South African Journal for Research in Sport, Physical Education and Recreation, 2004, 26(1): 55-64.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2004, 26(1): 55-64.
ISSN: 0379-9069

A MEASURE FOR THE BATTING PERFORMANCE OF CRICKET PLAYERS

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ABSTRACT

A single measure that can be used to assess the performance of batsmen in cricket is defined. This study shows how it can be used to rank batsmen. The batting ability of a batsman is generally measured by means of his average. His strike rate is, however, also very important and is often looked at as well. It will furthermore be motivated that a batsman's consistency is also of great importance. The consistency coefficient will be discussed and it's importance will be illustrated by showing that a batsman with a high consistency coefficient has a better chance to get a good score than one with a low consistency coefficient. It will also be shown how the consistency curve can be used to assess the present form of a batsman. By making use of a data set consisting of the statistics of a large group of one-day international players, these three measures will be combined into a single measure that can be used to assess the performance of a batsman and to compare different batsmen with each other. A classification scheme with ten classes according to which batsmen can be classified will be given. The best batsmen are those who fall into class one. The same procedure will be used to find a formula for batting performance and a classification table for Test players.

Key words: Batting performance; Consistency; Cricket; Present form of a batsman; Rating of batsmen.

INTRODUCTION

A batsman's *batting ability* is customarily measured by means of his average - see Lemmer (2001). If the average of a batsman is calculated from innings to innings, it is found (cf. Figure 1) that after initial and possibly large fluctuations it stabilises and tends to a more or less constant value as the number of innings increases. This limiting value can be interpreted as an estimate of the *batting ability* of the batsman. The average, however, does not reflect his *performance* well enough because it does not take into account any other skills of the batsman. Characteristics like *consistency* (variation of scores) and *strike rate* (average number of runs scored per hundred balls faced) are also very important and should therefore be incorporated into the measure, especially (but not exclusively) in the case of limited overs matches. It will be shown that the Lemmer-Nel (Lemmer & Nel, 2001b) consistency coefficient gives important information about the expected performance of a batsman and how it can be used to assess a batsman's *present form*. This study defines a measure of batting performance and shows how it can be used to rank batsmen.

CONSISTENCY

Measures of the consistencies of batsmen defined in Barr and Van den Honert (1998) as well as Lemmer and Nel (2001a) are based on match scores (i.e. no distinction is made between out and not out scores). Barr and Van den Honert (1998) use the so-called geometric coefficient (GC) whereas Lemmer and Nel (2001a) use its inverse, the coefficient of variation (CV=1/GC). Using match scores has a serious drawback because a low not out score contributes to labelling a batsman as inconsistent when he could have achieved a score closer to or above his average. Another problem is that a very good score also counts against the batsman because it increases the standard deviation and therefore the CV. To eliminate these two deficiencies, the adjusted coefficient of variation (ACV) has been defined in Lemmer and Nel (2001b). The average is defined as the sum of all scores divided by the number of times the batsman was out. The adjusted standard deviation is similar to the ordinary standard deviation excepting that scores above the average and not out scores are not taken into account. Then ACV is equal to the adjusted standard deviation divided by the average. The consistency coefficient is then defined as CC=1/ACV. According to this definition, a batsman is consistent if his scores are generally close to or above his average. On the other hand, a batsman is inconsistent if he gets out for scores far below his average too often (e.g. if more than 35% of his out scores are less than one-third of his average – see the case study to follow). The higher the value of CC, the more consistent the batsman is. The numerical value of CC has no specific physical meaning, so it is difficult to judge a batsman's consistency by simply looking at the value. In order to assess a batsman's consistency based on his CC value, a data set consisting of all the 'current' ODI (one-day international) players of the major cricket playing countries who have played at least 20 innings each, has been used to construct a table containing 10 classes. The data, taken on 11 April 2002 from Cricinfo (2002), comprised 189 players. The 10% with the highest (best) CC values were classified into class one, the next 10% into class two, etc. In order to determine the class boundaries, the bootstrap technique (Efron, 1990: 79) was used to estimate the deciles for the data set. The class boundaries used for the classification scheme are given in Table 1. A similar data set of Test players taken on the same date was used to calculate class boundaries for Test matches.

