

# Handicap Modelling Summary

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## Definitions

In this paper, a number of terms are introduced which are briefly described here:

- **Blended** – a handicap system where a variable number of best rounds out of twenty is taken, taking fewer for the high markers, more for the low markers. This has the effect of reducing the handicaps of the higher markers without changing those of the lower markers.
- **Hybrid** – a handicap system where the lower of a fast moving average (say best eight of sixteen) and a slower moving average (say best sixteen of thirty two) is taken. This has the objective of reducing the handicaps of improved form players faster, while reducing the speed with which handicaps are eased for poor form.
- **Handicap Bias** – the proportion of winners in a given handicap range compared to the proportion of the field in that range. 100% is neutral, greater than 100% is favourable, and less than 100% is unfavourable.
- **Weighted Handicap Bias** – the Handicap Bias weighted by the number of competitors in the relevant handicap range. This gives the percentage of the field by which a given handicap range is winning above or below their proportion of the field.
- **Tilt Index** – related to the gradient of a line of best fit to the weighted handicap bias values for the various handicap groups. A negative Tilt implies that the bias favours the low marker; a positive Tilt implies the bias favours the high marker. In the subsequent tables, a Tilt favouring the high marker is reddish, a Tilt favouring the low marker is blue, and a close to zero Tilt is green.
- **Level Index** – related to the standard deviation of these weighted handicap bias values. In the subsequent tables, green is more Level, orange is more lumpy.
- **Stableford Equivalent** – the score in a round, adjusted to the equivalent stableford score, and adjusted for course rating.
- **Anchor** – a secondary handicap rule where a handicap cannot exceed four more than the lowest exact handicap over the prior twelve months.
- **Cap** – a secondary handicap rule where the Differential used for handicap calculation cannot exceed 40 for men and 50 for women. (Handicap Differential equals Gross Score minus Course Rating.)

## Phase 1

Following an earlier report, in which it was demonstrated that the Old Australian Handicap System was biased in favour of the low markers, and that the Current Australian Handicap System was biased, especially for the men's fields, in favour of the higher markers, a number of different options were considered with the objective of removing some of the current bias.

These ranged from simply changing the Bonus For Excellence (BFE) to reducing the number of flagged rounds, eg take only eight from the last twenty rounds, to more complex systems such as the Blended and the Hybrid.

Fifteen clubs were chosen as representative. Each of the club's home competitions was recalculated on the various handicap methods, using data from December 2007 through November 2010.

A "good" system would be one in which the playing field was tilted neither in favour of the low markers nor the high markers, and where the playing field was relatively smooth.

No system will achieve a perfect zero Tilt and a perfect zero Level. The following analysis, it is hoped, will allow a decision to be made which achieves the best result, or possibly, the least worse result.

At the end of Phase 1, the best eight of twenty rounds, was recommended as the method of choice, with some variation to the BFE. Essentially, it achieved as good a result as the other methods, and was able to do so with far less complexity. It should be noted that the "anchor" that had been partially modelled in Phase 1 was based on a different definition than that which was finally adopted.

## Phase 2

In order to check the Eight20, and the Eight20 with Anchor, the modelling was repeated on the original 15 clubs, plus another 10.

The Men's and Women's rounds, for handicap purposes, were capped at a Differential of 40 and 50 respectively. A full set of cases was included for the Anchor and Prize-winners (Leaders) as well as the Winners.

The Cap and Anchor mainly impact the higher markers, and their impact on competition is the equivalent of a 0.01 of Bonus For Excellence reduction.

As an example of the impact of these two measures for the men's field, the reduction in handicap that results compared to the calculated Ten20 0.96 Current System is:

Men		
Handicap Range	31 to 35	Max 36
Ten20 0.96 Cap Impact	(0.07)	(0.30)
Ten20 0.96 & Cap & Anchor Impact	(0.32)	(0.65)
Eight 20 0.95 & Cap & Anchor Impact	(1.47)	(1.28)
Eight 20 0.94 & Cap & Anchor Impact	(1.79)	(1.48)
Eight 20 0.93 & Cap & Anchor Impact	(2.11)	(1.72)

The anchor also does a good job of improving the Level of the playing field. Time and time again in the detailed club analyses, it is seen that the peaks and troughs of handicap bias are less with the anchor than without it. The Level index bears this out:

Impact of Anchor on Playing Field Level			
	Eight20 0.95	Eight20 0.94	Eight20 0.93
Average Level index without Anchor	23.4	22.0	22.1
Average Level index with Anchor	21.7	20.7	21.8

The dynamics of the Eight20 compared to the Ten20 should also be noted. The Ten20 has the property that as form deteriorates or improves, the handicap rises or falls at the same rate. However with the Eight20, as form deteriorates or improves, the handicap rises more slowly, and falls more quickly. This is because when form is improving, it takes only eight rounds to have a completely new handicap. But when form is deteriorating, as the twelve poorest rounds are discarded, it takes at least twelve rounds before there is a completely new handicap. So handicaps can actually rise some 50% more slowly than they fall. This somewhat asymmetric movement, although far from the asymmetry of the Old System, provides a culturally acceptable dynamic.

The Phase 2 analysis confirms that the Eight20 with Cap and Anchor provides a consistent set of results for the additional ten clubs compared to the original fifteen.

Next the BFE needs to be chosen. Here is a summary of the Tilt table that follows later in full for the Men's competition.

Winners Eight20 & Cap & Anchor - Men				
	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.93 No Grade
Average 15	11	1	-6	-14
New South Wales	99	89	86	-8
Victoria	58	47	40	-46
Average 15 ex NSW & Vic	1	-9	-17	-12
Average 10	-4	-10	-14	-15
Grand Average	5	-3	-10	-14
Grand Avge Ex NSW & Vic	-1	-9	-16	-13
Weighted Average	3	-6	-13	-16
Weighted Average ex NSW & Vic	-4	-12	-19	-15
Clubs with Tilt favouring the Low Marker	12 48%	15 60%	18 72%	19 76%
Clubs with Tilt favouring the Low Marker excl NSW & Vic	12 52%	15 65%	18 78%	17 74%
Level	22	21	22	23

As the BFE varies from 0.95 to 0.94 to 0.93, the average Tilt for the original fifteen clubs is shown to vary from 11 to 1 to -6.

However two clubs, New South Wales and Victoria, stand out in having significantly positive Tilts, favouring the high markers. But when these two clubs have grading removed from a given day's competitions, the Tilt immediately reverts to a more normal negative Tilt.

In other words, it is the practice of grading, in ways which favour the higher markers, which is causing the positive Tilt at these two clubs, not the handicap system.

If they are excluded from the average, the Tilt moves from 1 to -9 to -17. This is not dissimilar from the Tilt average of the ten new clubs, which move from -4 to -10 to -14.

The Grand average, excluding New South Wales and Victoria moves from -1 to -9 to -16. This average gives each club an equal weighting.

If the clubs' Tilts are weighted by the number of members, then the weighted Tilt moves from -4 to -12 to -19. Not a significantly different result.

The number of clubs with negative Tilt moves from 48% to 60% to 72%, but when New South Wales and Victoria are excluded, from 52% to 65% to 78%.

So if 0.95 is chosen, the Tilt is -1, with Level of 22, and 48% of the chosen clubs have a negative bias favouring the low marker.

If 0.94 is chosen, the Tilt is -9, the Level is 21, and 60% of the chosen clubs have a negative bias.

If 0.93 is chosen, the Tilt is -19, the Level is 22, and 72% of the chosen clubs have a negative bias, or 78% excluding NSW & Victoria.

If the objective is to restore some bias in favour of the lower marker, in all but, say, 25% of the cases, then 0.93 will achieve the objective.

With regard to Women's competitions, the fifteen and the ten results are consistent, and all BFE choices show considerable Tilt towards the low marker. Grading is used, particularly by Lake Karrinyup and Victoria, to provide a positive bias to the high markers, but the overall Tilt is still negative, favouring the low marker.

