

Probability and the Gwōdyèn Dàu/Dv̄ Jīng

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Statistics can be useful to text philology. Here is a case in point.

Theory. I proposed in 1990¹ that the first half of the Dàu/Dv̄ Jīng 道德經 text, the so-called Dàu Jīng (DDJ 1-37), grew symmetrically around a DDJ 14 core down to c0300, and that the second half, the Dv̄ Jīng (DDJ 38-81), grew by linear accretion from c0300 to c0249. If that were true, then a text of the DDJ dating between c0300 and c0249 *should lack the highest-numbered chapters*. An empirical test of that hypothesis arose when Tomb #1 at Gwōdyèn 郭店 proved to contain three sets of passages which are part of our DDJ. Details were first made public at a May 1998 conference. The organizers supplied me with the numbers of the DDJ chapters found at Gwōdyèn. They totaled 32 out of 81 DDJ chapters, all within the range DDJ 2-66 inclusive. I submitted a paper in absentia, pointing out that the Gwōdyèn DDJ limits matched the prediction inherent in the 1990 theory, and so supported that theory.

Conference. The paper was not circulated at the Conference,² which deadlocked between two views: (1) the text behind the florilegia was a cloud of oral sayings, or (2) a full 81-chapter DDJ. The former (favored by the international scholars) refutes itself: how did the Gwōdyèn scribe select from the oral cloud *only* what would later figure in our DDJ?³ The latter (favored by the Chinese scholars) is refuted below.

Date. Li Xueqin proposed (Allan **Guodian** p246), and Liu Zuxin agreed (p29), that a cup found in Gwōdyèn 1 identifies its occupant as the Tutor of a Chǔ Heir Apparent. But Heir to which Chǔ King? Hwár-wáng (r 0326-0299) includes Bāushān 2 (c0316), which archaeologically predates Gwōdyèn 1.⁴ Likelier is Syāng-wáng (r 0298-263),⁵ since in 0278, during his reign, Chín conquered the Chǔ capital Yǐng and forced its abandonment, along with the Gwōdyèn burial area. If the Tutor died on the same day he was appointed, then 0298 is the earliest possible date for his burial; the *latest* date is the 0278 abandonment of the area. A reasonable estimate would be the midpoint of that range, or c0288. The Tutor's texts should be at least slightly earlier, say c0290.

¹At the Third New England Symposium on Chinese Thought (19 May 1990); see also the later Brooks **Present** (1994) and the still later Brooks **Formation** (2002).

²Attention was however called to it by a participant; see Allan **Guodian** 239.

³For mixed anthologies, see rather the Gwōdyèn Yǔ Tsung 語叢 (“Sayings”) texts, where (for example) bits of pre- and post-Analects sayings mingle with other material.

⁴Considering the evidence of other Chǔ sites, Xu Shaohua is inclined to put the possible range of dates for Gwōdyèn 1 at c0300/0278 (personal communication, 1998).

⁵So Li Xueqin (Allan **Guodian** 246, with others agreeing); this identification was repeated by Li Xueqin at a 22 Oct 1998 lecture at Dartmouth College, attended by the present author.

Prediction. What does the accretional theory predict for the DDJ in that year? Briefly, that it had probably grown as far as DDJ 56,⁶ but had not yet reached DDJ 70.⁷ Any cutoff within that range would be sufficiently compatible with the theory.

Result. The Gwōdyèn total inventory of 33 DDJ chapters, in DDJ order, is:

Dàu Jīng: 2 5B 9 13 15 16A 17 18 19 20A 25 30AB 31BC 32 35 37

Dý Jīng: 40 41 44 45 46BC 48A 52B 54 55 56 57 59 63AC 64A 64B (twice) 66

The cutoff is at DDJ 66. The result is then *highly* compatible with the theory. But perhaps the compilers ignored DDJ 67-81 simply by chance? That is one possibility. If it were true, the theory of an 81-chapter DDJ source text could after all be saved.

This happens to be a possibility that can be evaluated by statistics.

Statistical Test. We may phrase the problem this way: How likely is it that 33 random choices⁸ from an 81-item string will leave untouched the last 15 items in that string? Or in standard textbook terms: An urn contains 66 White and 15 Red balls. From it we draw 33 balls. Except on the final draw, the ball drawn is not replaced. How likely is it that *all* balls drawn are White?

The way to answer this question is known to those who know statistics. We may here rely instead on pure ratiocination. First, the probability of drawing a White ball from an urn containing a 66/81 ratio of White balls is obviously 66 out of 81, or 66/81, or (to four decimal places) 0.8148. There would thus be nothing odd about drawing White on the first try. On the contrary, it is by far the more likely outcome. It is important to distinguish in this way between the probability of getting a certain result on *one* draw, and that of getting a certain result in a *series* of draws.

