Do you get more than your fair share of weak hands?

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Computer dealing of boards has become universally adopted and there should be no doubt that the hands are 'randomly' distributed. Even so players have perceived that they have regularly been unfairly treated by their miserable share of high cards; is this a realistic gripe?

Looking at pairs duplicate on Fridays in 2016 I have downloaded the joint North-South and East-West hcp for each board and determined on how many boards **NS** pairs had **20**, or **less than 20** (minority) at a session. (**NS** having **<20** is the same as **EW** having **>20** hcp). Given that all boards score the same for the ranking result, these simple counts should be more significant than hcp averages that can be heavily weighted by a few large values.

	Figure 1 13 Fridays			arrow		EW	binomial	NS
			boards	switch	$B_{(20\text{-}20)}$	$B_{(<20)}$	peak	$B_{(<20)}$
1	3rd June 2016	M	30	3	2	9	14	19
2	10th June 2016	M	30	3	0	13	14	17
3	17th June 2016	M	28	4	3	8	13	17
4	24th June 2016	M	28	4	1	13	13	14
5	1st July 2016	¾H	26		2	11	12	13
6	8th July 2016	¾H	26		1	10	12	15
7	15th July 2016	M	30	3	3	11	14	16
8	22nd July 2016	M	27	3	2	12	12	13
9	29th July 2016	M	27	3	3	7	12	17
10	5th August 2016	M	27	3	5	10	12	12
11	12th August 2016	M	27	3	7	9	12	11
12	19th August 2016	M	30	3	3	10	14	17
13	26th August 2016	¾H	26		1	11	12	14
	TOTALS		362		33	134	166	195
				Theoretical			45.9%	

During June thru August there were thirteen Friday evening sessions and Fig. 1 shows the number of boards (***B***) in each category for the 26, 27, 28 or 30 in play; M denotes Mitchell, and ¾H denotes ¾Howell movements.

For any board the theoretical binomial probability for either **NS** or **EW** having **<20** hcp is **45.9%** so the expected and most probable number of such boards in a session is as shown. **8.22%** are expected to have **20-20** hcp equality. For all thirteen sessions **NS** had the minority of the points more times than and, in all but 1 case, more than the binomial peak. The deviations from the peak can be compared to the *standard deviation* σ to estimate their probability [a].

Fig.2 shows how the most probable, and plus or minus **1σ** and **2σ** lines increase with the sample number of boards; the actual numbers for **NS<20** and **EW<20** are superimposed. For a normal distribution **68%** of points should lie within **±1σ**, **95%** within **±2σ**. For the three months, **NS** had a minority of hcp on more boards than did **EW** at every session.

Overall, the $B_{(NS<20)}$ = **195** is **3.4σ** above the expected **166** whilst $B_{(EW<20)}$ = **134** is **3σ** below it. These appear to be remarkable results since the odds are roughly equivalent to those for tossing 12 heads in succession.

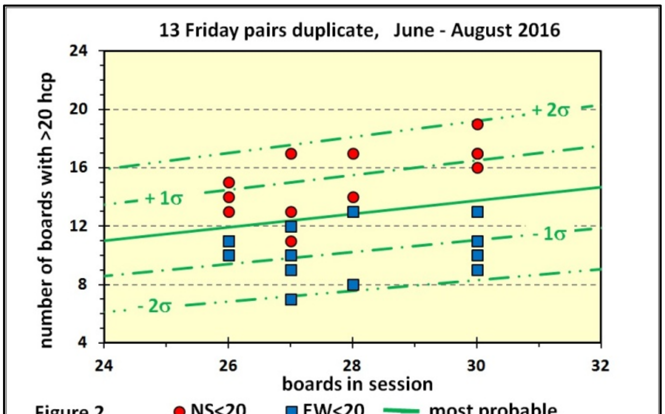

Figure 2

Remarkable but also weird because with the **417** boards used for 15 Friday pairs during January to May, $B_{(NS<20)}$ = **185** and $B_{(EW<20)}$=**195**, both close to the expected **191** – showing no significant unbalance.

For a straight Mitchell movement (with two winners), and for some sitting pairs in a ¾Howell movement, the figures can have direct application, but arrow-switches, sit-outs and skips can significantly modify the numbers for particular pairs. As an example on 29/07/16 with 27 boards, **EW** pair 18 had the majority of hcp on **20** boards, with **NS** pair 8 on only **4**.

Players' memory limit for governing perception is probably only two or three months so you certainly can become aware of a run of poor hands, but does it matter? There is no evidence of any correlation between the number of weak hands and a final ranking result, but having to defend on a string of boards with very few hcp can be most depressing; on 3rd June I defended on the first 12 boards, averaging <8 hcp, and rather lost any motivation. However, whether a pair plays or defends a board depends upon more than hcp; suit lengths - especially spades, vulnerability and possible sacrificing opportunities, are often critical.

In general, having the majority of hcp on a good fraction of boards does tend to produce to a more interesting and satisfying evening. David Kirkpatrick is thanked for advice on statistics and presentation.

Reference [a]: https://www.mathsisfun.com/data/standard-normal-distribution-table.html 02/09/2016

13 Weeks of E-W Bias

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Following some perception that members sitting North-South were getting more than their fair share of boards with few high card points, the following analysis was performed. During June, July and August 2016 there were 13 sessions of Friday pairs duplicate, with 26, 27, 28 or 30 boards in play [1]; the total number of boards, random deals produced by a Duplimate machine, was **362**.

Complete randomness can be described with great precision [2][3] and thus any departures can easily be identified if the sample number S is large enough.

