

A study of Double Dummy Analysis by Andrew Simmons



1. FORWARD

Hand copies of deals generated by bridge duplicating software contain predicted outcomes. These are generated using sophisticated algorithms. The outputs, often referred to as “double-dummy” predictions, are made with the knowledge of the layout of all 52 cards and are therefore purely theoretical. Even so, many players use them for analysis of their games after receiving hand copies from a duplication session.

My database analysis of double-dummy predictions revealed facts about hand shapes and other issues that I found of interest. It particularly caught my attention that 4441 hand shape has trick making capacity in excess of expectation. Other issues such as trick making relative to trump fit and the merits of hand evaluation techniques like ‘suit quality test’ aroused my interest for further analysis.

Data is pure, simple and honest. Some analysis results challenge widely held belief but I have produced a truly random database and analysed it with due diligence and fairness. The information produced therefore has integrity. Also, outcomes that can be applied in terms of bidding method have been subjected to an objective trial that has supported the conclusions. Many examples of these trials have been recorded as evidence.

Material for analysis is out there in abundance. Therefore my analysis conclusions can readily be reproduced by anyone with a few database programming skills and a lot of time and patience.

2. METHODOLOGY

First of all I created an application using a standard database tool. I entered as many details as I could about each hand and its relationship to its partner's hand. At first I entered details for 1000 hands and checked out the results from that. Each hand is unique in terms of shape and high card quality and the performance of each hand is calculated by the double-dummy analysis produced by duplicator machine system software. I have recorded hand details and double dummy predictions straight from handout sheets as my raw data. Primary data being:

1. High Card Point Count - **HCP**
2. Partnership High Card Point Count – **PHCP**
3. Maximum Predicted Tricks – **MPT**
4. Maximum Predicted Score – **MPS**

My first analysis grouped the results by hand shape so that I could evaluate the relative merits of each. I followed this up with more detailed studies where the information pointed me.

At extreme HCP range there are often few hands in the sample and sometimes this throws up unusual results like two weak hands having a particularly good suit fit. It is tempting to apply statistical methods to rule out extreme results but I am determined not to manipulate the raw data in any way. I want recipients of the information produced to be in no doubt as to the honesty of the approach. So everything goes in, good or bad.

Benchmarks

Development of benchmarks has been undertaken in analysis of balanced hands for game making situations (Presentation 1) and hands that contained a 6-card suit for pre-emptive situations (Presentation 2). The benchmarks enable conceptualisation of the analysis results and produce compelling conclusions.

Benchmarks are derived from two widely used bidding strategies that are believed to be successful. This way the analysis is structured in a way that most bridge players can understand and believe in.

PRE-EMPTIVE BENCHMARK

Many are happy to bid weak at the two level with 6-card suits in the range 6-10 HCP. My analysis has shown that such hands are predicted by double-dummy to produce a trick making capability of between 7.7 to 9.5 MPT. Therefore it follows that the **“ZONE OF ACCEPTABILITY”** benchmark for pre-emptive bids is a hand that will achieve within the range 7.7 to 9.5 double-dummy MPT.

GAME MAKING BENCHMARK

Many people are happy with the concept that a pair of balanced hands with a combined total of 25 HCP should be bid to 3NT. Double-dummy analysis of my random collection of hands has shown that 50% of these hands are predicted to succeed and 50% to fail.

So the benchmark is that hands are worth bidding to **GAME level when there is a 50% double-dummy probability of success.**

These benchmarks are the foundation of the analysis. They relate to conventional wisdom. Achievement of MPT and MPS is factual, carefully documented and properly calculated. Also, the reader has no need to consider how good or bad double dummy predictions are because the information is all presented relative to the same method of calculating. All you have to believe is that the double dummy calculations are consistent (I know some people still don't trust computers).

