could be recorded accurately before serious errors in notation started to occur. With the later software-based notation system, six Judo fights could be recorded accurately before serious errors started to occur.

Also the authors work and family commitments needed to be factored into the sequencing of the data collection. This scheduling revolved around a timetable of 1 hour 4 times per week.

One hour allowed the notation of an average of 5 Judo fights. This equalling 4 hours of footage per week, 20 fights. The notation period was scheduled to be from the first week in September 2008 to the second week of March 2009, 20 weeks in total factoring in holidays, etc. This was estimated to allow data collection from the entire footage available.

Unfortunately this was not the case in practise. Time management was an issue with notation sessions being less frequent than planned.

The video footage used in this study was from the BBC Interactive service, and as such some fights were not included in the footage. This was because the BBC footage covered one mat of the two in operation, and some fights were also excluded if the footage was incomplete or action was missed due to video replays etc.

To explore the reliability and accuracy of the data being collected, extra steps were introduced. Before, during and after the data was collected from the DVD footage, intra-operator reliability testing was completed. The author notated three fights, three times at the start and end of the project.

An inter-operator test was conducted at the University of Bath in April 2009. The author taught nine students in the first year of the FdSc Sport, who were all Judo Brown belts and above using the paper-based notation system. These students then

notated a fight individually and the notation sheets were collected by the author and used to determine reliability levels. The fight notated was the same as used in the intra-operator testing.

Process of data collection

The data was initially collected using a paper based form that was designed by the author for a pilot study (Wicks, 2006). This was however very time consuming and error prone, limiting the amount of data able to be collected.

An electronic notation system was written by the author in the Perl programming language, and used for a majority of the data collection (70% of Judo fights recorded), the source for this software is included in the appendix. This data was then entered into a spreadsheet (OpenOffice.org, n.d.) and at completion of the data collection phase this data was then exported into PAWS Statistics 17.0 statistical analysis package.

The notation form included recording the official scores in each fight, this was sourced from the official site (“The official website of the BEIJING 2008 Olympic Games,” n.d.). Disk number, fight number (per disk), and time stamps for start and finish of fights was also recorded on the notation form to ensure locating fights again was possible if required.

Once collected the data was analysed for reliability, this is covered later in this document.

Skill sets used evaluation

During the planning and execution of this research project a number of existing and new skills were required. Time management skills were highlighted and the process of completing the research has improved the authors skills in this area .

The necessity to decrease the time and complexity of notating fights, necessitated the development of a computer software to achieve this task. The author although having programming skills had never written software of this type before.

The time constraints also forced the author to make decisions regarding the size and consistency of the sample group used in this study. This involved evaluation of the implications of not being able to collect data from an entire population.

In writing the software required, the author developed new skills in software design, software programming and software development “best practise”(Conway, 2005; Gunderloy, 2004). This included the operation of an Integrated Development Environment (Coda by Panic, n.d.) and the use of revision control software (SVN, n.d.).

Developing these skills has increased the author's versatility as a person working in the Information Technology (IT) sector. The software developed could with more development, be sold to other researchers, becoming a business opportunity for the author that previously did not exist.

Developing a more advanced notational software package could have benefits to the author and to the wider Judo community by making the process of collecting information easier and more standardised. This could lead to the collection of normative data which could be used by researchers.

In working on this project, the author has become aware of the importance of accuracy and reliability testing in a research project. This has become part of the research project itself and extended to the authors work with interpreting and presenting Judo data on his www.JudoMetrics.com website.

In analysing the data collected, the PASW Statistics software (formerly known as SPSS Statistics) was used. The author during this process developed skills both in using the software and also developed a better knowledge of inferential statistics. It has proven difficult to present the data without a stronger knowledge of statistics, future research by the author would be assisted by attendance in statistics training Alternatively (or additionally) consultation with an experienced statistician could be beneficial.

Chapter 4: Project Report :

Results

In this study the author aims to prove or disprove the hypothesis that the player who attacks more in a Judo fight will win the Judo fight. The following tables suggest that this hypothesis was true at the 2008 Beijing Olympic Judo Tournament.

Table 1.

Summary Showing Number of Fights Won By Player Who Attacks Most.

TOTAL FIGHTS:	58
Population size:	386
BLUE WINS WITH MORE ATTACKS	15
WHITE WINS WITH MORE ATTACKS	17
Total fights won by player attack most:	32
% won by player who attacks most	**55%**

This simple table (table 1) shows that based on the 2008 Beijing Olympic Judo Tournament, the hypothesis is true, that the player who attacks more will win a Judo fight a majority of the time. This concurs with the pilot study done in 2006 at Commonwealth level (Wicks, 2006) and the work of Heinisch shown at the 2008 Judo World Championships and International Judo Research Symposium (Emerson Franchini & Boscolo Del Vecchio, 2007).

This table uses percentages which is not ideal given the small sample size; they have been used to simplify presentation of the information only. The data also includes 7 matches where the number of attacks was equal and this affects the results.

The basic structure of Judo matches at this elite tournament can be suggested by the data in table 2 below:

Table 2.

Structure of Judo fights at the Beijing 2008 Olympic Judo Tournament.

