

# Correlation of the bottom turn technique with the scores attributed in high performance surfing

## *Correlação da técnica bottom turn com as notas atribuídas no surf de alto rendimento*

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**Abstract** – The surf contests worldwide have presented a high and homogeneous level of performance by the athletes. Thus, the hypothesis that the bottom turn (BT), curve on the base of the wave which is essential to the construction of subsequent maneuvers, might influence the results in high performance competitions. The objective of this study was to quantify the time taken in the execution of the BT by the athletes and correlate it to the scores awarded. The research sample was composed of four contests of the Surfing World Tour. Four heats of each contest were assessed, in a total of sixteen heats studied. The analysis of each BT was performed by using the video split feature available in the Sony Vegas Pro 10.0 software. The statistic analysis was performed with the software SPSS 18.0. The Pearson correlation coefficient was calculated with a significance level of  $p < 0.01$ . According to the correlations, there was an association between the variables for 87.5% of the cases. Results show that the increase of the curve in the base of the wave (BT) can maximize the performance potential of the surfers, suggesting that BT is a fundamental technical aspect in the construction of subsequent maneuvers that suit the judging criteria of this category.

**Key words:** Bottom Turn; Maneuvers; Performance; Surf.

**Resumo** – As competições de surf no cenário mundial têm apresentado um alto e homogêneo nível de desempenho entre os atletas. Assim, atentou-se à hipótese de que o bottom turn (BT), curva na base da onda essencial para a construção de manobras subsequentes, pode afetar os resultados alcançados em baterias de surf de alto rendimento. O estudo teve como objetivo quantificar o tempo que os atletas levam na execução de BT em suas ondas e correlacioná-lo com as notas atribuídas. A amostra foi composta por quatro eventos do World Tour de Surf, sendo avaliadas 4 baterias de cada evento, perfazendo um total de 16 baterias investigadas. A análise de cada BT foi realizada por meio do recurso de corte de vídeo disponível no programa Sony Vegas Pro 10.0. A análise estatística foi implementada no software SPSS 18.0, sendo calculado o coeficiente de correlação de Pearson, com nível de significância de  $p < 0,01$ . Resultados: os índices de correlação encontrados apontam que há associação entre as variáveis para 87,5% dos casos. Pode-se concluir que o alargamento da curva na base da onda (BT) pode maximizar o potencial de rendimento dos surfistas, sugerindo que o BT é um aspecto técnico fundamental na construção de manobras subsequentes que se adequam aos critérios de julgamento desta modalidade.

**Palavras-chave:** Bottom Turn; Desempenho; Manobras; Surf.

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## INTRODUCTION

Surfing is classified, according to the challenges to the practitioner, as a natural sport. It is also a sliding sport, since the surfer, on top of a board and with the support of the anterior-posterior legs, removed (one foot near the tail of the board and the other in the middle), slides in the surface of the wave toward the beach<sup>1</sup>.

When considering the trajectory of a surfer on a wave, from the moment he or she stands upright on the board until the end of the wave, surfing is a sport that primarily uses the anaerobic energy source, alternating the alactic and/or lactic systems according to the total time of his or her journey on a wave. In the literature, some studies report physiological aspects of competitive surfing<sup>2-6</sup>.

In practicing this sport, surfers use a repertoire of specific techniques. In addition to the techniques paddling, submersion, sit on the board and climb on the board, there are techniques performed from the moment the surfer is standing on the board, called maneuvers. The maneuvers are the most relevant technical actions of surfing. They characterize the modality itself. In fact, they comprise the motor actions responsible for the movement of the surfer and, consequently, of the board, resulting from decision-making actions<sup>1</sup>.

The maneuvers are of great complexity. They require determination, persistence, control and ability to deal with the sea<sup>7</sup>. The surfer must at all times maintain a high level of control over his or her board and full sync with the wave he or she is surfing<sup>2</sup>. The movements require a precise combination of motor coordination, agility, balance, speed and explosive strength, among other physical qualities.