Winners Eight20 & Cap & Anchor - Women				
	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.93 No Grade
Average 15	-18	-21	-26	-34
Average 10	-21	-24	-28	-34
Grand Average	-19	-22	-27	-34
Clubs with Tilt favouring the Low Marker	22	22	22	24
	88%	88%	88%	96%
Level	25	26	26	29
Lake Karrinyup	27	20	14	-36
Victoria	16	13	8	-7

The Leaders (top 20% of the field) are significantly tilted in favour of the low marker for all the BFE's, with all but one (Barcaldine) exhibiting this characteristic.

Leaders Eight20 & Cap & Anchor - Men				
	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.93 No Grade
Average 15	-35	-40	-43	-48
Average 10	-25	-31	-34	-34
Grand Average	-31	-36	-39	-43
Clubs with Tilt favouring the Low Marker	24	24	24	24
	96%	96%	96%	96%
Leaders Eight20 & Cap & Anchor - Women				
Average 15	-25	-29	-31	-35
Average 10	-25	-26	-28	-30
Grand Average	-25	-28	-29	-33
Clubs with Tilt favouring the Low Marker	24	24	24	24
	96%	96%	96%	96%

## Conclusion

Eight20 0.93 with Cap and Anchor provides a negatively tilted playing field for the Men Winners in 75% of the chosen clubs, also negative in Tilt favouring the low markers for the Leaders, and also negative for both Winners and Leaders in Women's competitions. Due to the "Eight" factor, it is more responsive to improved form, and less responsive to deteriorating form. Due to the Cap and Anchor it is less volatile for the higher markers, leading to a somewhat more level playing field.

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May 2011.

## Tilt & Level

### Tilt & Level – Men – Phase 1

Club	Tilt - Men															Number of Clubs with Tilt Favouring the Low Marker	Level	
	Belmont	Brisbane	Carnarvon	Cumberland	Kooyonga	Lake Karrinyup	Lakelands	Maitland	Narrabri	New South Wales	Pacific	Royal Canberra	Tea Tree Gully	The Lakes	Victoria			Average
Method																		
Old System	-48	-78	-53	-43	-78	-83	-36	-15	-17	61	-86	-76	-87	-76	-12	-48	14	34
Ten20 0.96 Apr-Nov 2010	43	17	17	55	-4	19	31	18	23	99	4	18	33	-34	34	25	2	33
Ten20 0.96 Dec08-Mar10	-11	-30	5	22	-21	3	-2	29	3	107	-33	-2	-15	-37	51	5	8	27
Ten20 0.96	0	-9	10	31	-18	5	15	23	9	99	-23	7	3	-32	46	11	4	24
Ten20 0.95	-4	-15	0	26	-21	-1	6	11	7	95	-29	1	-8	-41	32	4	8	23
Ten20 0.94	-11	-20	-9	11	-30	-10	0	3	0	87	-42	-5	-13	-48	29	-4	10	21
Ten20 0.93	-22	-27	-20	12	-42	-17	-10	-2	5	91	-43	-15	-18	-50	21	-9	11	21
Ten20 0.92	-32	-34	-27	0	-42	-27	-14	-11	-3	94	-50	-22	-31	-51	9	-16	12	22
Ten20 0.91	-34	-35	-38	-9	-47	-33	-25	-19	-16	83	-57	-32	-50	-57	1	-25	13	24
Ten20 0.9	-44	-43	-44	-15	-55	-40	-33	-24	-23	81	-67	-37	-57	-61	-8	-31	14	25
Nine20 0.96	0	-11	7	36	-18	-2	14	14	10	99	-24	8	4	-30	39	10	5	23
Nine20 0.93	-24	-23	-19	9	-42	-25	-15	-3	6	90	-44	-15	-30	-45	18	-11	11	21
Nine20 0.90	-47	-40	-49	-24	-65	-44	-30	-21	-13	75	-63	-36	-58	-64	-6	-32	14	26
Eight20 0.96	-6	-4	4	29	-24	2	7	15	7	98	-23	8	-4	-36	37	7	6	20
Eight20 0.95	-9	-8	-4	25	-26	-5	3	10	4	95	-29	3	-11	-39	33	3	8	20
Eight20 0.94	-13	-12	-12	21	-29	-12	0	4	2	93	-36	-2	-19	-41	30	-2	10	20
Eight20 0.93	-16	-16	-19	17	-32	-18	-4	-1	-1	90	-43	-7	-27	-44	26	-6	12	21
Eight20 0.92	-27	-24	-31	3	-42	-26	-15	-10	-6	84	-52	-18	-40	-51	16	-16	12	23
Eight20 0.91	-37	-32	-42	-11	-51	-34	-26	-18	-11	78	-62	-29	-53	-58	6	-25	13	25
Eight20 0.90	-48	-40	-53	-26	-61	-42	-37	-27	-16	72	-71	-40	-66	-65	-4	-35	14	27
Blended 0.96	-14	-19	-9	7	-32	-13	-10	-1	-4	88	-43	-10	-23	-57	24	-8	12	22
Blended 0.94	-34	-29	-37	-7	-48	-25	-24	-18	-7	82	-56	-23	-35	-57	13	-20	13	23
Blended 0.92	-52	-46	-50	-27	-55	-41	-38	-29	-16	77	-67	-42	-60	-71	-4	-35	14	27
Hybrid 0.96	2	-12	0	30	-17	-1	6	17	8	90	-40	3	-4	-39	31	5	6	21
Hybrid 0.95	-10	-19	-9	21	-24	-10	-2	7	5	85	-47	-5	-14	-44	23	-3	10	20
Hybrid 0.94	-23	-26	-19	12	-32	-19	-10	-4	2	79	-53	-13	-25	-49	16	-11	11	19

Tilt & Level – Women – Phase 1

Club	Tilt - Women															Number of Clubs with Tilt Favouring the Low Marker	Level	
	Belmont	Brisbane	Carnarvon	Cumberland	Kooyonga	Lake Karinyup	Lakelands	Maitland	Narrabri	New South Wales	Pacific	Royal Canberra	Tea Tree Gully	The Lakes	Victoria			Average
Method																		
Old System	-65	-58	-51	-41	-42	19	-34	-23	-25	-30	-105	-28	-25	-18	-3	-35	14	32
Ten20 0.96 Apr-Nov 2010	-10	5	-3	-17	-18	51	3	0	-12	-16	-54	-18	-10	-19	15	-7	10	33
Ten20 0.96 Dec08-Mar10	-31	-33	-25	-30	-30	30	-24	-20	-9	-22	-88	-11	-10	-5	-7	-21	14	26
Ten20 0.96	-23	-23	-18	-27	-29	36	-16	-16	-18	-18	-75	-12	-9	-8	4	-17	13	24
Ten20 0.95	-35	-24	-24	-32	-32	32	-23	-19	-17	-19	-79	-19	-13	-9	4	-21	13	24
Ten20 0.94	-42	-33	-33	-37	-35	29	-21	-20	-21	-24	-84	-22	-16	-14	1	-25	13	25
Ten20 0.93	-52	-33	-39	-37	-38	24	-26	-23	-22	-26	-90	-24	-24	-18	-3	-29	14	27
Ten20 0.92	-57	-40	-40	-42	-37	17	-29	-22	-21	-26	-91	-29	-24	-21	-2	-31	14	28
Ten20 0.91	-61	-49	-49	-46	-40	13	-29	-24	-30	-28	-98	-33	-27	-20	-8	-35	14	29
Ten20 0.9	-73	-54	-56	-43	-47	8	-33	-27	-33	-31	-101	-38	-36	-23	-11	-40	14	32
Nine20 0.96	-36	-27	-20	-30	-29	32	-16	-19	-16	-19	-78	-18	-8	-9	6	-19	13	24
Nine20 0.93	-51	-38	-34	-38	-32	20	-25	-18	-20	-25	-89	-26	-20	-19	-1	-28	14	26
Nine20 0.90	-69	-54	-55	-47	-45	5	-31	-27	-30	-31	-105	-38	-39	-24	-13	-40	14	32
Eight20 0.96	-32	-18	-24	-26	-29	34	-19	-18	-21	-19	-85	-16	-13	-10	4	-19	13	24
Eight20 0.93	-43	-35	-32	-34	-33	21	-24	-16	-23	-24	-87	-26	-19	-19	-3	-26	14	26
Eight20 0.90	-72	-55	-55	-47	-47	10	-32	-27	-36	-33	-104	-37	-37	-24	-13	-41	14	32
Blended 0.96	-39	-35	-34	-33	-35	23	-25	-20	-22	-23	-86	-22	-18	-16	4	-26	14	26
Blended 0.94	-58	-40	-50	-45	-45	20	-31	-23	-29	-31	-92	-30	-31	-22	-9	-34	14	30
Blended 0.92	-68	-49	-56	-49	-48	11	-39	-29	-34	-33	-102	-36	-35	-26	-12	-40	14	33
Hybrid 0.96	-38	-30	-19	-29	-29	33	-16	-16	-19	-23	-80	-21	-12	-16	7	-20	13	24
Hybrid 0.94	-44	-36	-29	-36	-29	21	-19	-20	-20	-27	-84	-26	-19	-22	2	-26	13	26