Hand Pattern Probabilities

Throughout the analysis and presentation of results we are aware that hand shapes occur as follows:

Hand	Percentage	Hand	Percentage
4-4-3-2	21.55	6-4-3-0	1.33
5-3-3-2	15.52	5-4-4-0	1.24
5-4-3-1	12.93	5-5-3-0	0.90
5-4-2-2	10.58	6-5-1-1	0.71
4-3-3-3	10.54	6-5-2-0	0.65
6-3-2-2	5.64	7-2-2-2	0.51
6-4-2-1	4.70	7-4-1-1	0.39
6-3-3-1	3.45	7-4-2-0	0.36
5-5-2-1	3.17	7-3-3-0	0.27
4-4-4-1	2.99	Others	0.69
7-3-2-1	1.88		

Conventional Balanced Shape	47.6%
5 Card Suit with a Singleton or Void	17.0%
5 Card Suit with no Singleton or Void	26.1%
6 Card Suit	16.48%
Hands with a Void Suit	4.75%
Balanced 3 suited 4441 + 5440	4.23%
Hands with longest suit of 7 or more	3.41%

Fig 1 –Hand pattern probabilities summarised into groups for primary analysis

3. PRESENTATIONS

Information produced by the analysis is presented in a standard format for each hand shape analysed.

Ability of deals to produce varying card distributions (good and bad) is taken care of by using high sample numbers that evens out the effect of the variation. Double-dummy ignores that other big variation – the human intervention. For the analysis purposes therefore we are allowed to conclude that the trick making capability of the hands analysed is mainly influenced by:

- Strength of high cards – HCP
- Strength of high cards within a partnership – PHCP
- Degree of fit for a trump suit or extra trick making capacity

So the analysis uses these elements as necessary with the raw data summarised in tables that have been transcribed using spreadsheet charts into graphical form for presentation. This enables us to reach straightforward conclusions. All presentation of results is summarised for specific hand shapes. Typical outputs are:

A table of how a hand performs when you consider the HCP of one hand of a partnership. This is the only information that you have when making an opening bid and this analysis is of particular value when considering pre-emptive openings.

A table of how a partnership pair of hands perform when you consider the partnership strength PHCP. This is of particular interest for some bidding methods. Variability decreases when you add partner into the picture and so this data tends towards a straight-line progression except at the extreme ends of the PCHP range where there are fewer examples of hands in the data.

Probability of fit level is outlined in tables and charts to present what to expect in terms of MPT and Suit Fit Level based on the fit in one’s own longest suit and the best fit available in the partnership (that may not always be in your long suit).

Scope of the database

The following hand shapes were identified for analysis:

Hand Shape	Mathematical Probability	Actual Occurrence in Original Sample
Balanced hands	47.60	42.50
5 Card Suit with a singleton or void	17.00	18.20
6 Card Suits	16.48	19.30
5-4-2-2 Shape	10.58	8.50
Hands with a void suit	4.75	5.30
Hands with 7 or more cards in longest suit	3.41	0.56
4441 Shape hands	2.99	2.70

Fig 2 – How hand shapes in the sample approximated to mathematical expectation

Because of the impact of initial findings I added more random data sets so that the final analysis is more robust in selected areas:

There were only 27 hands of the 4441 shape and 53 of Void Suit shape in the original analysis because of their low frequency of occurrence. But these hands are performing well on the analysis and merit a more detail analysis. To do this I obtained random data for a further 128 of each of these hand shapes.

Hands where the longest suit is five but also contain a singleton are the second most common hand shape after balanced hands. I had a random data set of hands of 5-4-3-1 shape and these make up most of the 5 cards plus a singleton hand shape (13% of the 17% total). This hand shape has interesting analysis so the extra data is worthwhile.

Hands which have a longest suit of 6 cards are defining a benchmark for pre-emptive weak 2. So to strengthen the data set I pulled in details for more of these hands using randomly produced handout sheets available.

Outputs from the database have been further analysed using spreadsheets and charts. For example by grouping data in HCP band ranges. It is this further analysis that reveals what is going on.

PRESENTATION 1

Balanced Hands and the Development of GAME MAKING benchmark

At a mathematical probability of 47%, balanced hand shape is easily the one we encounter most. This has given rise to a whole series of bidding strategies, offensive and defensive, based on opening or re-bidding No Trumps. The NT strategies are widely used and so this is a good place to produce a benchmark that can be readily understood.