Average duration of fight:	00:03:52	
Average Segments per fights:	13.38	
Average duration of segment:	00:00:17	
Average scores per fight	2.97	
Average Scores per fight (excluding penalties)	1.36	
Average attacks per fight	21.03	
Total Ippon	26	15%
Total Wazari	21	12%
Total Yuko	27	16%
Total Koka	5	3%
Total Penalty	93	54%
Ippon (% of total excluding penalties)		33%
Wazari (% of total excluding penalties)		27%
Yuko (% of total excluding penalties)		34%
Koka (% of total excluding penalties)		6%
Mean number of attacks per match	21.03	
Mean number of segments per match	13.38	
Mean number of attacks per segment	1.57	

The above table indicates that the average fight in Olympic Judo is 3:52 minutes long and consists of 13 segments of action; with each segment being 17 seconds in duration.

Over half of all scores at this level are penalties. Scores earned by the players are almost evenly distributed between Ippon, Wazari and Yuko; with Koka scores being infrequently scored.

Through observation of these basic descriptive statistics, we can suggest that the hypothesis of this study is not proven; only 55% of fights being won by the player who attacked the most in each fight. This is a majority of fights being one by the player who attacks most often, however but cannot be considered statistically significant as is discussed later in this report.

The data relating to the structure of a Judo fight at the Beijing Olympic Judo Tournament is interesting as it repeats aspects of the work of Sikorski et al. (1987). The structure of Judo fights identified in this study and in the 1987 study is nearly identical in terms of duration of overall fights, segments of activity and penalties being the most frequent score. This too is discussed in more detail in the later discussion section of this report.

Inter and Intra Operator testing was conducted during this study and identified that the methodology needs considerable time to learn. The hand notation system used originally was slow and inaccurate compared to the computerised system used later, this concurs with the views of Mike Hughes & I. M. Franks (2004).

The most prevalent score in the Beijing 2008 Olympic Judo Tournament is penalties at over 54% of all scores awarded. The next highest score is Yuko scored throws at just under 16%.

Discussion

The Structure of Judo Fights

As described earlier in this study, a seminal piece of research in Judo is the work of Sikorski et al. (1987), in which the structure of a Judo match is defined. The 1987 study has been the basis for many other research projects (Boguszewski & Boguszewska, 2006a; Degoutte, Jouanel, & Filaire, 2003; Sterkowicz et al., 2007) and is an important influence on this study of the Beijing Olympic Judo Tournament.

There has been 20 years of development and rule changes in the sport of Judo since the 1987 research was published("International Judo Federation Rules," 2008), and comparing the structure of Judo fights from both studies shows some similarities, as shown in table 3 below.

Table 3.

Structure of Judo fights in 2008 and 1987.

	1987	**2008**
Average Fight Duration	00:03:56	00:03:52
Average segment of action	11 to 20 seconds*	00:17.35

** Sikorski et al. (1987) provide a range rather than an average.*

The table above suggests that the average duration of a Judo fight has not changed considerably in the past 20 years. The duration of a segment of action (the period of time between the "Hajime" and "Matte" calls of the referee) in 2008 also matches the range described in 1987.

Attack rate at the 2008 Beijing Olympic Judo Tournament.

Sikorski et al. (1987, p. 62) suggest that the medalists in their study scored on average twice per fight and gained the equivalent of a Yuko or Wazari score (they used a numeric scoring system). The following pages examine the 2008 data and find similarities between the 1987 and 2008 data that could suggest that the structure of Judo has not changed considerably over the two decades between events, despite the changes in weight categories and rules (International Judo Federation, 2009; "International Judo Federation - Weights," n.d.; "International Judo Federation Rules," 2008; Villamon, D. Brown, Espartero, & Gutierrez, 2004).

In this study 55% of all fights were won by the player who attacked the most in the fight. This can be used to support the hypothesis that a player who attacks more shall win more, if we consider the prior works in the area such as Sikorski et al. (1987) and Heinisch (Emerson Franchini & Boscolo Del Vecchio, 2007).

The table below shows the descriptive statistics relating to the Winning Players total attack rate (WTA) and losing players total attack rate (LTA). This table shows that the winning players attack only slightly more than the losing players. The mode is interesting in this table as it is the widest difference between the two sets of figures.

Table 4.

Winning and Losing players total attack rates (including scoring and non-scoring attacks).

		WTA	LTA
N	Valid	58	58
Mean		11.0517	10.0517
Std. Error of Mean		.90686	1.01454
Median		9.0000	9.0000
Mode		7.00[a]	1.00
Std. Deviation		6.90645	7.72651
Variance		47.699	59.699
Skewness		1.138	1.233
Std. Error of Skewness		.314	.314
Kurtosis		1.480	2.256
Std. Error of Kurtosis		.618	.618
Range		34.00	38.00
Minimum		1.00	.00
Maximum		35.00	38.00

a. Multiple modes exist. The smallest value is shown

The table above is based on total attacks including attacks that resulted in a score. This data clearly shows that the winning player does, on average, attack 1 more time per match than the losing player, however the standard error of the means overlap meaning we do not consider these results statistically significant.

The next step was to then look at the attacks that did not result in a score. In this table WTANS relates to the winning player's total attacks not including scoring techniques; LTANS refers to the losing players equivalent rate. In this table, the losing player is shown to make slightly more attacks than the winning player.

Table 5.

Winning and Losing players total attack rates (NOT including scoring attacks).

