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Comment

John W. Tukey

The overall impact of this paper is both substantial and sound. Thus my comments will have to focus on recommended changes in flavoring or on possibilities for the future.

1. THE MUD CAN BE DULL

The Murray Hill tradition in data analysis has long included aspects of "plant your feet firmly on the ground, even if they do sink deep in the mud." The limitation of scatterplot matrices to original coordinates is a case in point. The discussion of (brain weight)/(body weight)$^{2/3}$ in Section 2.1 is another case in point. A scatter of "log brain weight MINUS ⅔ log body weight" against log body weight would be a useful supplement to the scatter of Figure 2, in part because it would offer an expanded vertical scale. In Figure 11, where "abrasion is stated to be the intended response," an additional row and an additional column for "abrasion loss residual" and "tensile strength" would greatly clear up the situation—perhaps leaving brushing the task of finding still subtler behavior.

2. HIGHLIGHTING MAY BE INESCAPABLE—BUT IS STILL INADEQUATE

Paper representations of screens with highlighted points are rather weak and wan—and highlighted screens may be somewhat so. Particularly for paper versions, we ought to further enhance the contrast between emphasized and background points. Two easy ways to do this are: a) median +'s or x's for emphasis, with dimensions at least 3 times those of background circles, or b) filled circles for emphasis and little dots for background. This sort of improvement is needed for alternagraphic emphasis as well as for brushed

John W. Tukey is Senior Research Statistician and Donner Professor of Science, Emeritus, at Princeton University. His mailing address is 408 Fine Hall, Washington Road, Princeton, New Jersey 08544.

emphasis. (Compare with the last paragraph of Section 2.1 in Becker, Cleveland and Wilks.)

3. DO PANELS MAKE UP A TABLE OR A GRAPH?

To Becker, Cleveland and Wilks, the answer seems to be "clearly, a table!" because they number rows of panels from above down (and put the vertical coordinate first!). For some of us, the answer seems to be "clearly, a graph" so we would number rows of panels from below upward, and put the horizontal coordinate first.

Whichever side you take—if one is to write in text about panel numbers, panel rows and panel columns, in the pictures, they should be labeled clearly enough (e.g. (1, −) and (−, 3) *or* (−, 1) and (3, −)) so it would be really hard for the reader/viewer to miss the point.

If you do adhere to the graphic paradigm, the distinctive diagonal of your scatter-plot matrix will run NE-SW and not NW-SE.

4. RECTANGLES, ANYONE?

It would have been helpful if the account of brushing had said—if it is true, as I think—that brushes are rectangular because rectangles can be computed faster. How much faster? Are we near the present boundaries when we include brushing? Or could we afford other brush shapes?

5. COGNOSTICS, ANYONE?

The paragraph in Section 2.4 on the scatterplot matrix assumes that scrolling is our only remedy when p is too large. Another approach would be to use cognostics (e.g., Tukey and Tukey, 1985) to help us rearrange our variables so that the initial view shows the most interesting k of them. Instead of simple scrolling, then, we might hold the first $k − 2$ (or $k − 3$, or $k − 1$) fixed and scroll the other 2 (or 3 or 1).