The probability $P_{[>20]}$ of a pair, **NS** or **EW**, having the majority of high card points **(>20 hcp)** on a board is, with breathtaking precision, **0•458889163352414**. In consequence the number of boards $B_{[>20]}$ should obey a binomial distribution peaked at $P_{[>20]}*S$ with a standard deviation (σ) equal to the square root of $P_{[>20]}*S*(1-P_{[>20]})$.

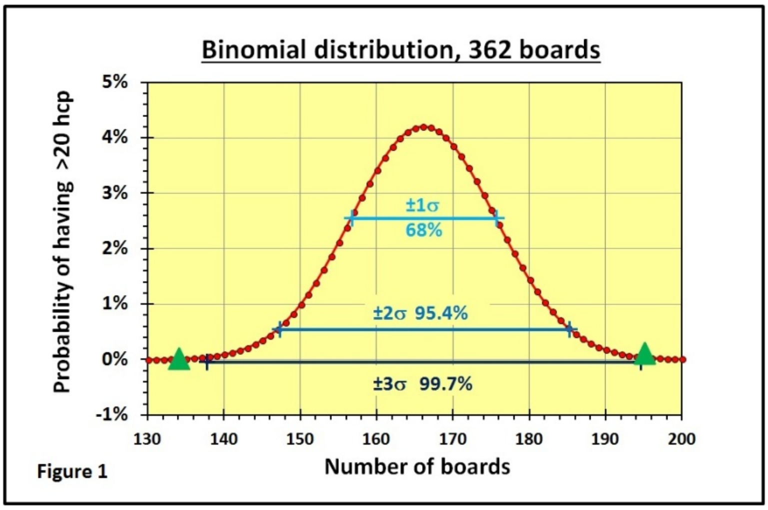

Figure 1

For S **= 362**, the expected, i.e. most probable, $B_{[>20]}$ **= 166** with σ **= 9•48** for either **NS** or **EW**; boards with hcp split equally have $P_{[20]}$ **= 0•0822** giving $B_{[20]}$ **= 30.** The counts in fact were $B_{[EW>20]}$ **= 195,** $B_{[NS>20]}$ **= 134** and $B_{[20]}$ **= 33.** Fig. 1 plots the probability expected against number of boards and the actuals encountered (green triangles). The extent of **±1**, **±2** and **±3** standard deviations are shown with the associated normal probabilities, the actuals lie outside **±3σ**. The odds against **195** and **134** are about **900 to 1** and **3960 to 1** respectively. Alternatively, these figures could be explained by bias in the system with the probability $P_{[EW>20]}$ = **0•5387** whilst $P_{[NS>20]}$ = **0•3702**, i.e. an **EW bias** of **1•46 to 1;** but the source of any such bias is hard to imagine.

Fig. 2 shows the ratio of $B_{[EW>20]}$ to $B_{[NS>20]}$ for each session using a LOG scale with the red points, covering June thru August, exhibiting the consistent and remarkable **EW** ***'bias'***. However the blue points, covering January thru May, have been added to highlight what is a weird step-change in the data. The 16 Friday sessions, from January through May 2016, used **443** boards, with $B_{[EW>20]}$,= **196,** $B_{[NS>20]}$, = **209** and $B_{[20]}$ = **38**, all well within 1 standard deviation of expected values. It seems unlikely that the included linear trendlines have any real significance.

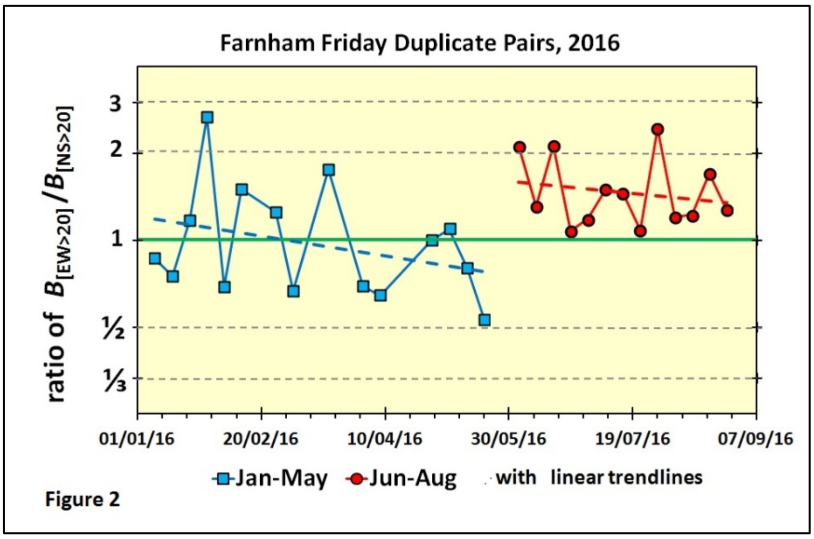

Figure 2

Neil Morley suggested that I should contact Duplimate and I will send this to David Stead. If they do not have any ideas perhaps EBU's little helpers [4] might be able to offer some explanation of what could have gone wrong.

References:

[1] http://www.bridgewebs.com/cgi-bin/bwoj/bw.cgi?club=farnham&pid=display_past
[2] http://www.ebu.co.uk/cmh-data/pages/Pre-dealt%20Boards%20and%20Dealing%20Machines.pdf
[3] http://www.bridgehands.com/P/Probabilities_Miscellaneous.htm
[4] http://www.ebu.co.uk/node/1990

05/09/2016