		WTANS	LTANS
N	Valid	58	58
Mean		9.8276	9.9138
Std. Error of Mean		.91209	1.01241
Median		8.0000	9.0000
Mode		6.00	1.00
Std. Deviation		6.94625	7.71029
Variance		48.250	59.449
Skewness		1.148	1.258
Std. Error of Skewness		.314	.314
Kurtosis		1.846	2.319
Std. Error of Kurtosis		.618	.618
Range		35.00	38.00
Minimum		.00	.00
Maximum		35.00	38

Separating the data further, we are able to examine the scoring attack frequencies for winning and losing players in the table below that shows that winning players have a higher mean for scoring attacks.

Table 6.

Winning and Losing player's total attack rates (including scoring attacks ONLY).

		WTAS	LTAS
N	Valid	58	58
Mean		1.2241	.1379
Std. Error of Mean		.12060	.04567
Median		1.0000	.0000
Mode		1.00	.00
Std. Deviation		.91849	.34784
Variance		.844	.121
Skewness		.657	2.156
Std. Error of Skewness		.314	.314
Kurtosis		.430	2.742
Std. Error of Kurtosis		.618	.618
Range		4.00	1.00
Minimum		.00	.00
Maximum		4.00	1.00

The average number of attacks that score is shown in this table to be less than once per match, suggesting that losing players are not frequently able to score against their opponents.

The final statistic to consider from this area of the study is the players' tendency to receive penalties from the referee. This statistic again favours the winning player with the losing players being penalised on average once per fight, which is the equivalent of having a Koka scored against them by the winning player.

Table 7.

Winning and Losing player's penalty rates.

		WP	LP
N	Valid	58	58
Mean		.60	1.00
Std. Error of Mean		.110	.139
Median		.00	1.00
Mode		0	0
Std. Deviation		.836	1.060
Variance		.700	1.123
Skewness		1.803	.641
Std. Error of Skewness		.314	.314
Kurtosis		4.243	-.505
Std. Error of Kurtosis		.618	.618
Range		4	4
Minimum		0	0
Maximum		4	4

Looking at these four sets of statistics we can suggest that it is the number of attacks that result in a score, and the penalty rate, that result in victory and not the non-scoring attack rate.

Medalists attack rates.

Examination of the tendencies of medalists winning matches, from within the sample is interesting and provides an interesting comparison to summary statistics, despite the sample being very small.

Table 8.

Medal winners winning against non-medalist

Fights medalist beats non-medalist:	21
% Where medalist attacked more than non-medalist:	67%
Attack rate of medalists:	11.9524
Attack rate of non-medalists:	10.0000

This table suggests that the medalists held a higher attack rate than that of their opponents. When compared to the 55% average from the entire sample this provides more support to the hypothesis that winning in Judo involves attacking more than your opponent.

The attack rate for medalists is also higher than that for winning players generally across the sample. Medalists are attacking almost 2 more times than their opponents and almost 1 more time than winning players generally.

The attack rate of non-medalists is very close to the mean for losing players generally, suggesting that it is the medalists that have a different behaviour to the rest of the players.

Examination of the penalty rate of this sub-sample group shows little difference from that of the general sample group. Table 9 below, when compared to table 7, suggests that the penalty rate is not what differentiates the medalists from other winning players.

Table 9.

Penalty rates of Medalists and Non-Medalists in fights where Medalists beat non medalists.

	Penalty Rate	Std. Error of Mean
Medalists:	0.67	0.22
Non-medalists:	1.000	0.249

This examination of the Medalists when compared against the general sample of winning players does suggest that the hypothesis is correct that the player that attacks more wins the fight. We need to consider the sample size and we cannot consider the results statistically significant, but they do give a perspective of the data that might otherwise be missed.

Scores in Judo fights.

Within this study an examination of the scores awarded was included. This data is presented in the table below which shows the dominance of the Penalty score within the sport of Judo in 2008.

Table 10.

Total number of scores analysis

	TSI	TSW	TSY	TSK	TSP
N Valid	58	58	58	58	58
Mean	.4483	.3621	.4655	.0862	1.6034
Std. Error of Mean	.06587	.07660	.08941	.03718	.22400
Median	.0000	.0000	.0000	.0000	1.0000
Mode	.00	.00	.00	.00	.00
Std. Deviation	.50166	.58334	.68096	.28312	1.70592
Variance	.252	.340	.464	.080	2.910
Skewness	.214	1.389	1.510	3.027	1.112
Std. Error of Skewness	.314	.314	.314	.314	.314
Kurtosis	-2.025	1.004	2.370	7.420	1.768
Std. Error of Kurtosis	.618	.618	.618	.618	.618
Range	1.00	2.00	3.00	1.00	8.00
Minimum	.00	.00	.00	.00	.00
Maximum	1.00	2.00	3.00	1.00	8.00
Sum	26.00	21.00	27.00	5.00	93.00

TSI = Total Scores Ippon, TSW = Total Scores Wazari, TSY = Total Scores Yuko, TSK = Total Scores Koka, TSP = Total Scores Penalty.

Population and Sample

The total population for this study is 386 fights (Fischer, 2008), the sample size of 58 fights is therefore 15% of the total population. The sample is taken from six of 14 weight categories. Within these categories the sample represents between 14% and 17% of the population of that weight category's fights.

The total video footage observed was 75 fights, however 17 fights were rejected as the footage was either incomplete, interrupted or periods of action were not visible due to video replays, etc.

The sample is an opportunistic sample and as such consideration must be made of the fights notated and their position within the structure of the tournament. The sample does not include any medal fights, with a majority (55%) of notated fights being sourced from the second round of fights at which point half the competitors have already been eliminated.