Among the maneuvers that characterize technical performance in Surfing, the bottom turn (BT) stands out, a maneuver classified as a turning point in the base that allows the wave to gain speed to climb the surface<sup>1</sup>. It is the turn or curve at the base of the wave after the *drop*, setting the direction to go (left or right) and preceding the maneuvers<sup>8</sup>. In general, the BT is a segment characterized by a curve in the base of the wave which the surfer must carry out in order to go up to the wave crest and perform another maneuver as a result of this one.

ASP (Association of Surfing Professionals) is the maximum body of professional surfing, which performs annually a world circuit of approximately 10 events, called World Tour (WT). Each heat is formed by two athletes, which advances to a next stage, while the other is eliminated, until a surfer wins the event.

During each heat, about 30 minutes long, athletes are entitled to surf a maximum of 10 to 15 waves. Opponents never share the same parts of the same wave. Scores from zero to ten are assigned according to the maneuvers performed by the surfer in each wave. Every athlete is ranked according to the sum of his or her two best scores, i.e., according to his or her two best waves. The criteria adopted by the referees are the commitment and level of difficulty of the maneuvers; innovative and progressive maneuvers;

the combination of major maneuvers; maneuver variety; speed; pressure (intensity with which maneuvers are applied) and fluidity<sup>9</sup>.

The maneuvers in the critical part of the wave have been a factor in determining the score of the athlete, as the surfer can only be fast, powerful and radical by attacking the part of the wave that promotes the strongest reaction on his surfboard. From the definitions of the component parts of the wave, the most critical part of a wave is called pocket<sup>1</sup>. However, in the literature, there was no evidence to suggest a significant benefit on the basis of the wave so that it reaches the critical part (pocket), respecting the criteria usually used by the judges. Thus the relevance and interest of this study are to investigate whether a surfer, when performing the turn on the bottom of the wave (BT) in a longer time and with a higher turn extension can better project his or her board and subsequent maneuvers in order to achieve better results

Given this, the objective of this study was to analyze the performance of bottom turn (BT) carried out in a wave and the level of correlation of this maneuver with the final score of the heats. More specifically, the time it took for each BT in two waves computed in the score sum of each athlete who competed in the heats was quantified and correlated to the scores awarded.

## METHODS

The study was conducted using data from four events of the Surfing World Tour, in particular Hangloose Santa Catarina Pro 2009 – Brazil, Billabong Pro Jefferys Bay 2009 – South Africa, Quiksilver Pro France 2009 – France and Billabong Pro Bells Beach 2010 – Australia. The videos, as well as the results, were then collected and made available on the official website of each event. In each of these events four heats were pre-selected, in a total of 16 heats investigated.

The selection criteria for the events were the importance attributed to them and the geographic distribution, as well as the similarity in wave size and quality. The heats selected were those with waves that did not allow the execution of tubes, with no fall from the board and that allowed approximately the same number of maneuvers performed by the surfers.

In an attempt to seek greater similarity of waves in each event, only heats that were played on the same day were analyzed.

