

Professional Visions in the Liminal Worlds of Graphs

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Abstract: A pair of comparable but contrasting episodes wherein biostatisticians narrate within the Cartesian space of regression graphs produced by software, illustrates how close analysis of narrations can reveal distinctive professional visions that correspond to differing views of work in biostatistical consulting or lecturing. Graphs serve as material anchors for conceptual blends that form the basis for narratives that merge Cartesian space with the space of artifacts from the setting from which the data came.

Introduction

Technical disciplines have distinctive material representations that experts tend to deploy more adroitly than novices. Experts invoke the privilege of coding and highlighting salient features of produced material representations in a way that constitutes a professional vision distinctive to that discipline (Goodwin, 1994). Indeed, to become an expert is to be “disciplined” to perceive accordingly (Stevens & Hall, 1998). A question for research is to explain how experts interact with novices to “discipline” their perception. In this study, I contrast how two biostatisticians spoke for the biostatistical practice of interpreting graphs, deploying them as medical researchers or other biostatisticians looked on. In these two brief selected episodes, both biostatisticians spoke in front of an audience beside screens illuminated by LCD projectors, about data summarized by graphical displays of regression analysis. But the biostatisticians differ in status: Steve is a Masters level biostatistician and Leonard is a full professor and head of the department. Steve spoke to an audience of researchers only, Leonard spoke to a group comprised of researchers and fellow statisticians. Furthermore, Steve had generated his graphs using SPSS, a proprietary, graphical user interface (GUI) software package that provides a limited menu of options for the user. Leonard was working with R, an open-source, code-driven statistical package that provides a vast array of options. These biostatisticians are properly considered to be experts in this situation, as they are situated within a familiar context (Roth, 2003) wherein they produced the graphs.

Because graphs summarize data by exploiting the human ability to reason spatially, readers notice different things depending on how they read *into* its spatial landscape and how they read *through* the lines, dots and labels to the laboratory setting from which the data came. In common with other professionals, such as physicists gathered around chalkboards (Ochs, Jacoby & Gonzales, 1994), the biostatisticians narrated and gestured as they created a liminal world that merged the interlocutors in the lecture hall, Cartesian space and the laboratory setting. Such merged spaces are evocative of conceptual blends (Fauconnier & Turner, 2002) for which graphs are potent material anchors, serving as a durable organizer of information (Hutchins, 2005) and a common reference for interlocutors to attend to and index by means of gesture (Williams, 2005). The purposes of this contrast are threefold. One, to simply catalogue narrations around graphs in a technological setting not yet well investigated from this perspective. Two, to briefly describe the liminal world of merged or blended spaces into which each biostatistician invited listeners to follow. Three, to determine who can follow the story and who cannot in order to illustrate how particular professional visions manifest in speech and gesture correspond to conflicting views on the role of the biostatistician in medical research.

The SPSS Episode with Steve

In this episode, Steve spoke about a graph depicting the weight of children compared to the difference between the energy measures from two devices monitoring the metabolic activity of children running on a treadmill: one, a closed chamber housed in the research facility (the “gold standard”), the other a portable armband device or “sensor”. See Figure 1: He placed the variables into the GUI, and then invoked SPSS to produce the regression graph as output. To the right, a map depicts the words spoken in

synchrony with hand tracings (words in transcript in synchrony with gesture are underlined, tracings in white in Figure 1). A member of the audience, “Brian” sometimes speaks as well.

- 1 Steve *So, so this is our graph that we saw a significant correlation in. And here's the weight. And here's the difference between the, uh, armband and the chamber. So, above zero means that the armband overpredicts the energy expenditure. And here the armband underpredicts. So what, what conclusion would you make from that?*
- 2 Brian *The lighter you are the worse it works?*
- 3 Steve *The lighter you are the worse the armband works right? Mm hmm. And, and actually after a certain weight the arm band starts to=*
- 4 Brian *=Oh, yeah*
- 5 Steve *overpredict. And, and maybe this is because these, uh, children are more like adults and it's, it's working better here. In the lighter children it's really, uhm, it's really most off in, in the children who weigh less.*