The sample is also taken from medium weight categories, not included are the light weight or heavy weight categories. This could affect the relevance of the results and how they should be interpreted.

When compared to the sample used by Sikorski et al. (1987) it should be observed that the 1987 study looked only at male competitors whereas this study looks at male and female Judo players. The sample in this study is also from a single event.

New and important aspects of the study:

This is an area that has not been explored explicitly before in Judo research. Researchers such as Heinisch (Emerson Franchini & Boscolo Del Vecchio, 2007) and Sikorski et al. (1987) have explored it in passing, but this is the first time the attack rate to victory relationship has been explored as a prime objective of research.

The hypothesis tested in this study is not considered proven, due to this marginal nature of the results. This is unexpected and may indicate too small a sample size or perhaps that Olympic Judo (or this specific event) is in some way different to the events studied previously. However, as the following findings show, we can suggest that the Judo at this event and from earlier studies are similar, lending more weight to the suggestion that the sample size for this study is the reason for the marginality of

results. Also the examination of medalists data more strongly supports the hypothesis, suggesting systemic errors in the methodology.

This study has found that the structure of Judo fights has not changed since 1987, despite a variety of rule changes in the sport. This is an area that has not been directly confirmed since the 1987 study and as such is of relevance to Judo researchers.

The findings of this study suggest that the hypothesis is likely to be, true, although unfortunately not proven as not a statistical significant difference; attacking more in Judo will result in victory. The study suggests that over 55% of fights are won by the player who attacks the most. Deeper examination of the statistics suggest that scoring attacks are arguably the key variable that relates to winning the match.

The study also confirms the findings of Sikorski et al. (1987) in relation to the average duration of fights and duration of segments of action in Judo fights. In the 1987 study, the most common scoring event was identified as penalties, this matches with this study where penalties make up over 50% of all scores in Beijing.

In this study segments of action were found to be on average 17 seconds in duration. In this study the duration of breaks between pauses were not observed, however the number of segments of action was observed to be on average 13. Sikorski et al. (1987) do not describe the number of segments per fight.

We can suggest, given the close similarities between this study and the 1987 research, that the number of segments in 1987 would be similar to the 17 figure of 2007. We can also suggest that the breaks between segments in 2007 would be similar to those identified in 1987; approximately 10 seconds.

Implications:

This study has confirmed the finding of the 1987 study by Sikorski et al. The Sikorski research included investigation into blood lactate levels in athletes and has served as the basis for various studies looking at the physiology of Judo (E. Franchini, Nunes, Moraes, & Del Vecchio, 2007; Ribeiro, Tierra-Criollo, & Martins, 2006).

If the structure of Judo has not changed since the 1987 research as suggested by this study, then existing training methodologies based on the 1987 research remain valid. This means that existing strength and conditioning programmes would not need to be re-designed for a different physiological requirement.

The suggestion that attack rate has a direct result on the outcome of a Judo fight could be used to propose different behaviour during matches by Judo players. Players might be coached to attack more frequently.

Critical evaluation of the methods

The methodology used in this study has several issues that must be considered. The methodology requires considerable training to produce consistent results. This was proven in the inter and intra operator testing. The sample size can also be considered an issue.

The identification of non scoring ineffective attacks is subjective and contributes to the inter-operator variations observed. It also makes repeatability of the research difficult. Future research could either choose to ignore these ineffective attacks or develop a more objective method of identifying these attacks.

Use of BBC television footage proved troublesome, resulting in a large number of fights having to be excluded. It would have aided the methodology to use footage filmed specifically for the study, without the interference of action replays and onscreen graphics etc.

The notation software developed assisted considerably with the speed, ease and accuracy of data collection. Specific improvements to the software would include a live onscreen display of variables and the ability to reverse a key press. It may also be worthwhile considering using generic video analysis software such as Dartfish or Sportscode.

The data, it can be argued, does not accurately represent the effectiveness of attacks. The selection of throwing techniques can affect the statistics. For example, Uchi Mata attacks were observed to be effective (although non-scoring) from a Judo perspective, in that the opponents balance was broken demonstrating good “kuzushi” (Kano, 1994; Almansba et al., 2007; Sugai, 1992).but were notated as ineffective in this study as the opponent remained standing, despite being very close to being scored against.

The opposite effect was observed of players using “drop” techniques such as Drop Seoi Nage or Drop Kata Guruma (Inman, 2005; Nakanishi, 1998). Attacks that Judo terms would be considered ineffective were notated as effective as the opponent often used standard defensive tactics that involved dropping onto their knees, often to move into an attacking position in ground fighting.

Limitations

This study has limitations that need to be considered when assessing the findings. The main limitations found in this study relate to the complexity of predicting Judo fight outcomes and the issues related to collecting data to make predictions.

This study is drawn from a small sample of a much larger population. It does not include all fights from the tournament and is based on only one tournament. As such, any inferences drawn can only be confidently said to relate to the single event and the relevance across the sport of Judo generally is questionable.

The rules of Judo are also a limitation to this study. Five months after the event, the International Judo Federation (the governing body for Judo) changed the rules to exclude the Koka score (“International Judo Federation Rules,” 2008). This means that the repeatability of this study at other Judo tournaments is affected. All results looking at similar data will be considerably different as the Koka score will not be part of the study. Also excluded is the first penalty awarded, this as of 1 January 2009 is a warning only, and will affect the results of any future study.

