

John W. Tukey as Teacher

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John W. Tukey was an atypical intellectual for our times, a thinker of surprising inventiveness. He spent his whole academic career at Princeton University, almost from the start dividing his time between Bell Labs and the University. Each term he taught courses for undergraduates and doctoral students. He cherished teaching and was beloved and highly respected by his students.

He had many interests outside of science, but was such a consummate statistician that we thought it might bring him closer to you, the reader, if we offer you a glimpse of one of his courses.

A COURSE ON COMBINING DATASETS

In the spring term of 1982, John W. Tukey taught a graduate course entitled “Combining Datasets.” At that time, John’s teaching method was firmly established. John wrote transparencies by hand and Eileen Olszewski, for many years his secretary at Princeton, typed them for distribution to the students. During lectures John used two projectors with each slide being first discussed and then moved to the second projector.

Combining Datasets was announced as follows:

The purpose of this course will be to review methods of combining results. This is, the simplest problems of data analysis—treating single batches, regression, and analysis of variance—all involve a single (often internally structured) body of data. The next natural step is to put together—to combine—the results of such separate analyses.

We do this in many ways, using as little, from each individual data body, as an apparent direction and as much as an estimated amount; together with an estimated variance for that estimate, and an indicated number of degrees of freedom for that estimated variance. We will try to work our

way through the most general of these methods, beginning with the simplest and adding complexity step by step.

The chapter headings included:

General outline; Combining independent results and assessing their significance; Combination of directionalities and indications of directionality; Combining tests of fit; Combining values to get a value; Combining values to get an interval; Combining intervals to get a value: group by group (scared, Paull-2, Paull-2F and PL combinations); Externally weighted combination of intervals to get an interval; Which combination when?

Chapter 12 discussed a statistical problem, the combination of intervals to get a value, that had fascinated John over a long period and the remainder of this section consists essentially of an extract of the course notes.

In this chapter and the next, we start from intervals—essentially values with estimated uncertainties—and combine them to get a value. Essentially, then, our problem is to choose the weights with which our values are to be combined, in the first instance on the basis of the given interval lengths (and in the second, if we go over to resistive combination, with a view to a more precise result).

The crucial consideration, which we met casually above, but which now drives and determines our choice of method, is the question of whether the values to be combined estimate the same thing or whether each value to be combined estimates a different thing—and we want to estimate a summary of the different things that are to be combined. Exhibit 1 illustrates one extreme, where it is clear that both:

- the intervals are NOT estimating the same thing, and

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