## Tilt & Level – Men – Phase 2

Tilt - Men																										
Club	Old System	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.92	Eight20 0.91	Eight20 0.93 No Grade	Eight20 0.95 Anch	Eight20 0.94 Anch	Eight20 0.93 Anch	Eight20 0.92 Anch	Eight20 0.91 Anch	Eight20 0.93 No Grade Anch	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.92	Eight20 0.91	Eight20 0.93 No Grade	Eight20 0.95 Anch	Eight20 0.94 Anch	Eight20 0.93 Anch	Eight20 0.92 Anch	Eight20 0.91 Anch	Eight20 0.93 No Grade Anch	
	Winners	Winners + Anchor						Leaders						Leaders + Anchor												
Belmont	-37	14	10	4	2	-16	4	8	1	-9	-18	-30	-9	-29	-34	-40	-44	-48	-40	-34	-39	-44	-49	-54	-44	
Brisbane	-32	1	-7	-11	-20	-30	-13	-5	-15	-19	-28	-36	-38	-37	-41	-46	-52	-55	-46	-39	-44	-49	-54	-57	-58	
Carnarvon	-50	5	-5	-12	-28	-34	-12	-2	-10	-14	-29	-40	-14	-38	-42	-45	-51	-56	-45	-41	-46	-48	-54	-59	-48	
Cumberland	-43	41	26	15	6	-2	19	30	20	4	-6	-14	6	-31	-36	-40	-44	-47	-38	-33	-38	-42	-46	-49	-41	
Kooyonga	-52	-11	-14	-22	-32	-39	-24	-11	-15	-26	-35	-45	-27	-42	-48	-53	-59	-64	-55	-49	-52	-57	-64	-68	-59	
Lake Karingup	-30	6	-2	-6	-14	-16	-5	4	-7	-10	-17	-20	-11	-34	-40	-43	-47	-52	-40	-37	-43	-45	-49	-53	-43	
Lakelands	-9	22	13	9	-5	-10	13	21	11	5	-9	-14	8	-24	-28	-30	-33	-38	-30	-26	-30	-32	-35	-40	-32	
Maitland	-2	23	11	4	1	-8	4	20	10	0	-5	-14	-1	-18	-24	-26	-30	-34	-27	-22	-26	-30	-34	-37	-30	
Narrabri	-16	26	11	5	-1	-1	5	27	9	-2	-6	-7	-2	-29	-36	-41	-42	-44	-41	-29	-39	-42	-44	-47	-42	
New South Wales	99	116	106	99	92	81	8	99	89	86	80	68	-8	-21	-25	-30	-31	-35	-74	-26	-30	-34	-35	-40	-80	
Pacific	-61	-25	-35	-44	-51	-53	-13	-37	-47	-50	-56	-61	-22	-34	-39	-44	-47	-52	-41	-37	-43	-47	-51	-55	-45	
Royal Canberra	-60	5	-4	-9	-22	-29	14	-2	-10	-16	-27	-35	7	-31	-37	-42	-48	-52	-35	-34	-40	-45	-50	-54	-40	
Tea Tree Gully	-48	-2	-18	-28	-38	-48	-26	-10	-26	-36	-47	-55	-34	-30	-35	-38	-43	-48	-38	-34	-38	-43	-47	-52	-43	
The Lakes	-58	-31	-31	-40	-51	-52	-9	-31	-41	-48	-53	-53	-16	-32	-36	-34	-38	-42	-32	-39	-43	-41	-46	-48	-38	
Victoria	-4	61	53	46	38	27	-40	58	47	40	32	16	-46	-37	-40	-44	-49	-51	-77	-37	-41	-45	-50	-51	-78	
Average 15	-27	17	8	1	-8	-15	-5	11	1	-6	-15	-23	-14	-31	-36	-40	-44	-48	-44	-35	-40	-43	-47	-51	-48	
Average 15 ex NSW & Vic	-36	6	-4	-10	-19	-26	-3	1	-9	-17	-26	-33	-12	-31	-37	-40	-45	-49	-39	-35	-40	-43	-48	-52	-43	
Barcardine	8	30	19	23	26	34	23	30	19	23	26	34	23	30	13	14	9	7	14	30	13	14	9	7	14	
Cottesloe	-60	-28	-41	-44	-54	-61	-34	-39	-45	-49	-60	-65	-40	-33	-39	-42	-48	-51	-40	-38	-43	-46	-51	-54	-44	
Grange	-56	2	-3	-8	-16	-19	-1	2	-3	-8	-16	-19	-1	-29	-33	-36	-40	-43	-32	-30	-33	-36	-40	-43	-32	
Kingston Beach	-17	34	30	22	6	-1	22	19	16	9	-5	-15	9	-24	-29	-32	-34	-38	-32	-30	-35	-37	-40	-44	-37	
Kogarah	-86	2	-11	-23	-32	-39	-13	-14	-21	-32	-40	-48	-21	-40	-46	-50	-55	-59	-49	-45	-52	-55	-59	-63	-54	
Launceston	-23	24	7	11	9	-4	-33	7	-1	0	-4	-12	-43	-34	-37	-46	-46	-48	-60	-39	-41	-48	-49	-53	-60	
Royal Adelaide	-61	-37	-50	-55	-59	-59	-44	-41	-53	-57	-60	-61	-49	-17	-22	-24	-30	-32	-22	-19	-25	-27	-31	-33	-25	
Serpentine	-9	28	22	9	7	11	9	28	22	9	7	11	9	-15	-25	-29	-27	-27	-29	-15	-25	-29	-27	-27	-29	
Southern	-42	15	6	0	-5	-17	-3	0	-4	-10	-18	-30	-13	-33	-38	-41	-46	-51	-41	-38	-42	-45	-49	-54	-45	
Trentham	-41	-16	-17	-17	-26	-41	-16	-26	-26	-29	-37	-52	-27	-22	-27	-27	-31	-34	-26	-27	-31	-33	-37	-39	-32	
Average 10	-39	5	-4	-8	-14	-20	-9	-4	-10	-14	-21	-26	-15	-22	-28	-31	-35	-38	-32	-25	-31	-34	-37	-40	-34	
Grand Average	-32	12	3	-3	-11	-17	-7	5	-3	-10	-17	-24	-14	-27	-33	-36	-40	-44	-39	-31	-36	-39	-43	-47	-43	
Grand Avge Ex NSW & Vic	-39	6	-4	-9	-17	-23	-6	-1	-9	-16	-24	-30	-13	-27	-33	-36	-40	-44	-36	-31	-36	-39	-43	-47	-39	
Weighted Average	-36	10	0	-6	-14	-22	-8	3	-6	-13	-22	-29	-16	-31	-36	-39	-44	-47	-41	-34	-39	-42	-47	-50	-45	
Weighted Average ex NSW & Vic	-43	4	-6	-12	-21	-28	-7	-4	-12	-19	-28	-35	-15	-31	-36	-40	-44	-48	-39	-35	-39	-43	-47	-51	-43	
Clubs with Tilt favouring the Low Marker	23	7	13	13	16	21	15	12	15	18	21	21	19	24	24	24	24	24	24	24	24	24	24	24	24	
Clubs with Tilt favouring the Low Marker excl NSW & Vic	22	7	13	13	16	21	14	12	15	18	21	21	17	22	22	22	22	22	22	22	22	22	22	22	22	
Level	29	23	22	22	22	24	23	22	21	22	22	25	23	15	17	19	21	22	21	16	18	14	15	15	14	