A further limitation of this study is the reliability of the data collected, the inter and intra-operator reliability testing suggest that the reliability of the data needs to be considered carefully.

Table 11.

Inter-Operator Reliability Testing

Student	Segments	Blue Ineffective Attacks	Blue Effective Attacks	Blue Koka	Blue Yuko	Blue Wazari	Blue Ippon
R1	26	11	8	0	0	0	0
R2	15	12	3	0	0	0	0
R3	20	11	7	0	0	0	0
R4	19	4	1	0	0	0	0
R5	20	9	4	0	1	0	0
R6	10	11	7	0	0	0	0
R7	25	16	5	0	0	0	0

The table above shows clearly the large differences in data collected by the students all received 15 minutes of explanation of the notation method at the same time during a lecture by the author.

This suggests that the level of training was not sufficient and that some of the students may not have understood the task properly. There may also have been language difficulties as some students were not native English speakers. Finally, we can consider also that the students were of differing technical levels in the sport of Judo and this may have had an effect on their ability to notate the fight.

Intra-operator reliability was also tested, the author notated the same fight three times at the start of the data collection process and again at the end of the data collection phase, the table below shows the results of that testing.

Table 12.

Intra-Operator Reliability Testing

	Segments	Blue Ineffective Attacks	Blue Effective Attacks	Blue Koka	Blue Yuko	Blue Wazari	Blue Ippon
O1	14	17	4	0	0	0	0
O2	15	15	5	0	0	0	0
O3	15	15	5	0	0	0	0
O4	15	16	5	0	0	0	0
O5	15	15	4	0	0	0	0
O6	14	16	5	0	0	0	0

Observations O1, O2 and O3 were conducted at the start of the data collection. O4, O5 and O6 were collected at the end of the data collection phase. Comparing the data presented in both the tables it is clear that there are reliability and accuracy issues to be considered in the data notation phase of the methodology. Intra-operator reliability over time was substantially superior to inter-operator reliability.

Future research:

This study has identified that attack rate can be used to make gross predictions about the outcome of a Judo fight, further research is required to confirm this. Further research should also include examination of attack rate over time and the relationship to tactics and strategy in Judo fights. Specifically, researchis indicated that examines how attack rates alter based on which player leads on points during a match. Research needs to identify if a Judo player once establishing a lead on points has a change in attack rate and if their opponent increases or decreases their attack rate.

Related research is also needed to examine the relationship between the awarding of penalties by the referee and the effect on attack rates of both players.

Given the importance of penalties in Judo fights, research could be conducted to determine what percentage of Judo fights are won on penalties and not by positive player action.

Research into the development of a standard software system to notate Judo needs to be conducted. The existing work of Hughes, McDonald and Michel (1988; 2006; 2008) could along with the software created for this study be examined to define the important features required.

Perhaps the most important area of research required is in the area of performance indicators for Judo. Outside of the sport of Judo (as discussed in the literature review of this study), examination of probabilities and predicting results is more common and predictions are becoming more accurate (Clarke et al., 2008; Gray & Le, 2002; Newton & Keller, 2005; Winkler, 1971; Yelas & Clarke, 2004).

To create an accurate model for predicting the outcome of Judo fights, research is required into the performance indicators that predict victory in Judo. This study suggests that attack rate is a gross indicator, further research looking at Judo more finely may provide more fine predictions. For example, McDonald (2006) interviewed a number of world leading Judo coaches and identified a number of elements of the Judo fight that they believed were important (for example who establishes the

dominant grip). Research into quantifying dominance of grip could be used to then study Judo fights and look for a correlation between grip dominance and victory (or grip dominance and attack rate).

Research into the relationship between attack rate and awarding of penalties should be conducted. This research could be used to test the hypothesis that penalties are being awarded to players that do not attack frequently enough (and what “enough” is statistically). It might also be used to explore the theory that by increasing attack rate, players can prevent penalties and win more fights.

Further research should be conducted to establish valid criteria for defining an “effective non-scoring attack” and “ineffective non-scoring attack”. This would reduce the amount of subjectivity involved in collecting data in this area.

This study suggests that players who attack most in the earlier rounds may be more likely to go on to be medallists; this hypothesis could be explored further in future research.

References:

Act, S. A. (2004). May the Best Team Win: Baseball Economics and Public Policy, by Andrew Zimbalist (Brookings Institution Press, Washington DC, 2003), pp. xviii+ 198. Baseball is an American obsession. It is widely. *THE ECONOMIC RECORD*, *80*(249), 258-267.

Almansba, R., Franchini, E., Sterkowicz, S., Imamura, R., Calmet, M., & Ahmaidi, S. (2007). A comparative study of speed expressed by the number of throws between heavier and lighter categories in judo. *Science & Sports*, *In Press, Corrected Proof*. doi: 10.1016/j.scispo.2007.10.014.

Atkinson, G., & Nevill, A. M. (1998). Statistical methods for assessing measurement error (reliability) in variables relevant to sports medicine. *Sports medicine (Auckland, N.Z.)*, *26*(4), 217-38.

Bailey, M., & Clarke, S. (2006). PREDICTING THE MATCH OUTCOME IN ONE DAY INTERNATIONAL CRICKET MATCHES, WHILE THE GAME IS IN PROGRESS. *Journal of Sports Science and Medicine*. Retrieved from http://jssm.org/vol5/n4/2/v5n4-2text.php.

