

An investigation into the role of chance in determining Skittles League End-of-Season positions.

2009

1. Introduction

Practical experience suggests that the results of skittles matches and therefore final end of season League positions, depend partly on skill and partly on chance. To investigate this proposition numerically a number of attempts were made to model the League data. The method adopted was to analyse the statistical distributions of points scored over a season from the league tables in order to assess the form of distribution and then to see what conclusions could be drawn using simple models for comparison. The results are outlined in this report.

The Author is a member of the "GEORDIES" skittles team, who currently play in Division 4 of the Thornbury and District League.

2. Analysis of end of season League data.

The results used were those taken from the *Thornbury and District Skittles League Players Handbooks* for the four seasons 2004/05 to 2007/8. Ref 1.

Because of a likelihood that Front-First results might behave differently to All-In, the Front-First Divisions 1 and 2 data was analysed separately from that for the All-In Divisions 3,4 and 5. Division 6 data was not included as it was felt that the annual introduction of new, inexperienced, teams could introduce an additional degree of variability to the data. In the event, these separations appeared to be justified.

Final, end of season, points scored were tabulated and ranked for the groups of teams as above. Because of differences between team numbers the performance variable used was the points gained divided by the number of games played. With two points available for each match this, obviously, has a mean value of 1. The ranks were turned into probabilities using $(r-0.5)/n$ and thence into standard deviations using the inverse normal function. If the results can be said to be normally distributed they should lie on a straight line when plotted. In fact they do with high correlation coefficients. The two graphs are shown as Figs, 1 and 2. The standard deviations exhibited are:-

Divisions 1 & 2	S.D.	0.293	with 1.9% of games ending as Draws.
Divisions 3,4 & 5	S.D.	0.235	with 2.7% of games ending as Draws.

The following conclusions are drawn from these results:-

1. The points scored fit normal distributions.
2. The Front-First results show a larger spread than the All-In, implying a bigger skill gap between teams at the top of the Division and those at the bottom.

3. Scoring models using zero skill factor.

The simplest model is by coin tossing, say, Heads we win, Tails you do. To simulate this process using random numbers the probabilities could be subdivided and designated 0 to 0.5 as a win for team 'A', and 0.5 to 1 as a win for team 'B'. The obvious snag with this method is that it does not recognise Draws. To handle this, the probabilities were partitioned to give 0 to 0.4875 Win, 0.4875 to 0.5125 Draw, and 0.5125 to 1.0 Lose for team A, with the opposite result, of course, for team B. This model was run for thirty games to give total points scored for one season and then 24 times to simulate one season of play for three divisions of 16 teams each, making 1440 games in total.

Two results from this model are shown as Figs. 3 and 4; in summary they were:-

S.D.	0.118	with 1.8% of games ending as Draws.
S.D.	0.164	with 3.3% of games ending as Draws.

An alternative random number model defines a Draw result when the ratio of the two random numbers is within a certain critical value; the critical ratio being chosen to give approximately the required proportion of Draws. Again, two trials were run, with the critical draw ratio of 1.02.

The results are given as Figs. 5 and 6. In summary they were:-

S.D.	0.160	with 2.6% of games ending as Draws.
S.D.	0.196	with 1.9% of games ending as Draws.

The conclusion drawn from all these results are:-

1. They show normal distributions.
2. The standard deviations are smaller than given by the League data, implying that skill differences may be required to reproduce the actual results.

4. Alternative models.

Random scores can be generated from random numbers using the inverse normal function with assumed mean and standard deviation. This way team `A` can play team `B`, with or without an implied skill factor present, and the result summed over a season. The EXCEL spreadsheet used for these calculations is shown as FIG. 7.

Calculations were run, as before, for 24 sets of 30 matches using a range of mean and standard deviation values. The results are summarised on page 3.

It can be seen from the graphs that the resulting distributions for the different `A` and `B` mean values when accompanied by the same standard deviation are not linear when plotted. These scores are, therefore, not normally distributed. However when accompanied by a difference of standard deviations the results were acceptably linear.

Conclusions,

1. As might be expected, this work shows that both skill and chance play a part in determining final end of season positions, with the Front-First results showing evidence of a higher skill factor.
2. It was not possible to reproduce the Div 1 & 2 data using the simple two team model chosen. It is probable that a wider range of team abilities is necessary.
3. Numerical results using simple models suggest that to achieve a good position in the league requires a mean performance level only, say, 2 to 3% above average, but with below average variation; the latter being probably the most important attribute.

Summary of results using team score modelling.

	Team		Result	
	Mean	Standard Deviation	S.D	Draws
`A`	170	15		
`B`	170	15	0.133	1.8%
`A`	180	15		
`B`	180	15	0.190	2.2%
`A`	170	12		
`B`	170	12	0.212	1.9%
`A`	170	15		
`B`	170	12	0.215	2.2%
`A`	175	12		
`B`	170	12	0.291	2.4%
`A`	175	15		
`B`	170	15	0.236	2.5%
`A`	180	15		
`B`	170	15	0.380	1.4%
`A`	185	12		
`B`	180	15	0.303	1.4%
`A`	185	12		
`B`	180	15	0.332	1.8%

Graphs illustrating the effects of changing mean values and team score standard deviations are attached as Figs. 8 to 16. These have been included to show confirmation, or otherwise, of the resulting normality of the distributions of League positions.

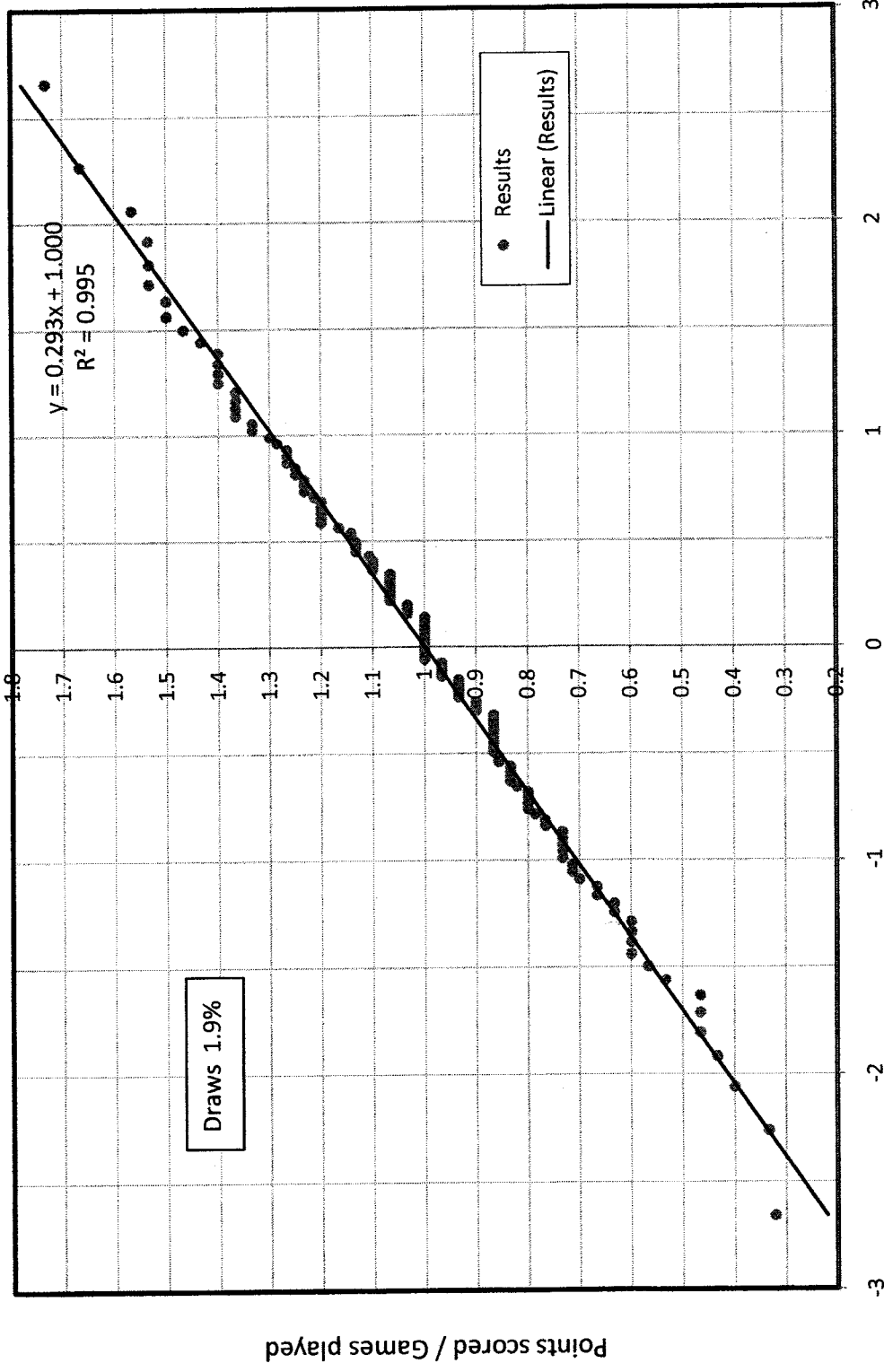
NOTE. The "Geordies" scores for the last 23 All-in home games were analysed and showed a mean of about 180 and a standard deviation of 14.7. These figures formed the basis for the choice of numbers used above.

References.

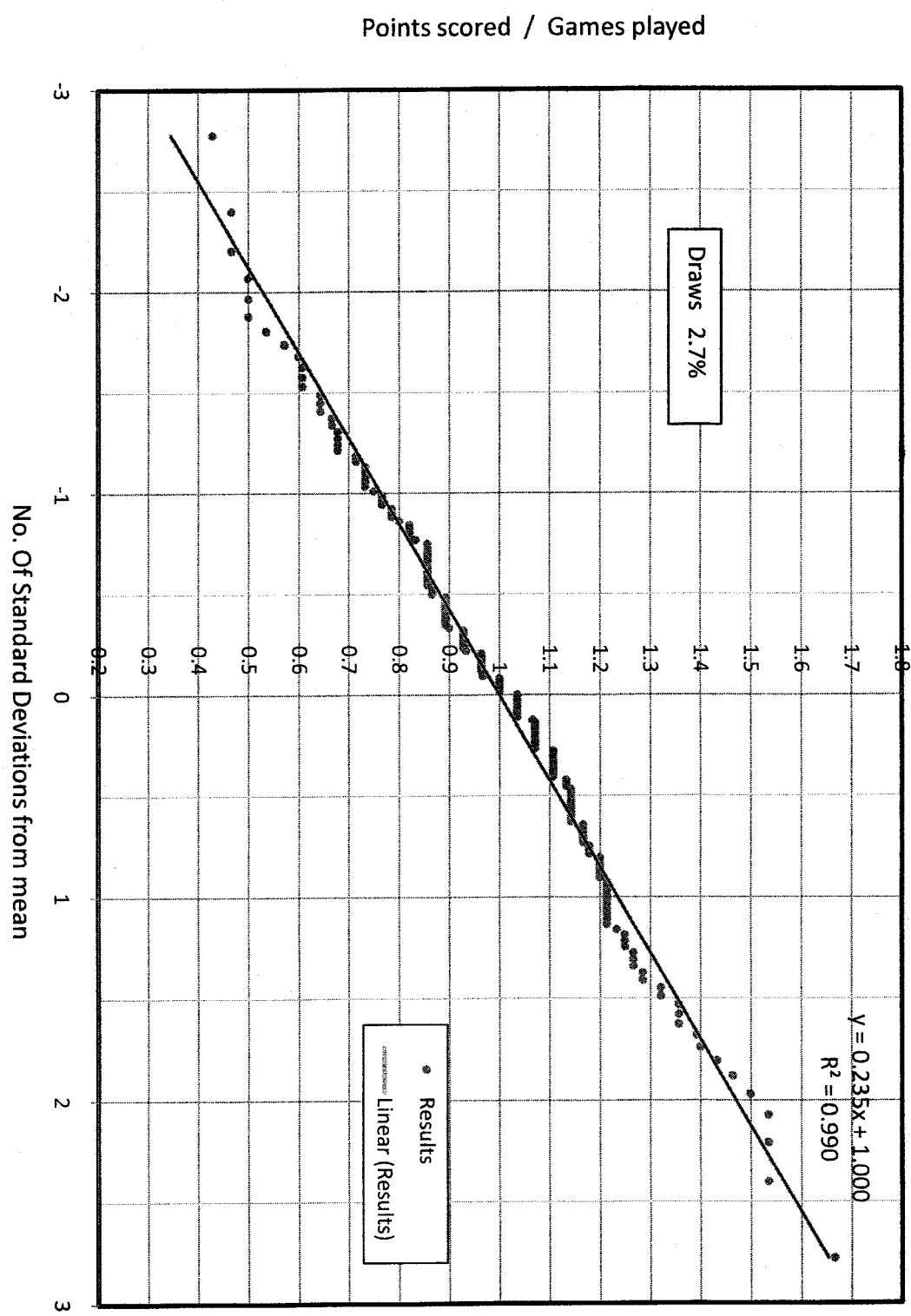
1. *Thornbury & District Skittles League Handbooks for seasons 2004/05, 05/06, 06/07 and 07/08.*
2. *A Book written and published by Ron Holpin summarises the history and development of the Thornbury League over the fifty years 1955 to 2005. It gives useful background information and data.*
3. www.thegeordies.org.uk gives historical and performance data for the Geordies skittles team who currently play in Division 4 of the Thornbury League.

Skittles League Results Divisions 1 and 2.

Seasons 04/5 to 07/8



Skittles League results Divs. 3, 4 & 5
Seasons 04/5 to 07/8



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