There are two situations to analyse:

Balanced Opposite Balanced

TRICK MAKING CAPABILITY

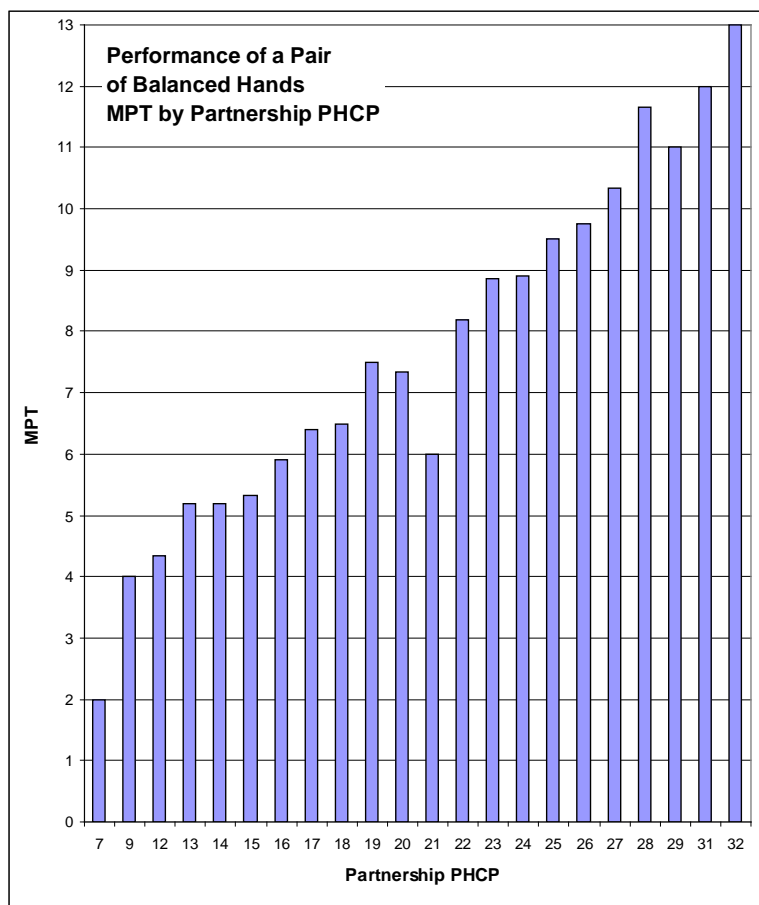


Fig 3. Performance of a pair of balanced hands

The double-dummy predicted performance of hands can be tabulated to compare hands with the same HCP and PHCP.

As expected, the number of tricks available increases as the strength of hands increases. A balanced hand that has a balanced hand opposite appears to be the least promising combination. Fig 3 depicts the results tabulated for partnership totals PHCP. This shows that there is nothing of special interest other than to note the miserable average trick making capability of 7.3 (calculated from the chart's table that is not shown here).

The charts below analyse the fit level. Most of fit is around the 7 and 8-card at best as depicted in the chart at Fig 4 below. Fig 5 indicate there is little to choose between fit level in one's own hand compared to the best fit available looking at one hand (fit for your own longest suit) and the best fit available between both hands in a partnership. So, as we all know, with two balanced hands the HCP strength is the obvious singular priority when considering how many tricks we might make.