Boguszewski, D. (2006). Fight Dynamics of the Double Olympic Champion in Judo (1988, 1992). *Journal of Human Kinetics volume*, *16*, 97-106.

Boguszewski, D., & Boguszewska, K. (2006a). Dynamics of judo contests performed by finalists of European Championships (Rotterdam 2005). *Archives of Budo*, *2*, 40-44.

Boguszewski, D., & Boguszewska, K. (2006b). Dynamics of judo contests performed by finalists of European Championships (Rotterdam 2005). *Archives of Budo*, *2*, 40-44.

Bracewell, P. (2002). Implementing Statistics in a Diagnostic Coaching Structure for

Rugby. *Research Letters in the Information and Mathematical Sciences*, *3*, 79–84.

Carmichael, F., & Thomas, D. (2005). Does the Best Team Win? An Analysis of Team Performances at EURO 2004. *football-research.bbk.ac.uk*. Retrieved from http://www.football-research.bbk.ac.uk/docs/bestteamwin.pdf.

Clarke, S. R., Bailey, M., & Yelas, S. (2008). Successful applications of statistical modeling to betting markets. *MATHEMATICS TODAY-SOUTHEND ON SEA*-, *44*(1), 38.

Coda by Panic. (n.d.). *Coda*. Panic. Retrieved from http://www.panic.com/coda/.

Conway, D. (2005). *Perl Best Practices*. O'Reilly Media, Inc.

Degoutte, F., Jouanel, P., & Filaire, E. (2003). Energy demands during a judo match and recovery. *Br J Sports Med*, *37*(3), 245-249. doi: 10.1136/bjsm.37.3.245.

Fischer, M. (2008 8). Olympic Games 2008 Overview. Retrieved May 8, 2009, from http://www.judo-world.info/world/olympics/2008_beijing/tta.php?tta_mode=&aktion=live&sprache=english.

Forrest, D. (2007). Anyone for Tennis (Betting)? *The European Journal of Finance*, *13*(8), 751-768.

Franchini, E., Nunes, A. V., Moraes, J. M., & Del Vecchio, F. B. (2007). Physical Fitness and Anthropometrical Profile of the Brazilian Male Judo Team. *Journal of PHYSIOLOGICAL ANTHROPOLOGY*, *26*(2), 59-67.

Franchini, E., & Boscolo Del Vecchio, F. (2007). Annals of the 5th International Judo Federation World Research Symposium. Retrieved from http://www.judoresearch.org/Rio2007/5Annals-final2.pdf.

Gray, S., & Le, T. (2002). How to fix a one-day international cricket match. In *In Cohen, G. (ed.), University of Technology, Sydney, Proceedings of the Sixth*

Australian Conference on Mathematics and Computers in Sport, Sydney, University of Technology, 2002, p.14-31. Australia. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=SPHS-840934&site=ehost-live.

Gunderloy, M. (2004). *Coder to Developer: Tools and Strategies for Delivering Your Software*. John Wiley & Sons.

Harville, D. (1980). Predictions for National Football League Games Via Linear-Model Methodology. *Journal of the American Statistical Association*, *75*(371), 516-524.

Hausch, D. B., Ziemba, W. T., & Rubinstein, M. (1981). Efficiency of the market for racetrack betting. *Management Science*, *27*(12), 1435-1452.

Hicks, S. (2005). Lecture. University of Bath.

Hughes, M., Cooper, S. M., Nevill, A., & Brown, S. (2003). An example of reliability testing and establishing performance profiles for non-parametric data from performance analysis. *eIJCSS International Journal of Computers in Sport Science (Electronic)*, *2*(1), 34-56.

Hughes, M. (1988). Computerized notation analysis in field games. *Ergonomics*, *31*(11), 1585. doi: 10.1080/00140138808966808.

Hughes, M., & Franks, I. M. (2004). *Notational Analysis of Sport: Systems for Better Coaching and Performance in Sport*. Routledge.

Hughes, M., & Franks, I. M. (2004). *Notational Analysis of Sport: Systems for Better Coaching and Performance in* (p. 304). Routledge.

Inman, R. (2005). *The Judo Handbook*. Silverdale Books.

International Judo Federation. (2009 3). MODIFICATION OF OLYMPIC QUALIFICATION SYSTEM FOR JUDO. Retrieved April 5, 2009, from

http://www.intjudo.eu/?Menu=News&Action=Full&type_id=194&id=194&lang_id=2&mid=4.

International Judo Federation - Weights. (n.d.). . Retrieved July 25, 2008, from http://www.intjudo.eu/?Menu=Static_Page&Action=List&m_static_id=45&lang_id=2&mid=7&main=12#5.

International Judo Federation Rules. (2008). . Retrieved May 8, 2008, from http://www.intjudo.eu/?Menu=Static_Page&Action=List&m_static_id=42&lang_id=2&mid=2&main=12#26.

Kano, J. (1994). *Kodokan Judo* (New edition.). New York: Kodansha International Ltd.

Kubatko, J., Oliver, D., Pelton, K., & Rosenbaum, D. (2007). A Starting Point for Analyzing Basketball Statistics. *Journal of Quantitative Analysis in Sports*, *3*(3). doi: 10.2202/1559-0410.1070.

McDonald, K. (2006). *Thesis*. University of Bath.

michel. (2008, 02T15:18:18Z 6). FRAMI - SOFTWARE FOR ANALYSIS OF TECHNIQUES AND TACTICS IN JUDO

(Bianca MIARKA, Michel CALMET, Emerson FRANCHINI). Retrieved April 18, 2009, from http://www.jorrescam.fr/spip.php?article40#.