## Tilt & Level – Women – Phase 2

Tilt - Women																									
Club	Old System	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.92	Eight20 0.91	Eight20 0.93 No Grade	Eight20 0.95 Anch	Eight20 0.94 Anch	Eight20 0.93 Anch	Eight20 0.92 Anch	Eight20 0.91 Anch	Eight20 0.93 No Grade Anch	Eight20 0.95	Eight20 0.94	Eight20 0.93	Eight20 0.92	Eight20 0.91	Eight20 0.93 No Grade	Eight20 0.95 Anch	Eight20 0.94 Anch	Eight20 0.93 Anch	Eight20 0.92 Anch	Eight20 0.91 Anch	Eight20 0.93 No Grade Anch
	Winners						Winners + Anchor						Leaders						Leaders + Anchor						
Belmont	-36	-27	-30	-38	-48	-49	-38	-28	-31	-38	-49	-54	-38	-35	-38	-41	-44	-46	-41	-37	-40	-42	-45	-48	-42
Brisbane	-37	-22	-28	-35	-42	-47	-37	-23	-31	-39	-45	-51	-54	-30	-32	-35	-38	-43	-36	-30	-34	-37	-38	-44	-46
Carnarvon	-11	-28	-28	-36	-41	-52	-38	-33	-36	-42	-48	-56	-44	-31	-36	-40	-43	-47	-40	-35	-39	-44	-46	-50	-44
Cumberland	-42	-29	-36	-39	-41	-41	-39	-32	-39	-39	-42	-43	-39	-33	-34	-36	-39	-40	-36	-33	-33	-35	-38	-39	-35
Kooyonga	-18	-16	-20	-24	-29	-28	-33	-17	-22	-26	-30	-28	-36	-16	-21	-22	-23	-23	-25	-18	-22	-23	-24	-24	-25
Lake Karrynup	16	28	21	14	10	6	-33	27	20	14	9	4	-36	-18	-22	-25	-28	-31	-55	-18	-23	-26	-28	-32	-55
Lakelands	-21	-13	-17	-21	-20	-24	-21	-12	-16	-22	-20	-24	-23	-17	-22	-21	-28	-29	-22	-18	-23	-22	-28	-29	-22
Maitland	-13	-10	-4	-7	-13	-11	-7	-8	-2	-8	-13	-11	-8	-12	-12	-19	-19	-21	-19	-12	-14	-19	-20	-23	-19
Narrabri	-29	-17	-15	-26	-27	-25	-26	-17	-15	-29	-29	-27	-29	-14	-16	-15	-20	-22	-15	-16	-18	-19	-21	-24	-19
New South Wales	-20	-17	-21	-23	-28	-28	-34	-20	-24	-26	-30	-33	-37	-21	-24	-25	-29	-31	-28	-23	-26	-27	-30	-33	-30
Pacific	81	-78	-75	-82	-86	-90	-75	-78	-77	-83	-87	-92	-75	-40	-43	-43	-49	-51	-44	-40	-44	-45	-51	-53	-46
Royal Canberra	-30	-19	-24	-24	-31	-34	-20	-20	-25	-26	-32	-36	-23	-23	-28	-29	-32	-36	-30	-26	-29	-30	-33	-37	-32
Tea Tree Gully	-8	-10	-14	-18	-25	-29	-17	-13	-17	-21	-29	-31	-20	-30	-33	-34	-38	-40	-34	-32	-35	-35	-40	-40	-35
The Lakes	5	-6	-13	-9	-14	-12	-36	-9	-13	-13	-12	-10	-40	-23	-25	-26	-26	-27	-35	-27	-28	-30	-32	-30	-39
Victoria	5	19	14	8	8	4	-8	16	13	8	7	2	-7	-16	-21	-23	-26	-27	-31	-17	-22	-24	-27	-28	-33
Average 15	-21	-16	-19	-24	-28	-31	-31	-18	-21	-26	-30	-33	-34	-24	-27	-29	-32	-34	-33	-25	-29	-31	-33	-36	-35
Barcaldine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cottesloe	-33	-32	-36	-47	-53	-50	-46	-33	-37	-48	-53	-52	-47	-27	-28	-32	-35	-36	-34	-27	-28	-32	-35	-37	-34
Grange	-49	-33	-32	-36	-40	-41	-61	-33	-32	-36	-40	-41	-61	-24	-26	-31	-31	-36	-43	-24	-27	-31	-31	-36	-43
Kingston Beach	-64	-50	-51	-64	-68	-69	-69	-64	-61	-70	-75	-71	-76	-23	-26	-30	-33	-33	-31	-31	-38	-39	-43	-43	-39
Kogarah	-22	-23	-27	-36	-36	-39	-32	-21	-29	-36	-37	-39	-33	-31	-32	-35	-39	-39	-34	-32	-32	-35	-39	-38	-33
Launceston	-28	-1	-5	-10	-14	-23	-42	-11	-14	-14	-17	-25	-48	-63	-68	-67	-71	-75	-69	-70	-73	-71	-75	-81	-73
Royal Adelaide	-14	0	-2	-7	-6	-10	-5	0	-2	-7	-6	-8	-4	-9	-9	-11	-13	-18	-14	-9	-9	-10	-13	-18	-13
Serpentine	-48	-15	-20	-18	-21	-21	-19	-15	-20	-18	-21	-21	-19	-14	-12	-14	-19	-18	-14	-14	-12	-14	-19	-18	-14
Southern	-55	-23	-29	-34	-40	-49	-34	-24	-34	-35	-41	-51	-36	-23	-29	-31	-33	-36	-30	-26	-30	-33	-35	-40	-33
Trentham	-24	-7	-11	-8	-12	-10	-8	-13	-15	-14	-20	-17	-12	-10	-10	-11	-15	-14	-11	-13	-14	-14	-19	-19	-13
Average 10	-34	-18	-21	-26	-29	-31	-32	-21	-24	-28	-31	-33	-34	-22	-24	-26	-29	-31	-28	-25	-26	-28	-31	-33	-30
Grand Average	-26	-17	-20	-25	-29	-31	-31	-19	-22	-27	-30	-33	-34	-23	-26	-28	-31	-33	-31	-25	-28	-29	-32	-35	-33
Clubs with Tilt favouring the Low Marker	21	22	22	22	22	22	24	22	22	22	22	22	24	24	24	24	24	24	24	24	24	24	24	24	24
	84%	88%	88%	88%	88%	88%	96%	88%	88%	88%	88%	88%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
Level	32	24	25	25	27	27	27	25	26	26	29	30	29	17	18	19	21	22	20	18	19	20	22	24	22

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## Structure

This paper is a summary of the findings taken from the considerably longer (400 pages) document Handicap Modelling Appendices which contains the full results from the modelling of the 25 Clubs.

The findings are presented in the earlier sections. The following sections contain background to the analysis, and also attempt to give insight as to why some of the paradoxical results occur.

## Methodology

### Phase 1

The dataset consisted of all rounds of golf at the club over the three year period to November 2010. There were fifteen clubs.

Rounds away from home were included for calculating members' handicaps. Rounds away from home were not considered in calculating Handicap Bias. (Handicap Bias is the proportion of winners in a given handicap range compared to the proportion of the field in that range. 100% is neutral, greater than 100% is favourable, and less than 100% is unfavourable.)

As a base case, the Handicap Bias was calculated under the Old and Current Systems. As an extension of this, the Handicap Bias was calculated with visitors eliminated from the competitions, ie members only.

For the most part, the remainder of the analysis took all rounds, regardless of old or current system, and recalculated the handicaps under various models.

As we had no history for visitors, we were unable to model their handicaps under the various options, and so they were eliminated from the competitions.

The members were sorted in date order, so that their prior rounds were available. Their handicaps were calculated if they had a minimum number of rounds (32) prior to each competition. Players without sufficient rounds at the time to have a calculated handicap were eliminated from the simulated competitions. Also, since the rounds in the first year for the most part had more players who had not yet reached 32 rounds, with only the more frequent players participating, to eliminate this bias, only competitions from 1/12/2008 were then taken.