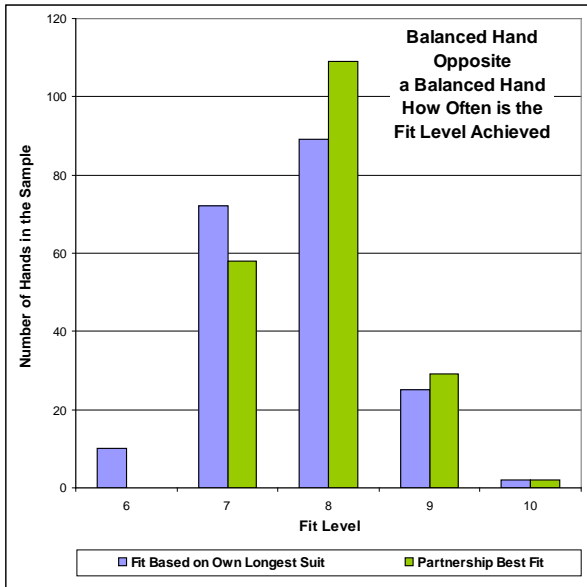


Fig 4

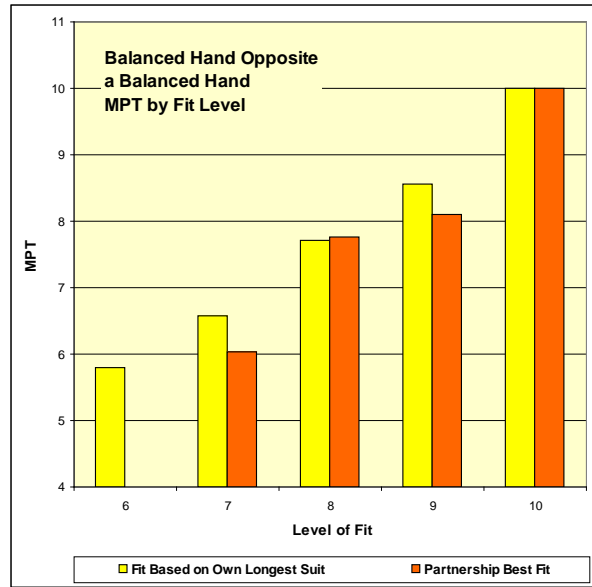


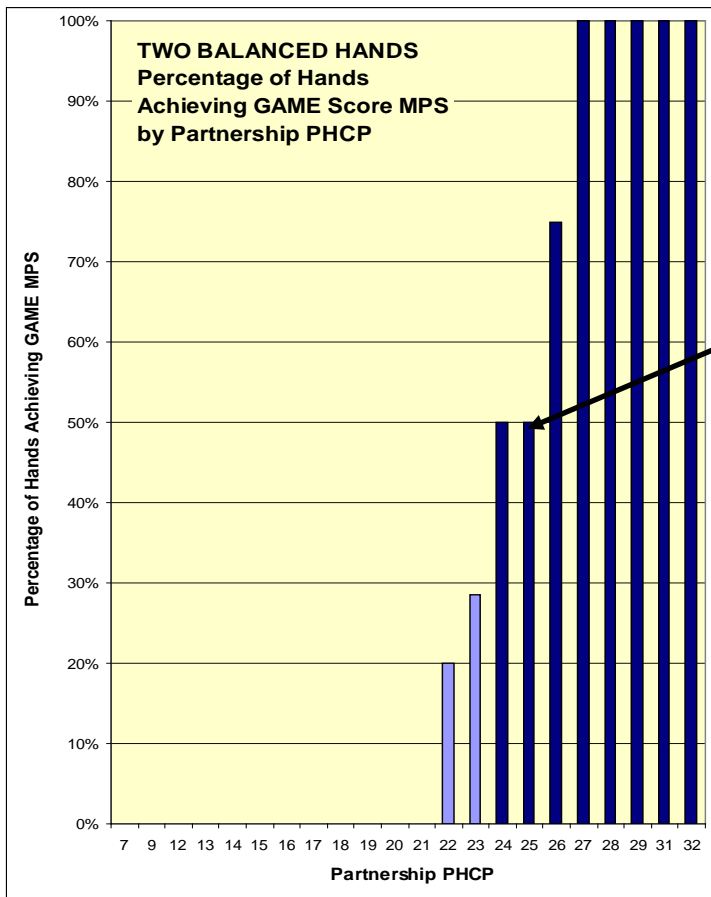
Fig 5

Even with two conventional balanced hands it is possible that each has five cards in the same suit and this will affect performance. It may be noted from examination of Fig 5 that there is a consistent progression in MPT that is analogous to the “law of total tricks”. With an extremely balanced best fit of 6 cards in any one suit the hands may average less than 6 MPT and the expectation increases approximately by one extra MPT for each extra level of fit.