Nakanishi, H. (1998). *Seoi-nage*. Chiron.

Nevill, A., Atkinson, G., Hughes, M., & Cooper, S. (2002). Statistical methods for analysing discrete and categorical data recorded in performance analysis. / Methodes statistiques pour l ' analyse discrete et par categories des donnees

rassemblees pour l ' analyse de la performance. *Journal of Sports Sciences*, *20*(10), 829-844.

Newton, P. K., & Keller, J. B. (2005). Probability of Winning at Tennis I. Theory and Data. *Studies in Applied Mathematics*, *114*(3), 241-269.

OpenOffice.org. (n.d.). *OpenOffice*. OpenOffice.org. Retrieved from http://www.openoffice.org.

Papahristodoulou, C. (2006). Team Performance in UEFA Champions League 2005-06.

Papahristodoulou, C. (2007). *An analysis of Champions League match statistics*. Working Paper.

Ribeiro, S. R., Tierra-Criollo, C. J., & Martins, R. (2006). Effects of different strengths in the judo fights, muscular electrical activity and biomechanical parameters in elite athletes. *Revista Brasileira de Medicina do Esporte*, *12*, 27-32.

Schwarz, A. (2005). *The Numbers Game: Baseball's Lifelong Fascination With Statistics*. Thomas Dunne Books.

Sikorski, W., Mickiewicz, G., Majle, B., & Laksa, C. (1987). Structure of the contest and work capacity of the judoist. *Proceedings of the International Congress on Judo ÒContemporary Problems of Training and Judo Contest*, 9-11.

Snyder, W. W. (1978). Horse racing: testing the efficient markets model. *Journal of Finance*, *33*(4), 1109-1118.

Sterkowicz, S., Lech, G., & Almansba, R. (2007). The course of fight and the level of sports achievements in judo. *Archives of Budo*, *3*, 72-81.

Sterkowicz, S., & Maslej, P. (1999). *An evaluation of the technical and tactical aspects of judo matches at the senior level*.

Sugai, H. (1992). *Uchimata*. Ippon Books.

SVN. (n.d.). *SVN*. Tigris. Retrieved from http://subversion.tigris.org/.

The official website of the BEIJING 2008 Olympic Games. (n.d.). . Retrieved May 4, 2009, from http://results.beijing2008.cn/WRM/ENG/Schedule/JU.shtml.

View, T. O. C. (1994). Expert prediction, symbolic learning, and neural networks. Anexperiment on greyhound racing. *Expert, IEEE [see also IEEE Intelligent Systems and Their Applications]*, *9*(6), 21-27.

Villamon, M., Brown, D., Espartero, J., & Gutierrez, C. (2004). Reflexive Modernization and the Disembedding of Judo from 1946 to the 2000 Sydney Olympics. *International Review for the Sociology of Sport*, *39*(2), 139-156. doi: 10.1177/1012690204043458.

Wicks, L. (2006). *Statistical Summary of Judo at 2006 Commonwealth Judo Tournament*. Retrieved from http://www.judocoach.com/analysis/2006-Summary.pdf.

Winkler, R. L. (1971). Probabilistic Prediction: Some Experimental Results. *Journal of the American Statistical Association*, *66*(336), 675-685.

Yelas, S., & Clarke, S. (2004). Forecasting the 2003 Rugby World Cup. In *In Morton, R.H. (ed.), Massey University, Proceedings of the Seventh Australasian Conference on Mathematics and Computers in Sport, Palmerston North, N.Z., Massey University, 2004, p.270-277.* Australia. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=SPHS-965917&site=ehost-live.