TABLE 1. **A CLASSIFICATION SCHEME OF TEN CLASSES FOR CC VALUES FOR TESTS AND ONE-DAY INTERNATIONALS**

Class number	Interval for tests	Interval for ODIs
1	1.86+ -	1.99+ -
2	1.82+ - 1.86	1.94+ - 1.99
3	1.78+ - 1.82	1.90+ - 1.94
4	1.75+ - 1.78	1.86+ - 1.90
5	1.73+ - 1.75	1.83+ - 1.86
6	1.71+ - 1.73	1.80+ - 1.83
7	1.68+ - 1.71	1.77+ - 1.80
8	1.64+ - 1.68	1.74+ - 1.77
9	1.60+ - 1.64	1.69+ - 1.74
10	0.00+ - 1.60	0.00+ - 1.69

It is interesting that batsmen achieve better CC values in ODIs than in Tests and this is probably mainly due to the fact that bowlers are far more restricted in ODIs than in Tests.

The implication of the Lemmer-Nel definition of consistency is that *consistent batsmen have higher probabilities of obtaining reasonable scores than inconsistent batsmen*. In order to illustrate this, a case study was executed, based on an updated data set. It consisted of all current ODI players of the major cricket playing countries who have played at least 20 innings each, taken on 1 February 2003 from Cricinfo (2003a), just before the start of the 2003 World Cup competition (140 in total). Suppose that a batsman is said to fail if he gets an *out* score smaller than one-third of his average. By counting the number of out scores smaller than one third of his average and dividing it by his number of scores, an estimate is found for his probability of failure. The CC values, consistency classes and failure probabilities of a selection of ODI batsmen are given in Table 2. For batsmen who are very consistent (in class one), the failure probability is slightly over 20% whereas for very inconsistent batsmen, the probability is around 35%. This clearly accentuates the importance of being consistent.

TABLE 2. **CASE STUDY OF RELATIONSHIP BETWEEN CC VALUE AND FAILURE PROBABILITY**

NAME	CC	CLASS	AVERAGE	INNINGS	FAILURE PROBABILITY
M Bevan	2.177	1	54.80	168	0.214
R Sarwan	2.109	1	51.05	28	0.214
H Tillakaratne	2.006	1	29.38	159	0.258
J Kallis	1.913	3	44.04	162	0.309
M Hayden	1.878	4	45.53	51	0.294
L Klusener	1.858	5	42.72	121	0.298
S Tendulkar	1.787	7	43.73	294	0.323
G Kirsten	1.786	7	40.56	179	0.346
V Sehwag	1.759	8	36.33	55	0.364
S Jayasuriya	1.74	8	32.14	279	0.355
H Gibbs	1.706	9	34.81	117	0.368

By plotting a batsman's CC values from innings to innings, one can clearly see how consistent he was at every stage in his career. In the top part of Figure 1 a batsman's scores were plotted with not out scores indicated by an asterisk.