GAME GOING

There is a widely held belief that balanced hands ought to be pursued in the auction to GAME level when the hands have a combined 25 HCP. Using this principle I have measured the trick making capability of these hands to calculate the relationship between holdings of HCP/partnership HCP and their associated predicted GAME-making (MPS) outcome. Data is presented as the percentage of hands within a range of HCP that manage to achieve GAME Score. This way we can assess the probability of success for any given holding of PHCP or HCP.

Results of the analysis are presented in this chart:



Common practice will bid GAME on balanced hands with a combined HCP (PHCP) of at least 25. At this point the analysis indicates GAME Scores are achieved 50% of the time. So it is logical to adopt this 50% expectation of success as the benchmark to evaluate GAME going situations with other hand shapes

Fig 6 – Establishment of Benchmark

The benchmark for GAME score making has to be the place where trick making potential crosses the partnership PHCP level 25. In other words, with 25 HCP GAME scores are achieved 50% of the time. It is coincidental that the analysis suggests that 24 HCP are as good as 25 HCP.

Most importantly there is a clear benchmark - **BASED ON THE DOUBLE DUMMY ANALYSIS A 50% PROBABILITY OF SUCCESS IS SUFFICIENT TO BID GAME ON – A BENCHMARK FEATURE THAT I WILL MAKE USE OF IN ANALYSIS OF OTHER HAND SHAPES**

Fig 7 - Further analysis to establish where the game scores were made is summarised in this table:

RESULTS FOR A PAIR OF BALANCED HANDS	Qty Hands	Percentage of Total
Game in Major Suit or NT	17	41.5%
Game in Minor Suit or NT	2	4.9%
Game Only Available in Major suit	5	12.1%
Game Only Available in Minor suit	0	0
Game Only Available in NT	17	41.5%
Total	41	100%

There are 198 hands of this type in the sample database of which 41 (21%) had MPS predictions for GAME scores. 88% of these GAME-scoring hands was capable of achieving GAME in NT but some had been made elsewhere. A small but reckonable 12% of the hands could only achieve GAME score in a Major suit contract.

Game-going potential is therefore best realised by partner, who can assess the situation by reckoning the strength and fit capabilities of both hands based on the opening bid.