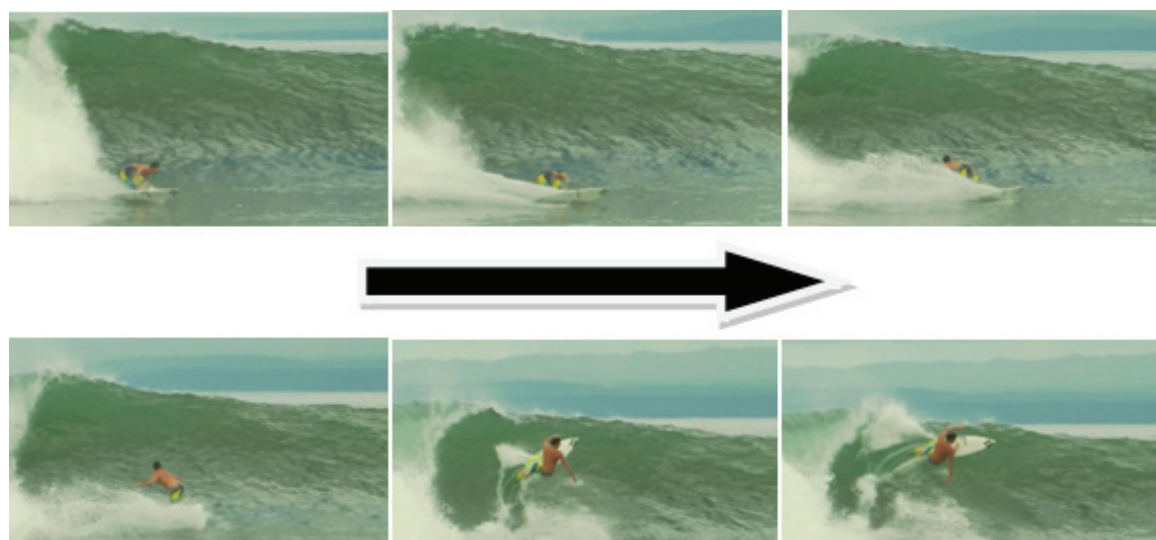
The videos of the two waves computed by the athletes in each heat and their bottom turns (BT) were analyzed. The 64 waves investigated had an average of  $4.71 \pm 1.91$  BT performed per wave, in a total of 310 reproductions of this maneuver. The average time per wave of each BT was  $1.05 \pm 0.13$  s.

The validity and reliability of the measurements were obtained with a pilot study with two heats of an event. Besides the concern to check the suitability of the assessor in handling the equipment, the reproducibility of the measurements was obtained by intraobserver assessment, resulting in a correlation value of 0.92.

The selective analysis of each BT was accomplished through the use of video cutter, which allows you to select and collect specific portions of a video, available in the software Sony Vegas Pro 10.0. A video cut was

made for the beginning and another for the end of each performance of this maneuver, establishing a specific piece of video in which its time in seconds corresponds to the BT execution time.

BT was computed from the time the surfer initiated a single turn on the bottom of the wave, which allowed him or her a continuous projection to the subsequent execution of another maneuver. Moreover, the BT ceased to exist from the time it was considered that the bottom of the board reached the lip of the wave or when the board was parallel to the lip of the wave (Figure 1).



**Figure 1.** Beginning and end of the *bottom turn* (BT)

An average time of BT for each wave analyzed was set from the data collection regarding the execution times of each BT. These average execution times for this maneuver were correlated with the scores assigned to the respective waves.

The Shapiro-Wilk test was used to verify the normality of the data that comprise the variables: average time of each wave's BT and the scores assigned to the respective waves. Subsequently, the degree of relationship between the variables was analyzed through the Pearson linear correlation coefficient, adopting the significance level of  $p < 0.01$ . In the statistical treatment of data the SPSS 18.0 software was used.