The average is also given from innings to innings – see Figure 1. The consistency curve (CC plotted against the innings number) is given in the bottom part of the figure. Normally the CC values vary substantially up to the tenth or even fifteenth innings but then start to stabilise. It must be kept in mind that CC is always calculated by using the deviations of all scores from the most recent average. A very high score increases the average markedly and may cause a lowering of CC because low scores then lie further from the new average than from the previous average. This decline in CC is the price that the batsman has to pay for increasing his average. This phenomenon can be observed by looking at the high not out score of the twenty-third innings. The batsman considered here was fairly consistent between his fourteenth and twenty-seventh innings (he was in classes two or three). A series of very low scores from his twenty-seventh until his thirty-third innings resulted in his CC values dropping from class two to class seven. Here he was not in good form and this is clearly indicated by the sharp decline in his consistency curve. From innings 34 onwards he was in good form and this is indicated by an increasing consistency curve rising from class seven to three. Note that the low scores of innings 37, 38 and 43 are all not out scores and must not be misread from the top figure as an indication of inconsistency. Actually, the top figure can be very deceptive for judging the Lemmer-Nel consistency. All scores above the present average and all not out scores must be ignored. The bottom figure therefore gives a better indication of form. As shown in the Figure a batsman's *present form* can be judged by looking at the shape of his consistency curve. If the trend is upward, he is improving his consistency and is therefore in good form, whereas a downward trend indicates that he is becoming more and more inconsistent and is not in good form. Clearly a batsman who is very consistent and has a stable consistency curve, is also in good form.

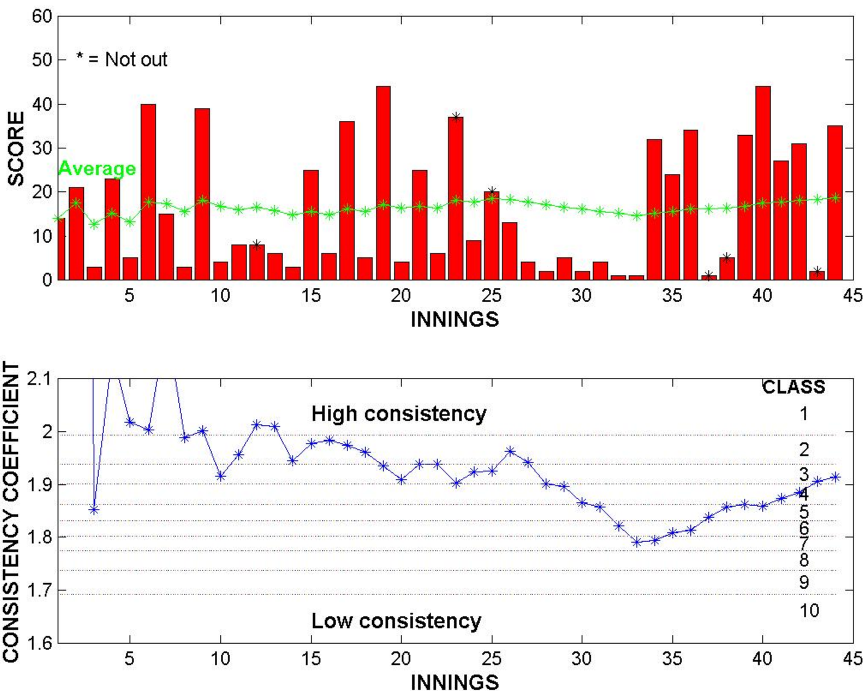

FIGURE 1. **TOP: SCORE AND AVERAGE PER INNINGS,**
BOTTOM: CONSISTENCY COEFFICIENT PER INNINGS

BATTING PERFORMANCE MEASURE

Based on the practical importance of consistency it is important to incorporate CC into a measure of batting performance, as has been done by Barr and Van den Honert (1998). They defined the *consistency adjusted average* by multiplying the average by the geometric coefficient. In this way, they scaled the average up (or down) depending on the extent to which a batsman's consistency deviated from the value *one*, which is seen as the yardstick for a batsman whose scores follow a geometric distribution.