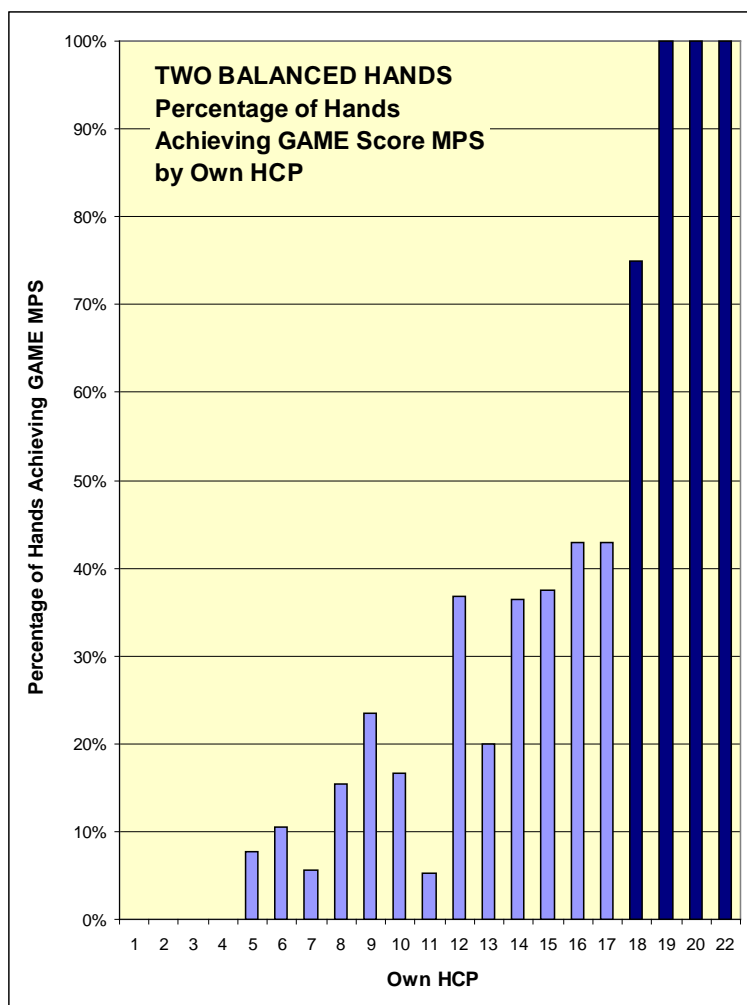


Fig 8 MPS with two balanced hands

Fig 8 shows the probabilities of GAME-Score based on your hand only and is therefore the criteria for making an opening bid. We can deduce from this that GAME scoring opportunities are quite low until we get to 18 HCP. It is therefore essential to have a strategy that communicates HCP strength to partner and we know that this is often taken care of by well known bidding strategies.

There is also a feature that hands with holdings of 18+ HCP have a 50% probability of GAME score. This might raise the question of what level might we make opening bids of 2NT?

Balanced Opposite Unbalanced

TRICK MAKING CAPABILITY

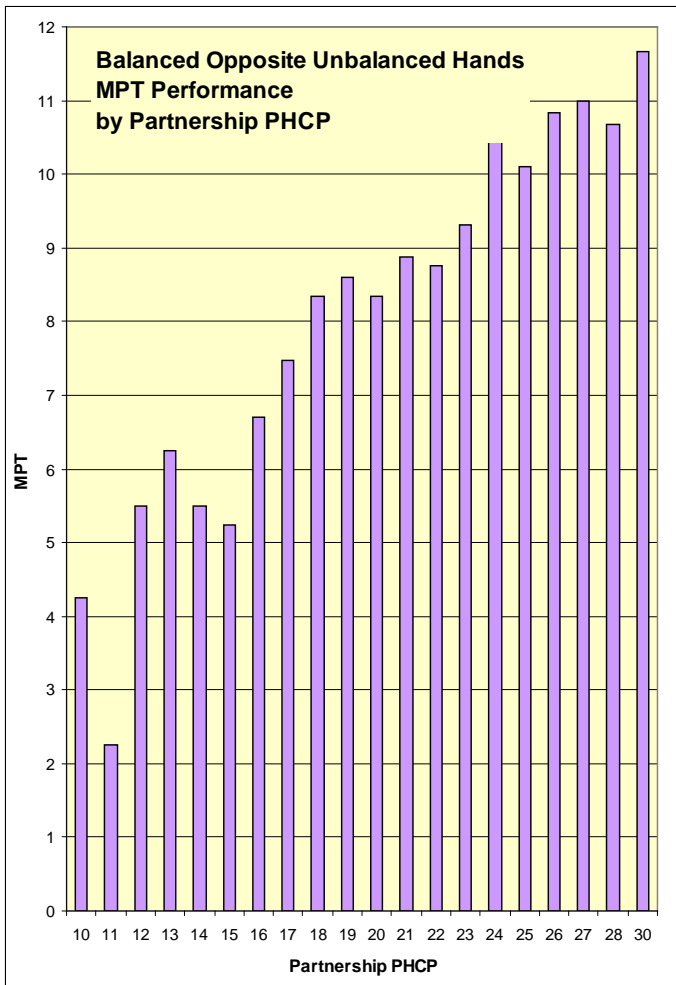


Fig 9 – Balanced opposite unbalanced trick making capacity

If partner has an unbalanced hand the trick making potential MPT is significantly improved by one whole extra trick to an average of 8.3. Obviously long suits make tricks, either as trumps or in NT.