## RESULTS

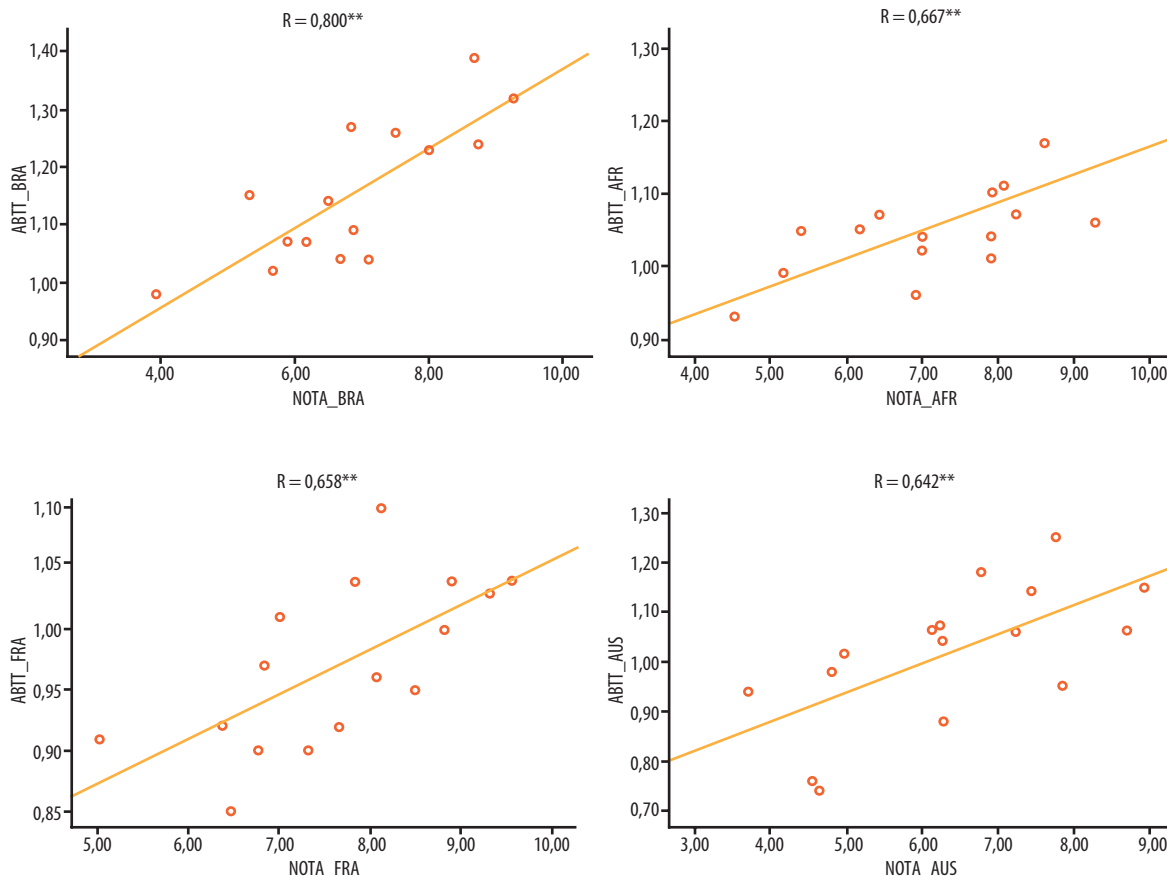
Table 1 presents the results in the four events investigated, containing data relating to the average BT time of the heats and the scores awarded by ASP judges. The correlation value applied by heat was represented by the Pearson "r". Correlations were made between the variables average BT time per wave and score awarded.

In an attempt to find more evidence on the association between average BT time per wave and awarded score, the general level of correlation for each event was also calculated. That is, correlation was applied between

all the average BT times per wave and all the scores awarded in every heat of every assessed event. The aim was to identify if the highest scores of each event correspond to waves with the highest average BT times. These correlations are shown as graphs in Figure 2.

**Table 1.** BT times and Scores awarded to the surfers participating in the selected heats of the four Surfing World Tour events.

Events	Heats	BT(s)		Scores		r
		Md (Sd)	(Min-Max)	Md (Sd)	(Min-Max)	
HangLoose Santa Catarina Pro 2009	1	1.15 (0.08)	1.07 – 1.24	7.44 (1.14)	6.17 – 8.73	0.96
	2	1.11 (0.11)	1.02 – 1.26	6.69 (0.79)	5.67 – 7.50	0.68
	3	1.11 (0.12)	0.98 – 1.27	5.49 (1.21)	3.93 – 6.83	0.87
	4	1.24 (0.15)	1.04 – 1.39	8.15 (1.11)	6.67 – 9.27	0.91
Billabong Pro Jefferys Bay 2009	1	1.07 (0.06)	1.01 – 1.17	8.42 (0.64)	7.90 – 9.27	0.40
	2	1.08 (0.14)	0.93 – 1.26	7.14 (1.94)	4.50 – 9.00	0.93
	3	1.03 (0.03)	0.99 – 1.07	6.00 (0.86)	5.17 – 7.00	0.54
	4	1.04 (0.06)	0.96 – 1.10	7.30 (0.94)	6.17 – 8.23	0.50
Quiksilver Pro France 2009	1	0.95 (0.04)	0.90 – 1.01	7.07 (0.41)	6.77 – 7.67	-0.16
	2	1.03 (0.05)	0.96 – 1.10	8.78 (0.77)	8.10 – 9.57	0.07
	3	0.95 (0.06)	0.90 – 1.04	7.43 (1.75)	5.00 – 8.90	0.69
	4	0.95 (0.08)	0.85 – 1.04	7.38 (1.16)	6.40 – 8.83	0.78
Billabong Pro Bells Beach 2010	1	0.90 (0.13)	0.74 – 1.06	6.92 (1.81)	4.67 – 8.77	0.98
	2	1.03 (0.09)	0.94 – 1.15	6.20 (2.38)	8.71 – 9.00	0.99
	3	1.00 (0.17)	0.76 – 1.18	5.66 (1.05)	4.57 – 6.83	0.88
	4	1.12 (0.09)	1.04 – 1.25	6.95 (0.83)	6.17 – 7.83	0.93