⁶LY 16:4 appears to be a criticism of the “weakness” advocated in such passages as DDJ 43, in LY 16:8 a response to the criticism of DDJ 53, and in LY 16:11 a dismissal of the indirect courtiership and diplomacy of DDJ 54-56 (see Brooks **Analects** ad loc). The latter two are more adversative in tone, and thus presumably more nearly current in date. We date LY 16 as a whole according to its latest passages, which respond to the Chí conquest of Sung in 0286, and thus to c0285. But the form of LY 16, which is that of an interrupted series of sayings based on numerical categories, suggests that the body of the chapter, including the passages above cited, was in being somewhat before the date of that overridingly important event. We might then responsibly refer that incomplete proto-chapter as a whole to the year c0290, bringing it within range of the likely Gwōdyèn start date.

⁷We see in the image of “cherishing a treasure” in LY 17:1 a meaningful similarity to the same phrase in DDJ 70. The tone of 17:1 is that of an activist who criticizes “Confucius” for maintaining his purity, and not helping the state in evil times. Then of the two, LY 17:1 is probably responding to the earlier DDJ 70. For several reasons (including a LY 17:2a/b reference to the Sywǎndž/Mencian human nature controversy), we date LY 17 as a whole, and these early passages with it, to c0270 (see Brooks **Analects** ad loc). The earlier DDJ 70 was dated in Brooks **Present** 73 to c0274, or slightly before the supposed date of the Analects chapter, but still later than the Gwōdyèn end date of 0278. The intertextual relationships here summarized thus suggest that DDJ 70 would not yet have been available to a Gwōdyèn compiler excerpting the then extant DDJ as of 0278, and still less so at any earlier date.

⁸The Gwōdyèn DDJ (as befits the textbook of a future King) is heavy on statecraft, and the second or “applied” half of DDJ is better represented than the first half. In this light, the absence of the last 15 DDJ chapters in the Gwōdyèn DDJ is even more notable. I here ignore this, and assume that all parts of the source DDJ were equally likely to be selected.

Drawing that White ball leaves 65 White balls out of a total of 80 balls. The chance of getting White on the next draw is thus $65/80 = 0.8125$; a little less, but still good. But to calculate the likelihood of drawing White on both the first *and* second tries, we must *multiply* the two probability fractions, $(66/81)(65/80) = 0.6620$. This is still likely, but it is less likely than getting White on any single draw. In graphic terms:

<i>First Draw</i>	<i>Second Draw</i>	<i>Final Probability</i>
White = 0.8148	White = 0.8125	WW = 0.6620
	Red = 0.1875	WR = 0.1528
Red = 0.1852	White = 0.8250	RW = 0.1528
	Red = 0.1750	RR = 0.0324
Total Probability of All Options		1.0000

As we continue to multiply fractions, the chance of an all-White result steadily decreases. For 33 draws (with replacement only on the last draw), we would have:

$$p = (66/81)(65/80)(64/79) \dots (36/51)(35/50)(35/50) = 0.0001354$$

or about 1 in 7,384. The likeliest outcome is a *mixture* of Red and White.⁹ Or in terms of our original problem, a mixture of DDJ chapters both before *and* after DDJ 66.

The standard threshold of practical improbability is 1 in 100 ($p = 0.0100$), a result which would occur by chance only 1% of the time. In such a situation, we are 99% sure that *the mere-chance hypothesis is not true*. Our result far exceeds that threshold. It follows that the text behind the Gwōdyèn florilegia was not a full 81-chapter DDJ.

Codicil. By arithmetic, the source DDJ text might have contained as many as 73 chapters and still given the same statistical outcome (less than 1% chance). What was its actual extent? I note that the Mǎwángdwēi text switches the Dàu and Dv̄ halves of the text (DDJ 1-37 and 38-81); within the latter, it places DDJ 80-81 before DDJ 67. That is, Mǎwángdwēi relocates DDJ 80-81 *from the end to the beginning* of the text block DDJ 67-81. Given the Chǔ locale of the Mǎwángdwēi tomb, it follows that there was a perception, in the Chǔ area, of a division in the DDJ between DDJ 66 and 67. It is from the text lying *before that division* that the Gwōdyèn DDJ was selected.

This statistical result does not of itself establish the accretion theory of the DDJ, but it does establish the reality of a situation suggestively compatible with that theory. The value of statistics is that it enables us to reach that position with confidence.

Works Cited

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⁹An all-White result is more likely than any *one* combination of White and Red, but it is not more likely than the *aggregate* probability of 65 White and 1 Red, *plus* the probability of 64 White and 2 Red, *plus* the probabilities of all the other mixed results.