Partnership best fit is more often in partners longest suit (Fig 10) but the analogy to the ‘law of total tricks’ does not now seem to be particularly valid (Fig 11)

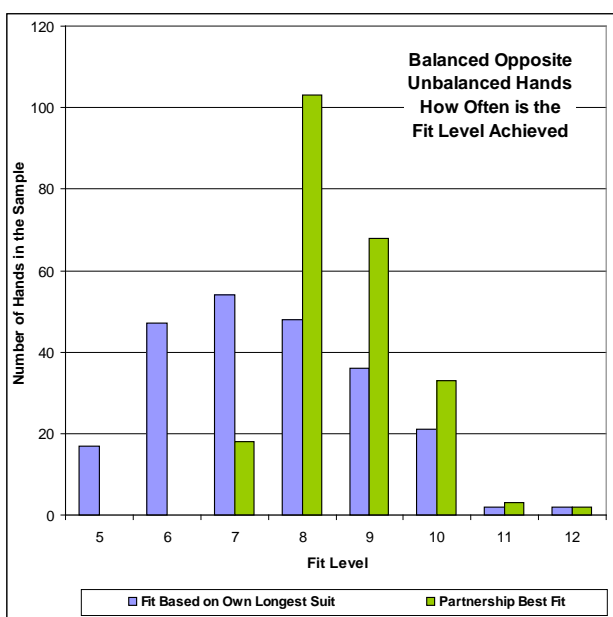


Fig 10

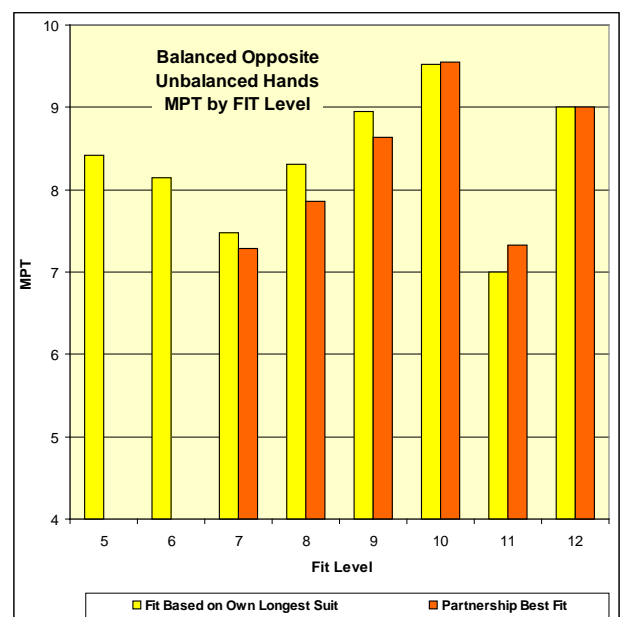


Fig 11

GAME GOING

The opportunity for making GAME score is still high from the joint 24 HCP holding.