**Figure 2.** Correlation (R) between the variable average BT time (ABTT) and awarded scores (SCORE) in the four Surfing World Tour events.

## DISCUSSION

As can be seen in Table 1, a significant association was found between the variables BT time and score awarded in 14 of 16 heats analyzed, i.e. in 87.5% of cases. These associations ranged from moderate to very high on the Pearson correlation scale proposed by Pestana and Gageiro<sup>10</sup>. The evidence can be explained by the fact that the longer the surfer stays in BT, the more area at the base of the wave can be covered, enabling the surfer to project his or her board properly, thus respecting the preestablished scoring criteria and allowing him or her to develop an optimal trajectory which will help the subsequent maneuver.

The data in Figure 2 indicate that there is a linear association between the variables investigated, indicating that the values of the scores assigned to waves in each event tend to increase as increases the average BT execution time. The execution of a curve not much enlarged at the bottom of the wave seems to imply a projection out of the surf judging criteria, so that the surfer moves away from required aspects and do not maximize his or her scoring potential. Moreover, it can be suggested that athletes performing more durable BTs on their heats in comparison to their opponents might win the duels.

A recently published study showed that ASP referees actually follow the pre-set scoring standard based on the surfing scoring criteria<sup>11</sup>. This study found significant correlations between the variables of the criteria and the scores awarded. However, taking into account that the quality of the bottom turn is not included among the scoring criteria, it is concluded that this is a variable that, although significant, produces an indirect influence on the score assigned.

Although the literature contemplates studies on the physiological adaptations induced by the practice of surf<sup>12-15</sup> and the injuries and the risk of its practice<sup>16-19</sup> and indicate that the image of the surfer is increasingly linked to aspects of quality of life<sup>20</sup>, the fact that not many studies related to the subject in question were found prevented more comparisons with the findings to be made.

Another important aspect to consider is that surfing suffers from the lack of a support structure by multidisciplinary sports training teams, followers of traditional periodization models based on the control of training workloads<sup>2,5,21,22</sup>. This context can be enhanced by the inefficient attempt to acquire scientific papers that can contribute to the evolution of the sport. It can also be improved by efforts that frame surfing in sports training, which includes an educational process based on complex, scientifically-based exercises, in a planned manner that aims to develop the ability of the athlete or the team<sup>23</sup>. It is believed that it is essential to know the characteristic profile of each type of sport, for only then, from measurements of the sport's specific actions, it becomes possible to prescribe and control the training loads, as well as the adequacy of the means and methods of training<sup>24-26</sup>.

## CONCLUSION

The evidence confirms that there is an association between the variables investigated, highlighting the importance of BT as a key technical element in the construction of subsequent maneuvers that best fit the scoring criteria in surf. In fact, the longer the surfer stays in BT, the greater the area covered at the bottom of the wave, enabling the surfer to project his or her board properly in order to approach as much as possible the scoring criteria recommended by the surfing referee commission.

The fact that there is an association between the curve at the bottom of the wave with the results achieved in surfing heats shows that athletes who pay attention to this aspect can maximize their potential output. In addition to highlighting the importance of a technical factor that must be taken into account in the athletic training for this sport, the data indicate the need for further investigations to identifying other factors associated with the efficiency of high performance surfers.

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