As a further extension of the base case, the Handicap Bias was recalculated for Old and Current systems with this reduced field.

There is always the possibility of adjustments in the GolfLink data, so for the period of the current system, the best 10 of 20 current handicap model was also calculated as a check on the Played Off handicaps. The obvious reason for differences here might be that a player played off a different handicap to that calculated.

A competitor's initial result was the Stableford equivalent score based on the actual handicap the player played off, adjusted for course rating. If a different handicap was calculated to what was played off, the difference was added to the score. Eg if a player played off 26, had a Stableford Equivalent (adjusted for Course Rating) of 35, and in the modelling had a calculated handicap of 24, then they are given a new score of 33 points.

The simulated competitions then had all participants ranked according to their calculated results.

The results of Handicap Bias were then computed for the various handicap models.

In order to assess how the above biases impact on the membership, one can calculate the bias, weighted by the number of players in each range. This is called the Weighted Bias, and is presented in the following as a difference from 100% so that positive and negative bias is highlighted.

A least squares regression line can be fitted to the weighted bias values, and its gradient will be a measure of whether the bias is tilted in favour of the low or the high markers. Multiplying this gradient by 10000, one gets the Tilt Index. An untilted playing field would have a zero Tilt Index. A positive index means the Tilt is in favour of the high marker, a negative Tilt means it is in favour of the low marker.

Similarly, the standard deviation of the Weighted Bias values can be calculated for each series. This is a measure of the “lumpiness” or how Level the playing field is. Multiplying this by 1000, one gets the Level Index. A perfectly flat field would have a zero Level Index.

In the Appendices, there is reference to an “Anchor” in Phase 1. This was defined differently to the Phase 2 definition, and was only considered as a variation on the Ten20 0.96 case. This “old” definition was not pursued, the current definition being simpler and just as effective.

### The Handicap Models

The first model was based on the current system, being the average of the ten best scores from the last 20 rounds, multiplied by a Bonus For Excellence (BFE) ratio. This was called the **Ten20** system. The current system is of course Ten20 with a BFE of 0.96. Other variations were modelled, such as Ten20 0.95, Ten20 0.94, etc.

The second method took fewer than ten of the best scores from the last twenty rounds. Taking only the best nine scores from the last twenty rounds was called the **Nine20** method, and was calculated for various BFEs. Similarly the **Eight20** was calculated.

The third method was based on taking fewer best scores for the higher markers. This was called the **Blended** method, with the number of rounds taken varying from six to ten:

Blended		
Best of 20	Men	Women
10	-5 to 15	-5 to 25
9	16 to 20	26 to 30
8	21 to 25	31 to 35
7	26 to 30	36 to 40
6	31 to 36	41 to 45

A BFE was then applied to the result.

The fourth model was based on taking the lower of two moving averages, the faster moving average being based on the best 8 from 16 rounds, and the slower based on the best 16 of 32 rounds. This was called the **Hybrid** method. Again a BFE was applied.

The objective with the Hybrid is to better manage movement in handicaps, not necessarily to have a different handicap on average. By limiting the rise in handicaps after poor form to the slow moving

average, the handicap will rise more slowly. By having a faster moving average apply when form is rapidly improving, the handicap will be less than it would otherwise have been.

## Phase 2

The same data bases were used in Phase 2 as in Phase 1, with the addition of another ten clubs.

In Phase 1, the Handicap Bias was calculated for the winners under varying handicap methods against the original field distribution based on the original playing handicap. In Phase 2, the winners under the variations, all of which related to the Eight20 method, were compared to the field handicap distribution based on the relevant method.

Also, in Phase 1, a player's rounds were eliminated if they had not completed 32 rounds – this was in order to compare like with like when the Hybrid (which used 32 rounds) was involved. In Phase 2 they are only eliminated if there are fewer than 20 rounds.

In addition, the Men's and Women's rounds, for handicap purposes, were capped at a differential of 40 and 50 respectively.

This gives rise to small variations between the Tilt and Level between the Phase 2 and Phase 1 results for the Eight20 cases. Also in Phase 1, for the Eight20 method only, the intermediate BFEs of 0.95, 0.94, 0.92, and 0.91 were obtained by interpolation. In phase 2 they are calculated explicitly.

In Phase 2 a full set of cases was included for the Anchor. Here handicaps are not allowed to rise beyond four strokes over the best exact handicap achieved in the prior twelve months.

In Phase 2 the Prize-winners were also considered as well as the Winners. The leading 20% of the Competition were defined as the "Leaders", and their Bias calculated.

Finally, for the Eight20 0.93 case only, the Bias was calculated assuming that grading was eliminated. If there was more than one competition for a given gender on the same day, the competitions were assumed to be graded. The "No Grade" Bias was calculated with all the competitors assumed to be participating in a single competition.

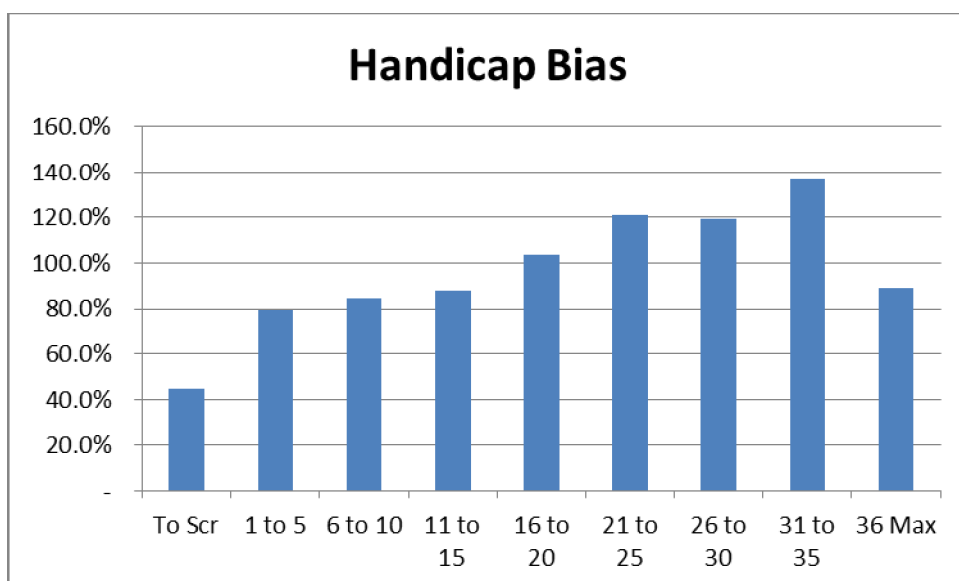
## Further Explanation of Tilt and Level

The handicap Bias, Weighted Handicap Bias, Tilt Index and Level Index are defined briefly in the Methodology section. What follows is a worked example of the calculation of each of these.

Consider a set of data such as this:

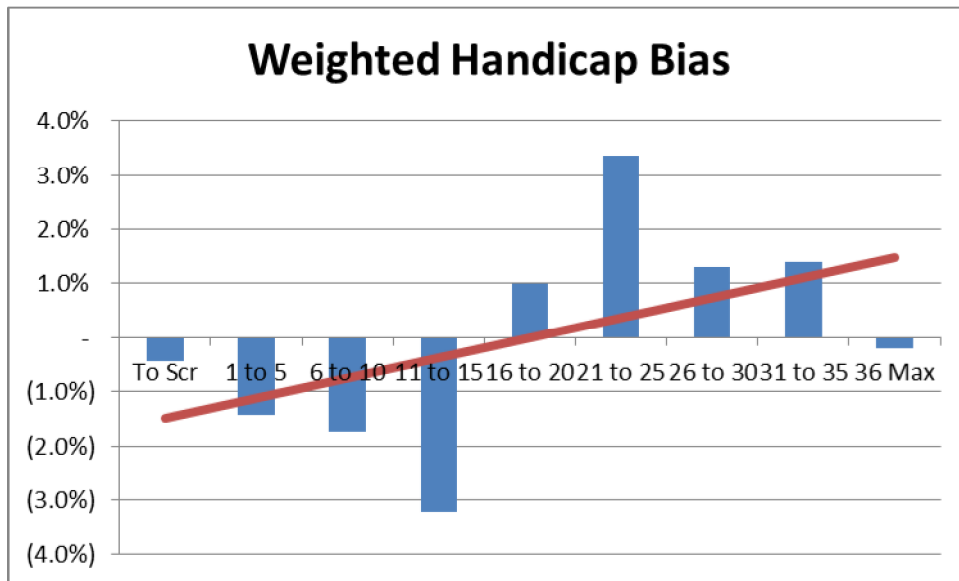
Derivation of Handicap Bias and Weighted Handicap Bias								
Group Number	Handicap Group	Rounds	Rounds % of Total	Winners	Winners % of Total	Handicap Bias	Weighted Handicap Bias	Winners % - Rounds %
A	B	C	D	E	F	G	H	I
1	To Scr	182	0.8%	4	0.4%	44.4%	(0.5%)	(0.5%)
2	1 to 5	1,577	7.0%	62	5.6%	79.5%	(1.4%)	(1.4%)
3	6 to 10	2,533	11.3%	106	9.5%	84.6%	(1.7%)	(1.7%)
4	11 to 15	5,923	26.4%	257	23.2%	87.7%	(3.2%)	(3.2%)
5	16 to 20	5,883	26.2%	302	27.2%	103.8%	1.0%	1.0%
6	21 to 25	3,573	15.9%	214	19.3%	121.1%	3.4%	3.4%
7	26 to 30	1,508	6.7%	89	8.0%	119.3%	1.3%	1.3%
8	31 to 35	858	3.8%	58	5.2%	136.7%	1.4%	1.4%
9	36 Max	408	1.8%	18	1.6%	89.2%	(0.2%)	(0.2%)
	<b>Total</b>	<b>22,445</b>	<b>100.0%</b>	<b>1,110</b>	<b>100.0%</b>		<b>0.0%</b>	<b>0.0%</b>
<b>Handicap Bias G is F / D</b>				<b>Weighted Handicap Bias H is (G-100%)*D</b>				
<b>Winners % - Rounds % I gives the same result as Weighted Handicap Bias H</b>								

From this the Handicap Bias can be plotted:





As can the Weighted Handicap Bias:



**The red line is line of best fit. The Tilt Index is derived from its gradient.**

Gradient of line of best fit	0.0037	Tilt Index	37.0
Standard deviation of Weighted Bias	0.01992	Level Index	19.9

**Colour of Tilt Index is based on:**

	Minimum	Midpoint	Maximum
Type:	Number	Number	Number
Value:	-30	0	30
Color:			
Preview:			

**Colour of Level Index is based on:**

	Minimum	Maximum
Type:	Number	Number
Value:	10	40
Color:		
Preview:		

## Why does New South Wales have a different pattern of competition?

Club	Eight20 0.95 Anch	Eight20 0.94 Anch	Eight20 0.93 Anch	Eight20 0.92 Anch	Eight20 0.91 Anch	Eight20 0.93 No Grade Anch
	Winners + Anchor					
Belmont	8	1	-9	-18	-30	-9
Brisbane	-5	-15	-19	-28	-36	-38
Carnarvon	-2	-10	-14	-29	-40	-14
Cumberland	30	20	4	-6	-14	6
Kooyonga	-11	-15	-26	-35	-45	-27
Lake Karrinyup	4	-7	-10	-17	-20	-11
Lakelands	21	11	5	-9	-14	8
Maitland	20	10	0	-5	-14	-1
Narrabri	27	9	-2	-6	-7	-2
New South Wales	99	89	86	80	68	-8
Pacific	-37	-47	-50	-56	-61	-22
Royal Canberra	-2	-10	-16	-27	-35	7
Tea Tree Gully	-10	-26	-36	-47	-55	-34
The Lakes	-31	-41	-48	-53	-53	-16
Victoria	58	47	40	32	16	-46

One answer may be found in the “No Grade” column. Here it is seen to have a Tilt very much in line with the other clubs.

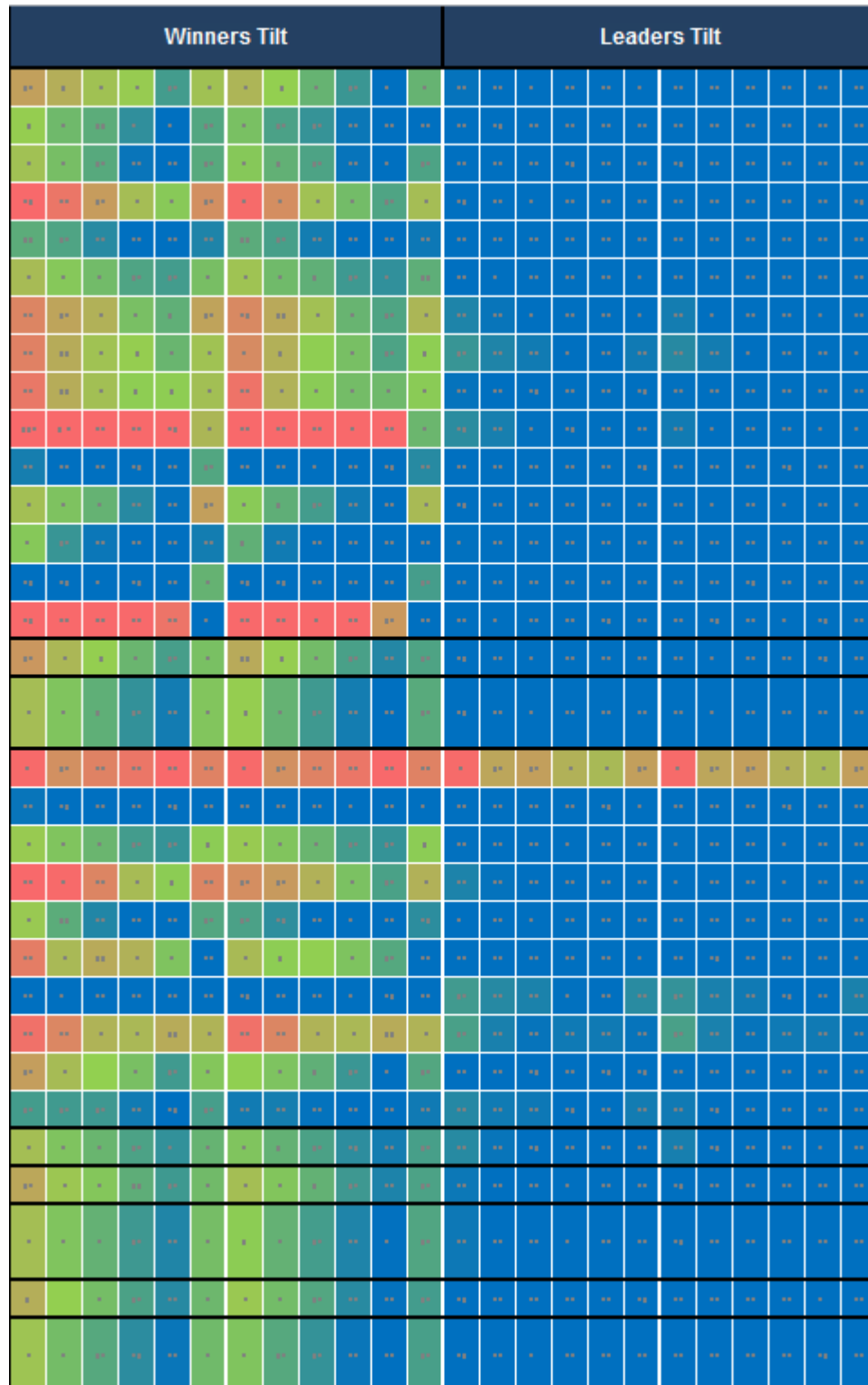
New South Wales has separate competitions with Golden Tees, in which the entrants are the higher markers. Naturally the higher markers win these competitions, and boost their Bias.

If all the competitions on the same day (same gender) were combined, one gets the “No Grade” result.

Other clubs also skilfully use a grading system to achieve results in line with their objectives.