This study now wants to use the consistency coefficient CC to scale the average up or down, but firstly it is necessary to look at the distribution of CC. For the updated data set the average of CC was found to be equal to 1.8173. Thus the ratio C=CC/1.8173 was used as scale factor whereby the average of a player whose consistency is better than the average consistency of the reference group will be scaled up, and one with consistency below the average will be scaled down. In order to construct a realistic measure of batting performance, a batsman's recent scores are more important than the scores at the start of his career. Instead of using the average (which gives equal weight to all scores), it is better to use an exponentially weighted average denoted by EWA in which each weight is equal to 0.96 of the next weight. See Gilchrist (1976: 51) for the formula of the exponentially weighted moving average. In this study the formula is applied only once per player and not repeatedly as in the case of a moving average and is therefore just called an exponentially weighted average. EWA is calculated for all the batsman's scores. If the last (most recent) score has a weight a, the second last weight is 0.96 x a, the third last weight 0.96^2 x a, etc. This is in accordance with the weights used by PriceWaterhouseCoopers (2002) in their ratings.

Up to this point, the proposed measure has the structure of BP=EWAxC. This is similar to the consistency adjusted average of Barr and Van den Honert (1998), but EWA replaces the average and C the geometric coefficient.

Another very important criterion to be taken into account to assess a batsman's performance is his strike rate SR=average number of runs scored per hundred balls faced. Two opening batsmen may have the same average but the first may have a strike rate of sixty and the second a strike rate of ninety. The latter obviously has better performance than the former. One can use R=SR/average(SR)=SR/71.4286 as a further scaling factor as in the case of C. An important question, however, is whether R and C should have the same weight (i.e. should one use EWAxCxR?). By using the same data set, the statistics given in Table 3 were found.

TABLE 3. **STATISTICS OF ODI DATA SET**

	CC	SR	C	R	RP
Average	1.8173	71.4286	1.0000	1.0000	0.9969
Standard Deviation	0.1230	11.2527	0.0677	0.1575	0.0681

The distributions of C and R have the same average but R has a much higher standard deviation than C. This means that if the formula EWAxCxR is used, R can have a much larger effect than C. In order to avoid R overwhelming C, it is desirable to scale R down relative to C. It is proposed to scale R down in relation to the ratio of their standard deviations, i.e. to work with $R^{0.0677/0.1575}=R^{0.43}$. Define $RP=R^{0.43}$ then average(RP)=0.9969 and standard deviation(RP)=0.0681. The averages and standard deviations of C and RP are now very similar (see Table 3) and the measure of batting performance is defined as BP=EWAxCxRP.

BP can be used to assess the performance of an individual batsman or to compare the performances of a group of batsmen. As in the case of CC, it is useful to draw up a classification table according to which batsmen can be classified. Exactly the same procedure has been followed by using the BP values of the data set. The classes are given in Table 4.

TABLE 4. **A CLASSIFICATION SCHEME OF TEN CLASSES FOR BP VALUES FOR TESTS AND ONE-DAY INTERNATIONALS**

Class number	Interval for tests	Interval for ODIs
1	52.65+ -	46.31+ -
2	43.63+ - 52.65	37.74+ - 46.31
3	37.78+ - 43.63	32.12+ - 37.74
4	32.32+ - 37.78	28.47+ - 32.12
5	27.49+ - 32.32	24.63+ - 28.47
6	23.56+ - 27.49	20.92+ - 24.63
7	20.31+ - 23.56	17.09+ - 20.92
8	14.58+ - 20.31	13.35+ - 17.09
9	7.94+ - 14.58	9.27+ - 13.35
10	0.00+ - 7.94	0.00+ - 9.27

In Table 5, the top players of the data set are ranked according to their BP values.