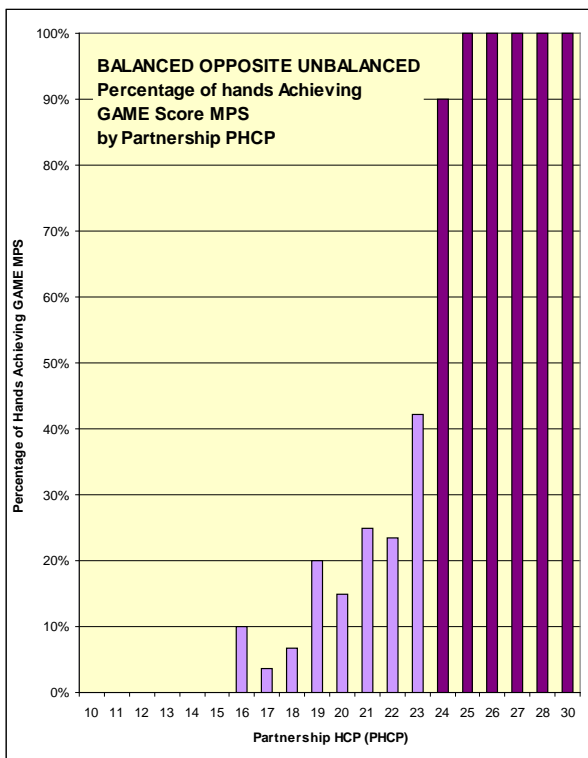


Fig 12

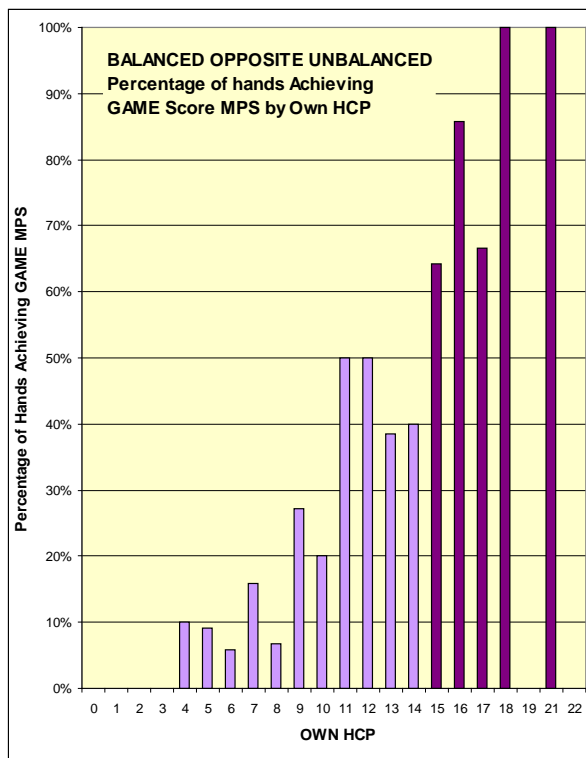


Fig 13

If you are the responder you might note that the prospect of a GAME score at 24 PHCP and above is significantly improved from 50% to 90% probability if you have a hand shape that is unbalanced.

Therefore we may consider that with a reasonable strength response in the region of 10 HCP it should be worth pushing a bit to find a fit for NT. The following hand was played 14 times. Only 8 of the N/S pairs reached 3NT (mostly played by North) that made equal or plus-one for a Game score. 6 pairs stayed in 2D and got left behind on the scoresheet.

♠ Q 10 9 7 2		
♥ A Q 10		
♦ 9 7		
♣ Q 9 3		
♠ A J 8		♠ K 5 4
♥ J 9 7 5 2		♥ 8 6 3
♦ A 5 2		♦ 8 3
♣ 8 5		♣ K 10 6 4 2
	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> N W E S </div>	
		♠ 6 3
		♥ K 4
		♦ K Q J 10 6 4
		♣ A J 7

Fig 14 Dealer North, Vul None

Possible auctions could be:

Pass	Pass	1♦	Pass
1♠	Pass	2♦	Pass
2♥	Pass	2NT	Pass
3NT			

Or, if West chooses to overcall

Pass	Pass	1♦	1♥
1♠	Pass	2♦	Pass
2NT	Pass	3NT	

CONCLUSIONS

Some interesting findings from the analysis of balanced hands can be summarised as:

1. In all cases where one hand has opened with a balanced shape, a joint holding of 24 HCP is expected to achieve GAME score MPS 50% of the time.
2. A balanced hand opposite an unbalanced hand provides the same GAME score expectation with a joint 24 HCP but with a 90% degree of certainty instead of 50%.
3. Improved degree of certainty with unbalanced hands could be catalyst towards achieving more GAME scores.
4. In all cases 24 PHCP seems to be as good as 25 PHCP.
5. On their own, balanced hands with 18+ HCP achieve GAME score with 75% probability
6. Calculations provide a robust platform to establish the **50% analysis benchmark** to explore GAME scoring situations with other hand shapes. This is dealt with in separate presentations.