## Why is the Leader Bias so different to the Winner Bias?

Clearly the Leaders Tilt is much more slanted in favour of the Low markers, whereas the Winners Tilt is more balanced. Why is it so? (The values in the following chart are illegible in order to emphasise the pattern.)



Consider this short table, taken from the New South Wales Club:

New South Wales - Men Eight20 0.93 & Anchor			
Description	To Scr	36 Max	Total
Field (Rounds)	508	214	23,990
Percent	2.1%	0.9%	
Winners	15	11	667
Percent	2.2%	1.6%	
Bias Winners	106.2%	184.9%	
Leaders	157	16	5,591
Percent	2.8%	0.3%	23.3%
Bias Leaders	132.6%	32.1%	

In the table, the two extremes of the handicap range are considered, the scratch and better range, and the maximum handicap 36 range.

They both represent a small proportion of the field, namely 2.1% and 0.9% respectively.

But in terms of Winners, the highest markers represent 1.6% if the winners, whereas the lowest markers represent 2.2%. The high markers “outperform” and have a handicap bias of 184.9%. The low markers perform well, with a bias of 106.2%.

But when it comes to being in the top 20% of the field, the “Leaders”, the low markers have increased their representation from the 15 winners to 157 participants out of the 5,591 leaders’ pool; the high markers have only increased from 11 to 16. So the low markers have a very strong positive bias of 132.6%, the high markers have a very low 32.1%.

It appears that the low markers are far more likely to be in the leaders’ pool than the high markers.

Yes indeed the high marker, who has his one in a hundred fabulous round, can win on the day producing a strong outperforming bias, but his fellow high marker competitors are not likely to also pull out a one in a hundred performance.

On the other hand, the low marker, who we know is more consistent and more likely to play at or near his handicap, finds many of his low marker fellow competitors are also in the Leaders pool with him, and thus, as a group, they have the very strong 132.6% favourable bias.

## Impact of Eight20 & Anchor on Handicaps

This result is from the Individual data base with 1,000,000 rounds. Golfers with fewer than 20 rounds over the period, which is 2/01/2008 to 30/11/2010, have been excluded.

The comparison is between what the handicap would have been on each method over this period.

Ten20 0.96 v Eight20 v Old									
Handicap Range - Based on Ten20 0.96	Ten20 0.96	Eight20 0.95 & Cap & Anchor	Eight20 0.94 & Cap & Anchor	Eight20 0.93 & Cap & Anchor	Old System	Diff-er-ence	Diff-er-ence	Diff-er-ence	Diff-er-ence
	1	2	3	4	5	2 - 1	3 - 1	4 - 1	5 - 1
<b>M</b>	<b>18.0</b>	<b>17.1</b>	<b>16.9</b>	<b>16.7</b>	<b>16.7</b>	<b>(0.9)</b>	<b>(1.1)</b>	<b>(1.3)</b>	<b>(1.3)</b>
-5 to 0	(0.5)	(1.0)	(1.0)	(1.0)	0.9	(0.5)	(0.5)	(0.5)	1.4
1 to 5	3.5	2.9	2.9	2.8	4.2	(0.6)	(0.6)	(0.6)	0.7
6 to 10	8.2	7.6	7.5	7.4	8.1	(0.7)	(0.7)	(0.8)	(0.1)
11 to 15	13.1	12.3	12.2	12.0	12.5	(0.8)	(0.9)	(1.0)	(0.6)
16 to 20	17.9	17.0	16.8	16.7	16.7	(0.9)	(1.1)	(1.3)	(1.2)
21 to 25	22.8	21.8	21.5	21.3	21.0	(1.0)	(1.3)	(1.5)	(1.7)
26 to 30	27.6	26.4	26.2	25.9	25.5	(1.2)	(1.5)	(1.7)	(2.2)
31 to 35	32.6	31.1	30.8	30.5	29.6	(1.5)	(1.8)	(2.1)	(3.0)
Max 36	36.3	35.0	34.8	34.6	33.0	(1.3)	(1.5)	(1.7)	(3.3)
<b>W</b>	<b>27.6</b>	<b>26.5</b>	<b>26.2</b>	<b>26.0</b>	<b>25.2</b>	<b>(1.1)</b>	<b>(1.4)</b>	<b>(1.6)</b>	<b>(2.4)</b>
-5 to 0	(0.6)	(1.1)	(1.0)	(1.0)	0.2	(0.4)	(0.4)	(0.4)	0.8
1 to 5	3.6	3.0	3.0	3.0	3.4	(0.6)	(0.6)	(0.6)	(0.2)
6 to 10	8.4	7.7	7.7	7.6	7.7	(0.7)	(0.8)	(0.8)	(0.7)
11 to 15	13.4	12.6	12.5	12.4	12.4	(0.8)	(0.9)	(1.0)	(1.0)
16 to 20	18.1	17.2	17.0	16.9	16.8	(0.9)	(1.1)	(1.2)	(1.3)
21 to 25	23.2	22.2	22.0	21.8	21.6	(1.0)	(1.2)	(1.4)	(1.6)
26 to 30	27.9	26.8	26.5	26.3	26.0	(1.1)	(1.4)	(1.7)	(2.0)
31 to 35	32.8	31.6	31.2	30.9	30.5	(1.3)	(1.6)	(1.9)	(2.3)
36 to 40	37.7	36.3	35.9	35.5	34.8	(1.4)	(1.8)	(2.2)	(2.9)
41 to 44	42.3	40.6	40.2	39.8	38.5	(1.7)	(2.1)	(2.6)	(3.8)
Max 45	45.3	44.2	44.0	43.8	42.3	(1.1)	(1.3)	(1.6)	(3.0)
<b>Grand Total</b>	<b>19.7</b>	<b>18.8</b>	<b>18.6</b>	<b>18.4</b>	<b>18.2</b>	<b>(1.0)</b>	<b>(1.1)</b>	<b>(1.3)</b>	<b>(1.6)</b>

The Anchor impacts 4% of rounds.

Impact of Anchor on Rounds of Golf		
Handicap Range	No Impact	Impact
M	96.0%	4.0%
-5 to 0	100.0%	-
1 to 5	99.7%	0.3%
6 to 10	99.3%	0.7%
11 to 15	98.2%	1.8%
16 to 20	96.5%	3.5%
21 to 25	94.4%	5.6%
26 to 30	91.8%	8.2%
31 to 35	88.0%	12.0%
Max 36	87.4%	12.6%
W	95.2%	4.8%
-5 to 0	100.0%	-
1 to 5	99.8%	0.2%
6 to 10	99.8%	0.2%
11 to 15	98.1%	1.9%
16 to 20	97.5%	2.5%
21 to 25	97.7%	2.3%
26 to 30	95.5%	4.5%
31 to 35	92.8%	7.2%
36 to 40	91.7%	8.3%
41 to 44	88.4%	11.6%
Max 45	91.9%	8.1%
<b>Grand Total</b>	<b>95.8%</b>	<b>4.2%</b>

13.8% of men and 15.6% of women would have had at least one round anchored over the three years period.

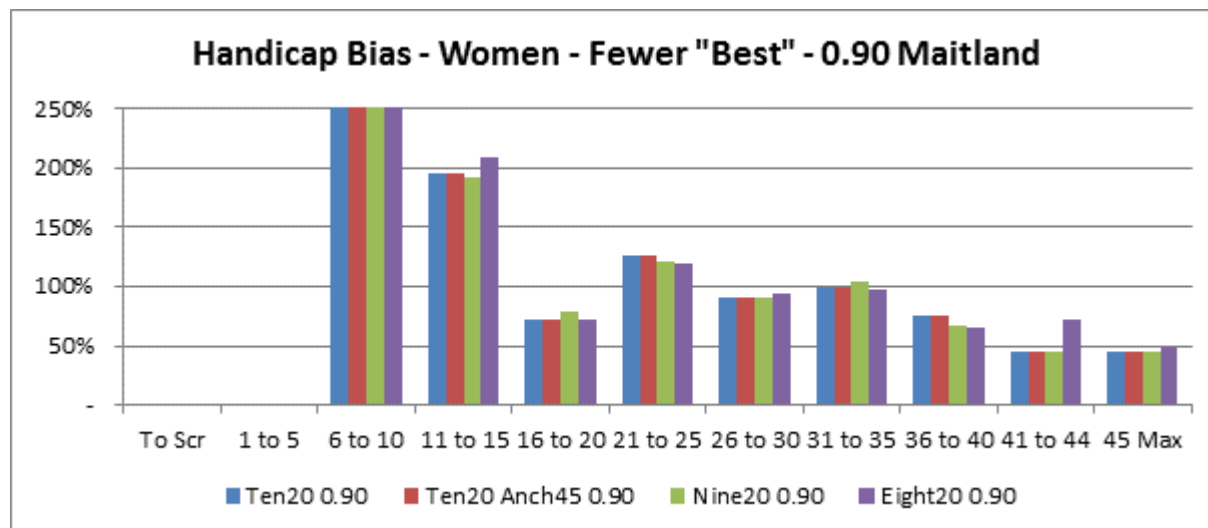
Impact on Competitors - One or More Rounds Impacted		
	No Impact	Impact
M	86.20%	13.80%
W	84.44%	15.56%
<b>Grand Total</b>	<b>85.84%</b>	<b>14.16%</b>

The average number of rounds impacted per player is 2.1, but that included the majority with no rounds impacted. Of those with one or more impacted rounds, the average number of rounds impacted is 14.9. The highest number of rounds impacted was 150 out of 404 rounds.



## Understanding the Paradoxes

Consider the following example from Phase 1:



How can the 41 to 44 group have a greater Handicap Bias at Eight20 than at Nine20? After all, the Handicaps must be no greater than they were, and thus the Stableford equivalent scores no better, yet they appear to perform better?

The actual handicaps and scores for Players A, B and C in the only competition that had winners in the 41 to 45 group were as follows:

	Handicap			Stableford Equivalent Score			Rank		
	Ten20	Nine20	Eight20	Ten20	Nine20	Eight20	Ten20	Nine20	Eight20
Player A	38	38	38	36	36	36	2	2	1
Player B	45	45	44	37	37	36	1	1	1
Player C	45	45	45	37	37	36	1	1	1

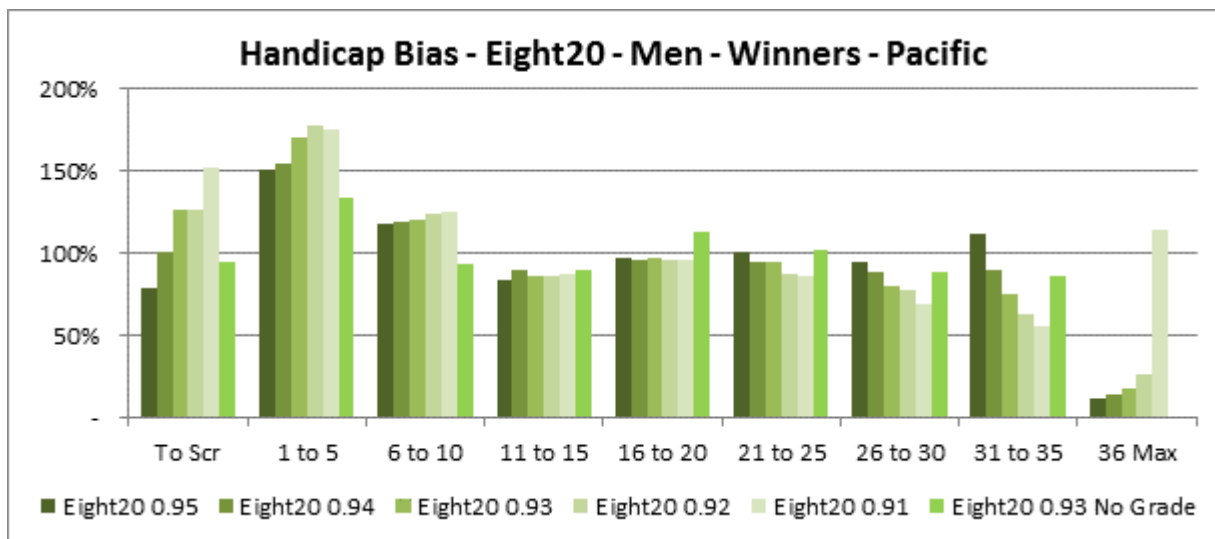
Although we are considering the 41 to 45 group, Player A was playing off a simulated 38, due to the 0.90 BFE. Players B and C were max 45 handicappers, in both the Ten20 and Nine20, but dropped to 44 for the Eight20. It was a movement in an unrelated handicap range that allowed Player A to become a winner, and consequently take the number of winners in this group from two to three.

Increasing from two to three sent the Bias from 44% to 72%.

Why does the bias not increase by exactly 50% from 44% to 66%? Because there is a slight difference in the number of winners at Eight20 (181) compared to Nine20 (197), and this impacts the percentages.  $2/197$  compared to  $3/181$  is exactly the same ratio as 44% to 72%.

As always, when dealing with the considerably smaller numbers at the extremes of the handicap ranges, not too much weight should be placed on the results which tend to be "lumpy".

Here's another example, this time from Phase 2.

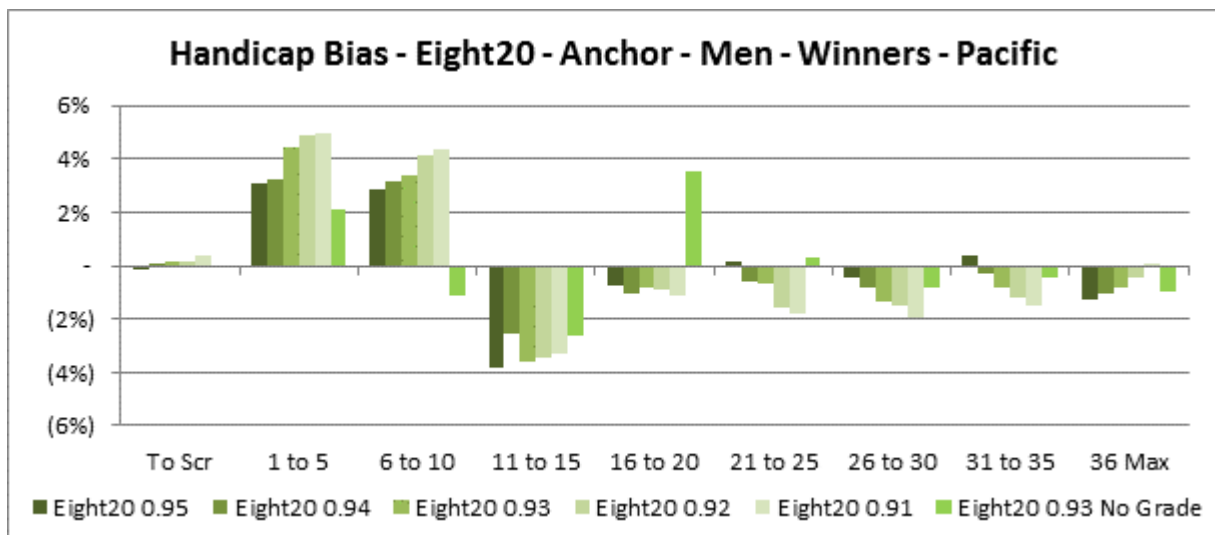


How can the 36 Max bars rise as the BFE rises?

Well the big rise from 0.92 to 0.91 was because the number of Max 36 Winners rose from one to two, as other grades had their scores reduced a tad.

But the rises from 0.95 through 0.94, 0.93 to 0.92 were because, although there was only one winner in the 36 Max group, the number of competitors in the Max 36 group reduced as the BFE rose and a number dropped off the Max 36 figure.

Of course when the ranges are weighted, the differences are seen to be insignificant:



## About the Author

GA commissioned a statistician with significant experience in developing practical solutions to conduct the data analysis. Michael Maher also has long-term peak-Level management and board experience with major Australian and international companies. Michael comes into this with a fresh outlook and without any industry baggage. Michael plays regular club competition golf in Sydney. His current professional focus is FX trading using automated algorithms.