TABLE 5. **RANKING OF ODI BATSMEN ACCORDING TO BP VALUES**

Rank	Name	SR	AVE	EWA	CC	C	RP	BP	Rank June
1	R Sarwan	79.40	51.05	57.61	2.109	1.161	1.047	69.98	1
2	M Hayden	77.85	45.53	55.03	1.878	1.033	1.038	59.01	17
3	M Bevan	74.44	54.80	46.69	2.177	1.198	1.018	56.93	2
4	J Rhodes	80.95	35.32	45.11	1.990	1.095	1.055	52.14	7
5	Y Youhana	72.33	42.89	51.28	1.811	0.997	1.005	51.39	24
6	D Lehmann	81.87	37.46	43.19	2.034	1.119	1.060	51.26	3
7	D Martyn	77.67	40.14	43.59	1.971	1.085	1.037	49.02	5
8	L Klusener	90.06	42.73	43.25	1.858	1.023	1.105	48.86	6
9	S Tendulkar	86.38	43.73	45.70	1.787	0.983	1.085	48.76	4
10	G Smith	74.39	41.28	40.62	2.140	1.177	1.018	48.66	15
11	H Dippenaar	64.25	42.89	44.72	2.069	1.138	0.955	48.64	12
12	C Gayle	80.25	36.44	45.02	1.827	1.005	1.051	47.57	14
13	J Kallis	69.99	44.04	44.96	1.913	1.053	0.991	46.92	23
14	R Ponting	76.69	41.33	42.22	1.951	1.074	1.031	46.73	8
15	V Sehwag	98.88	36.33	40.81	1.759	0.968	1.150	45.44	26
16	A Flower	74.72	34.89	43.82	1.844	1.015	1.020	45.34	10
17	S Jayasuriya	89.85	32.14	42.38	1.740	0.958	1.104	44.79	34
18	B Lara	78.61	42.65	41.78	1.843	1.014	1.042	44.16	18
19	C Hooper	76.59	35.84	38.49	1.949	1.072	1.030	42.53	29
20	S Chanderpaul	68.98	36.44	40.02	1.960	1.078	0.985	42.52	20
21	R Dravid	68.40	38.39	39.12	1.993	1.096	0.982	42.10	9
22	N Knight	71.39	41.58	40.98	1.865	1.026	1.000	42.04	29
23	A Gilchrist	91.26	34.16	35.34	1.934	1.064	1.111	41.78	16
24	S Elahi	73.29	37.38	39.43	1.838	1.011	1.011	40.31	30
25	H Gibbs	81.31	34.81	40.30	1.706	0.939	1.057	40.01	11
26	M Trescothick	87.95	37.18	36.39	1.782	0.981	1.094	39.03	33
27	M Atapattu	67.18	37.99	39.47	1.828	1.006	0.974	38.68	35
28	S Anwar	80.91	38.94	35.19	1.891	1.041	1.055	38.64	21
29	M Samuels	71.60	32.94	36.52	1.857	1.022	1.001	37.35	49
30	Y Khan	70.61	31.48	36.93	1.836	1.011	0.995	37.13	25

The data set consisting of all current ODI players who have played at least 20 innings until 1 February 2003 contained a number of players who have retired from ODIs, but for the sake of interest they have been retained in the rating. The data set is actually very large because it includes scores of players who have been playing for many years. The statistics used for the development of the formula (cf. Table 3) do not differ much from the statistics of the data set taken on 11 April 2002 because there is a large overlap. Actually, if the 2002 statistics are used in the formula, the BP values per player differ slightly from those of the 2003 data set, but the ranking of all 140 players is exactly the same. There is thus no need to update the formula soon, unless major changes are to be introduced in the rules of the game.

To illustrate the motivation for the construction of BP, take Sarwan as first example. His last 13 scores were exceptionally good, resulting in his average of 51.05 being scaled up to EWA=57.61. Being very consistent with CC=2.109 and C=1.1607 results in a scaling up of EWA by 16.07% to EWAxC=57.61x1.1607=66.8679. His strike rate is also better than the average (R=1.1116 and RP=1.0465) and leads to a further 4.65% scaling up to EWAxCxRP=69.98. It must be mentioned that Sarwan had only played 28 ODI innings until 1 February 2003 and it will be interesting to see whether he could maintain his good performance. Secondly, note that Dippenaar is very consistent – he is in class one with CC=2.069 and has C=1.1383 which scales his EWA of 44.72 up to 50.9048, but his strike rate of 64.25 is below the average, so his RP value of 0.9555 scales 50.9048 down to a BP value of 48.64. These figures of C and RP are not surprising because very often he walks out to bat after a collapse of the top order batsmen and has to consolidate the innings. This he does very well, but at the expense of having to bat carefully and thus sacrificing on his strike rate.
The ordinary averages of the players have also been given in Table 5. It is interesting to note that amongst the group of 30 players shown in the table, Jonty Rhodes ranks 24th on average but fourth according to BP. The large difference between his average of 35.32 and his EWA of 45.11 is proof of the fact that he had much better scores towards the end of his ODI career than before. He was also very consistent (CC=1.990 lies on the boundary between classes 1 and 2). His strike rate of 80.95 was also very good. Taking into account that very often he came in to bat at a stage when fast scoring was necessary, it is clear that his good BP value gives him a much more realistic rating than his fairly low average. Michael Bevan, who ranks first according to average (54.80), is also very consistent and has a good strike rate, but his EWA value of 46.69 indicates that he was not in good form towards the end of January 2003. He is therefore third in the BP ranking.

The last column of Table 5 contains the ranks of the players based on data updated on 3 June 2003. Note that players who have performed well in the period from February until June have improved their rankings, e.g. Gibbs, Dravid, Tendulkar and most of the Australians (except Hayden, who was in a downward spell).

TEST MATCHES

In the case of Test matches, the batting statistics of all the current Test players who have played at least 20 test innings until 1 February 2003, taken from Cricinfo (2003b) have been used. Unfortunately for the players of India, Pakistan and Sri Lanka, the strike rates were not available, so they have been excluded. The statistics for the remaining 86 players are given in Table 6.

TABLE 6. **STATISTICS OF TEST MATCHES DATA SET**

	CC	SR	C	R	RP
Average	1.7372	43.0016	1.0000	1.0000	0.9937
Standard Deviation	0.1247	10.4986	0.0718	0.2441	0.0729

For Tests C=CC/1.7372 and R=SR/43.002. The scale down ratio for R is 0.0718/0.2441=0.2941. Define $RP=R^{0.30}$ and the measure of batting performance as BP=EWAxCxRP.

TABLE 7. **RANKING OF TEST PLAYERS ACCORDING TO BP**

Rank	Name	SR	AVE	EWA	CC	C	RP	BP	Rank June
1	A Gilchrist	82.70	58.11	60.13	1.804	1.039	1.217	75.99	1
2	M Vaughan	52.49	50.93	61.97	1.821	1.048	1.062	68.96	4
3	M Hayden	59.25	51.60	58.94	1.783	1.026	1.101	66.60	3
4	J Kallis	39.63	50.40	65.89	1.761	1.014	0.976	65.18	5
5	R Ponting	57.52	47.91	54.61	1.766	1.017	1.091	60.58	2
6	H Gibbs	48.59	44.48	56.43	1.760	1.013	1.037	59.29	9
7	B Lara	59.22	49.49	49.64	1.782	1.026	1.101	56.05	6
8	A Flower	45.07	51.55	53.05	1.794	1.033	1.104	55.55	10
9	J Langer	51.74	44.32	48.98	1.767	1.017	1.057	52.65	7
10	S Chanderpaul	40.38	44.30	50.62	1.833	1.055	0.981	52.41	11
11	M Richardson	40.10	47.17	46.05	1.988	1.145	0.979	51.61	8
12	G Thorpe	46.57	41.88	46.00	1.784	1.027	1.024	48.39	13
13	A Stewart	48.76	40.13	43.16	1.831	1.054	1.038	47.25	16
14	G Kirsten	42.46	42.89	47.88	1.689	0.972	0.996	46.37	17
15	D Martyn	50.95	46.51	44.15	1.727	0.994	1.052	46.18	18
16	M Trescothick	51.66	40.24	40.08	1.893	1.090	1.057	46.15	14
17	C Cairns	54.24	32.79	40.25	1.829	1.053	1.072	45.44	19
18	S Pollock	50.18	33.45	42.29	1.778	1.023	1.047	45.33	20
19	C Hooper	50.27	36.47	41.12	1.779	1.024	1.048	44.12	23
20	S Waugh	48.13	49.45	43.24	1.709	0.984	1.034	44.00	12
21	N Astle	49.51	38.00	40.69	1.774	1.021	1.043	43.35	24
22	M Waugh	52.27	41.82	38.37	1.790	1.031	1.060	41.93	25
23	M Butcher	42.34	32.99	38.12	1.847	1.063	0.995	40.35	22
24	R Sarwan	38.43	37.39	38.99	1.907	1.098	0.967	40.31	21
25	C Gayle	47.57	35.29	39.02	1.737	1.000	1.031	40.22	26
26	N Hussain	40.34	37.15	40.44	1.751	1.008	0.981	39.98	27
27	M Sinclair	44.80	43.16	41.46	1.636	0.942	1.012	39.54	37
28	N McKenzie	41.47	35.74	35.82	1.904	1.096	0.989	38.84	29
29	C McMillan	56.91	39.68	34.23	1.786	1.028	1.088	38.27	28
30	W Hinds	47.04	32.76	33.79	1.837	1.057	1.027	36.70	33