Appendices:

```
use strict;
use warnings;
use English qw( -no_match_vars );
use version;
use Term::ReadKey;
ReadMode 4;

local $OUTPUT_AUTOFLUSH = 1;

# $Id$
our $VERSION = qv('0.0.1');

# ------------------------------------------------------------
#
# This file created by Lance Wicks.
#                     Last Modified, 18 April 2009.
#
#
#    notator.pl - Notation software for BSc. project.
#    Copyright (C) 2009  Lance Wicks
#
#    This program is free software: you can redistribute it and/or modify
#    it under the terms of the GNU Affero General Public License as
#    published by the Free Software Foundation, either version 3 of the
#    License, or (at your option) any later version.
#
#    This program is distributed in the hope that it will be useful,
#    but WITHOUT ANY WARRANTY; without even the implied warranty of
#    MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
#    GNU Affero General Public License for more details.
#
#    You should have received a copy of the GNU Affero General Public License
#    along with this program.  If not, see <http://www.fsf.org/licensing/licenses/agpl.html>.
#
# ------------------------------------------------------------

# -------------------------------------------
# Sub routine stubs
# -------------------------------------------

sub DisplayWelcome;
sub ResetCounters;
sub PrintResults;
# -------------------------------------------------
# Global Variables
# -------------------------------------------------
my $key;

my $segments = 1;

my $events = 0;

my $blue_Attack = 0;
my $blue_EffAttack = 0;
my $blue_Koka = 0;
my $blue_Yuko = 0;
my $blue_Wazari = 0;
my $blue_Ippon = 0;
my $blue_Penalty = 0;

my $white_Attack = 0;
my $white_EffAttack = 0;
my $white_Koka = 0;
my $white_Yuko = 0;
my $white_Wazari = 0;
my $white_Ippon = 0;
my $white_Penalty = 0;


# -------------------------------------------------
# MAIN LOOP
# -------------------------------------------------

DisplayWelcome();

my $run_flag = 1;
while ($run_flag) {

    while (not defined ($key = ReadKey(-1))) {
                # No key yet
        }
        if ($key eq "q" || $key eq "Q") {
```

```
            $run_flag = 0;

        }
        if ($key eq "f" || $key eq "F") {
            $blue_Attack++;
            $events++;

        }
        if ($key eq "d" || $key eq "D") {
            $blue_EffAttack++;
            $events++;

        }
        if ($key eq "v" || $key eq "V") {
            $blue_Koka++;
            $events++;

        }
        if ($key eq "c" || $key eq "C") {
            $blue_Yuko++;
            $events++;

        }
        if ($key eq "x" || $key eq "X") {
            $blue_Wazari++;
            $events++;

        }
        if ($key eq "z" || $key eq "Z") {
            $blue_Ippon++;
            $events++;

        }
        if ($key eq "t" || $key eq "T") {
            $blue_Penalty++;
            $events++;

        }


        if ($key eq "j" || $key eq "J") {
            $white_Attack++;
            $events++;

        }
        if ($key eq "k" || $key eq "K") {
            $white_EffAttack++;
            $events++;

        }
        if ($key eq "n" || $key eq "N") {
            $white_Koka++;
            $events++;

        }
        if ($key eq "m" || $key eq "M") {
            $white_Yuko++;
            $events++;

        }
        if ($key eq "," || $key eq "<") {
            $white_Wazari++;
            $events++;

        }
        if ($key eq "." || $key eq ">") {
            $white_Ippon++;
            $events++;

        }
        if ($key eq "u" || $key eq "U") {
            $white_Penalty++;
            $events++;

        }

        if ($key eq " ") {
            $segments++;
            $events++;

        }
```

```
if ($events >= 10 ){
    print "\b\b";
} else {
    print "\b";
}
print "$events";
}
ReadMode 0;

PrintResults();



# ------------------------------------------------
# Sub Routines
# ------------------------------------------------

sub DisplayWelcome {
    print "\n\nJudo Notator ($VERSION)\n\n";
    print "-------------------------------------------------------------------------------\n";
    print "|                        BLUE           |                    WHITE             |\n";
    print "|  F = Attack                           |  J = Attack                          |\n";
    print "|  D = Effective Attack                 |  J = Effective Attack                |\n";
    print "|                                       |                                      |\n";
    print "|  V = Koka                             |  N = Koka                            |\n";
    print "|  C = Yoka                             |  M = Yoka                            |\n";
    print "|  X = Wazari                           |  < = Wazari                          |\n";
    print "|  Z = Ippon                            |  > = Ippon                           |\n";
    print "|  T = Receive Penalty                  |   U = Receive Penalty                |\n";
    print "|                                       |                                      |\n";
    print "|                                SPACE = MATTE                                 |\n";
    print "|                                       |                                      |\n";
    print "|                                Q     = SOREMADE                             |\n";
    print "-------------------------------------------------------------------------------\n";
    print "  Events:  ";

}

sub ResetCounters{
    $segments = 1;

    $blue_Attack = 0;
    $blue_EffAttack = 0;
    $blue_Koka = 0;
    $blue_Yuko = 0;
    $blue_Wazari = 0;
    $blue_Ippon = 0;
    $blue_Penalty = 0;

    $white_Attack = 0;
    $white_EffAttack = 0;
    $white_Koka = 0;
    $white_Yuko = 0;
    $white_Wazari = 0;
    $white_Ippon = 0;
    $white_Penalty = 0;

    $events = 0;

}

sub PrintResults {
    print "\n\n";

    my @months = qw(Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec);
    my @weekDays = qw(Sun Mon Tue Wed Thu Fri Sat Sun);
    my ($second, $minute, $hour, $dayOfMonth, $month, $yearOffset, $dayOfWeek, $dayOfYear,
$daylightSavings) = localtime();
    my $year = 1900 + $yearOffset;
    my $theTime = "$hour:$minute:$second, $weekDays[$dayOfWeek] $months[$month] $dayOfMonth,
$year";
    print "Notation Time and Date\n$theTime\n\n";



    print "Segments: $segments\n";
    print "\nBLUE\n";
    print "Ineffective Attacks: $blue_Attack\n";
    print "Effective Attacks: $blue_EffAttack\n";
    print "Koka: $blue_Koka\n";
    print "Yuka: $blue_Yuko\n";
```

```
    print "Wazari: $blue_Wazari\n";
    print "Ippon: $blue_Ippon\n";
    print "Penalty: $blue_Penalty\n";
    print "\nWHITE\n";
    print "Ineffective Attacks: $white_Attack\n";
    print "Effective Attacks: $white_EffAttack\n";
    print "Koka: $white_Koka\n";
    print "Yuka: $white_Yuko\n";
    print "Wazari: $white_Wazari\n";
    print "Ippon: $white_Ippon\n";
    print "Penalty: $white_Penalty\n\n\n";


}
```

Contest Notation Form

Date: __/__/____ Event: _____

Category: Fight #:

Notator: Match Length:

Player 1 (Blue)		*Player 2 (White)*
Name:		Name:
Final Score:		Final Score:
Time Remaining:		

NOTES: