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Systematic Reconnaissance of Cycles in War

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Previous research has shown that the index of International War Battles, 600 BC - 1957 AD is cyclic in nature.

Previous research has been on a hit and miss basis. Obvious cycles have been chosen for study, but no comprehensive survey of all cycles in this series of figures has hitherto been made.

The time has now come when such a comprehensive study can be begun.

The first step in a comprehensive study is the construction of a systematic period reconnaissance.[Note: The term systematic period reconnaissance has been adopted as being more descriptive than the terms fractional harmonic analysis or multiple harmonic analysis, used formerly. All terms refer to the same procedures.] Such a reconnaissance shows the periods at or near which there may be real cycles. It may also deceptively suggest periods which have no significance, and are created by combinations of randoms. And finally, in such a reconnaissance, real cycles create echoes or shadows that, before investigation, appear as possible periods. Because of these difficulties, each indicated period should be evaluated separately so that it can be accepted or discarded.

Notwithstanding the limitations of any comprehensive scanning procedure such as a periodogram analysis, a power spectrum analysis, a systematic period reconnaissance, or any other form of reconnaissance, some comprehensive investigation is needed as a first step in the serious investigation of any series of figures. This is so for two reasons: such reconnaissance indicates the more probable periods to investigate. Such reconnaissance shows us, when studying any individual cycle in depth, the possible existence of other cycles which, if not taken into account, might impair the results of the study. For example, if we were studying a 4-year cycle in a series of figures that might also contain a 7-year cycle, we would treat the figures very differently than we would if we suspected that it might also contain a 9-year cycle.

Therefore, as a first step, we made a systematic period reconnaissance of the Wheeler Index of International War Battles, 1700-1913. We used departures from a straight line trend fitted to the logs of the data plus one. We stopped the investigation as of 1913 to avoid possible distortions caused by World Wars I and II. We carried it back only to 1700, partly for reasons of economy and partly to hold it to a span of time over which we had other data-especially sunspot numbers.

The results of the scanning are shown in Figure 1.

The peaks and bulges adjudged worthy of further study are listed in Table 1.

It is necessary to stress again and again that the peaks on the chart provide merely *hints* of

periods at or near which there *may* be cycles. They do not indicate that there are cycles at or even near these periods. Moreover, even if there are such cycles, they may not be real or significant. All these matters must be investigated by other means. Consequently, all the figures in the Table are of specious accuracy unless there are real cycles of the indicated period.

Why then do we not drop more decimals? Because in the next stage of the analysis we must use some value and we might as well use a value which, at this stage of the analysis is the most probable value.

In looking at Figure 1 and Table 1, remember that the height of the curve represents the amplitude or strength of the various cycles present on the average in the data for the 214 years under review. The cycles are really there - *on the average* – but they may be present as the result of coincidence of randoms. Or, cycles that are real may have been distorted by randoms or by other cycles to appear to have a period different from the true period.

The horizontal scales represent the periods or average cycle lengths from crest to crest or from trough to trough. The top scale represents these periods in fractions of 214 years. The bottom scale shows you the periods in actual years.

The investigation was carried on with respect to cycles down to 4.9767 years only (in order to include cycles of 5 years or more).

If the periods shown are not the true periods, the dates given in column 5 will be incorrect and so will the slopes.

Column 6 shows the slope. It is computed as follows: twice the amplitude (that is, the average distance from the bottom of an ideal trough to the top of an ideal crest) divided by half the period (that is, the average time from a trough to a crest, or vice-versa). The slope shows which cycle will prevail over which, if the cycles are real and are correctly measured for period and amplitude.

In speaking of strength, period, timing and slope, I shall, for the most part, use round numbers. You can obtain the true arithmetic values from Table 1.

From the standpoint of timing it is interesting to note how many of the suggested cycles crest, ideally, at about the present time; and of course crest again at multiples of their own period forward and backward from their current crest. Remember that these dates will change if-as a result of study in depth-the periods change. The dates should therefore not be taken too seriously.

The computation of slope (the last column) shows that the three hints with greatest slope are No. 8 of 17.4 years, No. 13, of 11.2 years, No. 26 of 6 years and No. 24 of 6.5 years. Any of these hints, if real, will prevail over any *one* of the other cycles, though not necessarily over a combination of other cycles.

From Column 6 any of the other cycles can be compared with all the rest, similarly.

It may be in point to comment more in detail in regard to some of the indications of the chart and Table.

The tallest peak in Figure 1, and hence the strongest average cycle, is at the 4th fraction of 214 years (top scale), or 53.5 years (bottom scale). If one were interested in the major swings, this would be a very important cycle to investigate, although to study it one would need to use many more data to get many many more repetitions of the cycle.

Could this cycle be the well-established 54-year cycle? Perhaps. However, previous work shows a 57-year cycle in these figures, 1750-1943.[1] We must therefore conclude that something has distorted the 57-year cycle and made it look, on the SPR, like a 53 1/2-year cycle. This "something" could very well be randoms or it could be the 17.7-year component (because 3 x 17.7= 53.1) We know from previous work that there is a

17.7-year component.[2] Also, it shows up as a 17.4-year peak on the SPR. Both the 53 ½-year cycle, as determined by the SPR, and the 17.4-year cycle, similarly determined, crest ideally at the same calendar time (1967), (whereas the 57-year cycle of which we already know crests ideally in 1975). This fact supports the idea that the 57-year cycle has been made to look like a 53.5-year cycle as a result of a 17-year cycle riding on its back.

You realize, of course, that this discussion is speculative. However, when the actual work begins on the analysis to define the precise length of the suggested periods, some insight has already been gained. You know what you are likely to find. You have a sound reason for selecting one particular period to define before others are worked out. And you know of possible interferences that must be compensated for.

Note also that the 17-year cycle has a slope that is nearly twice as great as the slope of the 53.5-year cycle. This fact likewise supports the idea that the 17-year cycle may have distorted a basic cycle of some other nearby period. (One should always look for interference from cycles that have periods that are odd fractions (or odd multiples) of the period of the cycle that one is looking at.)

The second strongest cycle, on the average, is 125.9 years long, but as this wave has had a chance to repeat but 1.7 times (see top horizontal scale) it is hardly worth investigating.

Third strongest among the cycles present on the average is the 17.4-year cycle, which has had a chance to repeat 12.3 times.

Note that I keep saying "has had a chance to repeat" instead of "has repeated." At this stage of the analysis we do not know that any cycle has repeated - that is, that it is rhythmic. It may be. However, the peak on the SPR chart may (a) result from a cycle some odd multiple of the indicated period or (b) be pointed up by a cycle some odd fraction of the apparent period, or (c) be created by two cycles closely related to each other in period, or (d) be the result of randoms.

Previous work shows that this cycle is real, but that over the entire span of 2557 years its period is 17.71 years. [2]

The next suggested cycle, in order of strength, has a period indicated at 23.8 years. This cycle is strong and important. The peak undoubtedly represents the 21.95-year cycle found by previous work 3 to be present in this series of figures from 599 B.C. through A.D. 1950. Why then does it show as 23.8 instead of 21.95? We do not yet know. It might be the admixture of randoms. It might be a concurrent 8-year cycle (3x8 = 24). Or, for all we know, the 21.95-year cycle (599 B.C. - A.D. 1950) might be just a little longer over this shorter (1700-1913) period of time, or again, the bulge at the 8th fraction of 214 years (top scale) suggests a slightly longer cycle (about 27 years) that might have combined with the 21.95-year cycle to make the 21.95-year cycle look a little longer. The series of figures used for this reconnaissance (214 years) is too short to resolve any of these questions, at least by an SPR alone.

The fifth strongest cycle suggested by the SPR has a period of 11.2 years. This cycle, also, has been confirmed by earlier work.

Detailed comment in regard to the other 27 cycle hints is perhaps unnecessary at this point.

It will be worthwhile, in closing, to recall the cycles in international war battles that have been discovered previously and to compare them with the hints provided by the SPR. These previously discovered cycles are listed below in Table 2.

We must now proceed to run down the other hints provided by the reconnaissance. This is the next order of business. We can then proceed to make a synthesis and a projection.

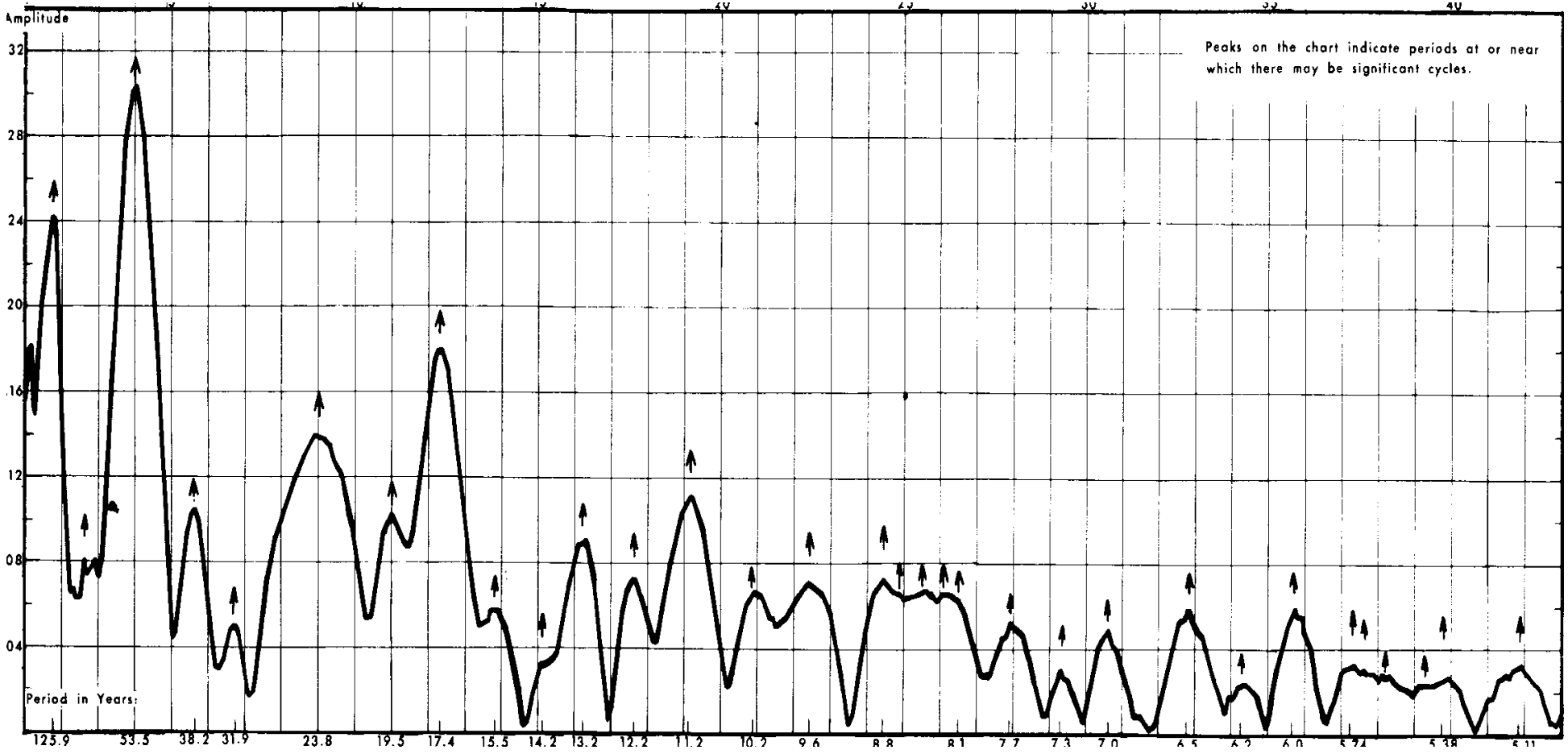
Amplitude
32
28
24
20
16
12
08
04
Peaks on the chart indicate periods at or near which there may be significant cycles.
Period in Years:
125.9
53.5
38.2
31.9
23.8
19.5
17.4
15.5
14.2
13.2
12.2
11.2
10.2
9.6
8.8
8.1
7.7
7.3
7.0
6.5
6.2
6.0
5.24
5.38
5.11

Table 1

Systematic Period Reconnaissance
Index of International Battles,
1700-1913 (Logs of Data Plus One)

Cycle Hint	Fraction of 214 years	Period in Years	Amplitude	Date of Crest	Slope
1	1.7	125.882	.242	2057.02	.008
2	2.6	82.308	.084	2038.79	.004
3	4.0	53.500	.304	1967.17	.023
4	5.6	38.214	.105	1977.99	.011
5	6.7	31.940	.050	1966.87	.006
6	9.0	23.778	.139	1971.54	.023
7	11.0	19.455	.103	1972.62	.021
8	12.3	17.398	.181	1967.02	.042
9	13.8	15.507	.057	1967.80	.015
10	15.1	14.172	.032	1973.65	.009
11	16.2	13.210	.091	1971.20	.028
12	17.6	12.159	.073	1976.12	.024
13	19.1	11.204	.110	1971.29	.040
14	20.9	10.239	.066	1974.54	.026
15	22.4	9.554	.070	1971.85	.030
16	24.4	8.771	.073	1972.73	.033
17	24.9	8.594	.066	1968.81	.031
18	25.5	8.392	.067	1972.95	.032
19	26.1	8.199	.066	1969.83	.032
20	26.5	8.076	.061	1967.86	.030
21	27.9	7.670	.052	1969.85	.027
22	29.3	7.304	.030	1972.25	.017
23	30.6	6.994	.048	1968.49	.028
24	32.8	6.524	.059	1971.02	.036
25	34.3	6.239	.024	1965.02	.015
26	35.7	5.994	.059	1967.51	.040
27	37.3	5.737	.033	1969.65	.023
28	37.6	5.692	.032	1968.62	.022
29	38.2	5.602	.027	1966.70	.019
30	39.3	5.445	.025	1968.21	.018
31	39.8	5.377	.028	1966.50	.021
32	41.9	5.107	.033	1966.24	.026

Table 2

A list of cycles discovered to date in the
Index of International War Battles
Together with the time spans over which the cycles were observed,
the dates of ideal crests, and the amplitudes

Period of Cycle in Years	Time Span over which observed	Date of an Ideal Crest	Amplitude % over trend	Reference	Notes
142	1 – 1950 AD	1950	78	4	
57	1750 – 1943 AD	1975	151	1	
21.98	556 BC – 1900 AD	1962.34	12	6	
17.71	600 BC – 1957 AD	1971.68	15.0	2	International & Civil combined
12.3456	563 BC – 1943 AD	1943.17	24.7	5	Present in alternate 86.4 year blocks
11.241	529 BC – 1900 AD	1970.7	8.65	6	
9.5986	562 – 1957 AD	1972.6	23.8	5	Present in alternate 86.4 year blocks
5.982	600 BC – 1957 AD	1967.6	2	7	
5.5	1750 – 1943 AD			8	details not determined

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