It is interesting to note that the exponential weight of the strike rate is much smaller in the case of Test matches (0.30) than in the case of ODIs (0.43). This is in agreement with the argument that a player's strike rate in the case of ODIs is more important than in the case of Test matches. For the data set of all the current test players who have played at least 20 innings each (excluding those of India, Pakistan and Sri Lanka), the ranking of the top players in terms of BP is given in Table 7.

Gilchrist is known as a very good Test player and he ranks first according to BP and also according to average. This is in sharp contrast to his ODI career where his strike rate is excellent, but his average only 34.16. Kallis is in position four but would rank first according to EWA, an indication that he was in very good form at the start of 2003.

At the start of this study there was uncertainty whether the strike rate should be incorporated into BP in the case of Tests, but observing strike rates in the low twenties and even 19.65, there remained no doubt that sooner or later the strike rate should be taken into account. Even in Test matches a player with a good strike rate is definitely better than one with the same average but a low strike rate.

The last column of Table 7 contains the ranks of the players according to their performances until 3 June 2003. Note Steve Waugh, who has climbed from the 20th up to the 12th position, which shows how good a batsman he is.

CONCLUDING REMARKS

The construction of BP was motivated by the argument that the exponential weighted average, the consistency coefficient and the strike rate are all important aspects of a batsman's performance. Any one of these, or the average, can be used to rank batsmen, but it makes much more sense to combine them into one criterion, BP.

BP is a measure of the batting performance achieved by a batsman up to his last innings, irrespective of when he played. This does not change if he misses matches or stops playing. A ranking according to BP will therefore differ from the PriceWaterhouseCoopers (2002) ratings because they penalise a player for missing matches. They also take into account various other factors including the strength of the opposition, the level of run scoring in the match, etc. It is a statistical fact that most of these factors tend to average out in the long run and are therefore not so important in the global assessment of batsmen's performances.

BP could be seen as a consistency and strike rate adjusted average as in the case of the Barr and Van den Honert (1998) measure, but should rather be described as a measure of the intrinsic performance value of the batsman.

BP is not only useful for the ranking of batsmen, but can also be used to monitor a specific batsman during the course of his career. By plotting his BP from innings to innings, one can see whether he is improving or deteriorating. This can be useful for a coach and for selectors. BP has the advantage that it combines the different aspects that are important for a batsman to be good.

The consistency curve (see the bottom part of Figure 1) is very useful to show the consistency and present form of a batsman. CC and BP can very easily be calculated and plotted by using computer software.

Cricket authorities will have to make more use of such measures instead of simply relying on their 'gut feeling' of players' performances.

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(Subject editor: Dr. E. Terblanche)