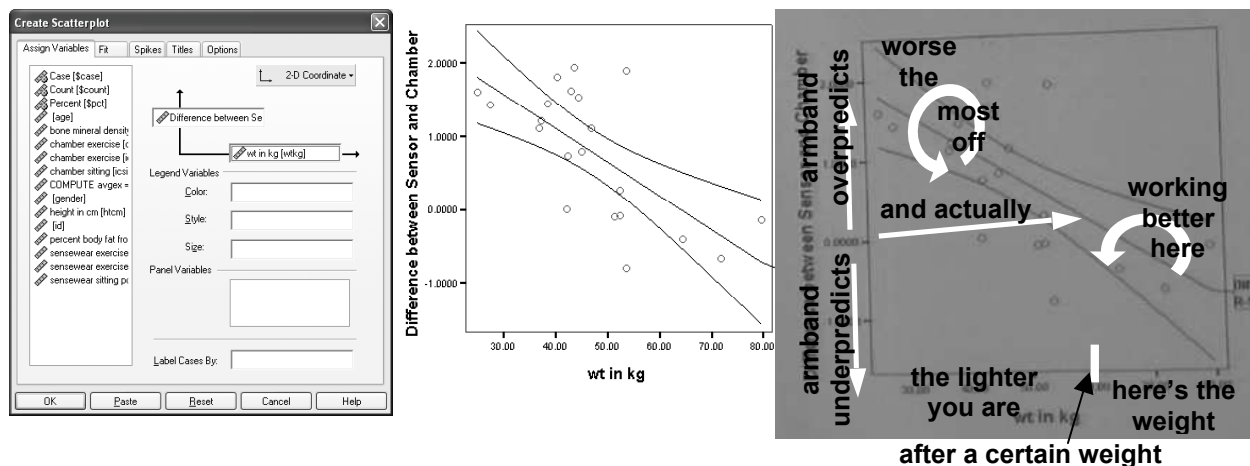


Figure 1. Reproductions of the GUI, the output graph and the marked up still frame from video.

The graph is a scatter plot with a regression line (equation not shown) and 95% confidence interval curves. Steve first highlighted the graph generally, each axis and the zero point on the ordinate axis. It was not necessary to code these features because they were generally understood at the outset. He then coded and highlighted regions where the armband overpredicts and where it underpredicts, thereby entering a liminal world where armbands from the laboratory reside in Cartesian space in view of Steve and his interlocutors. After Steve asked for conclusions (turn 1), Brian suggested a straightforward interpretation: less weight, worse performance (turn 2), employing a personal pronoun, predicate structure (Ochs, Jacoby & Gonzales, 1994) wherein the subject (“you”) diminishes his weight as the armband works progressively worse. Steve at first confirmed Brian’s overall interpretation, borrowing the same grammatical structure, but quickly disconfirmed Brian’s suggestion in part, using his left hand as if to emphatically slice through the graph from the zero point rightward until his hand reached the trend line (turn 3). He thereby re-highlighted the zero point, coded and highlighted a zero-value horizontal line, and reversed the direction of weight variation towards increasing values. Next, he coded “a certain weight” by using his right hand as if to slice the horizontal axis at the 60 kg tick mark. This was a critical value after which the armband will “overpredict” (sic, turn 5). I believe he meant to say, “underpredict”. He then recoded the armband reliability within this bottom right Cartesian space as “working better here” and coded the upper left Cartesian space as the location where the armband is “most off” (turn 5).

The R Episode with Leonard

Leonard has stated often that biostatisticians should interpret for researchers and envisions a future where researchers in the medical school rely on his department more. He hopes to offer them sophisticated analyses that only highly trained biostatisticians can do. He advocates R as a substitute for

others, pointedly singling out SPSS for its reliance on outdated or inappropriate statistical methods. But few medical researchers can take the time to learn R, as it is not easily approachable to the statistical novice, especially anyone unfamiliar with programming. Leonard's short course on regression modeling was the setting for this episode, a retrospective analysis of passenger data on the Titanic. He posed the problem of how to determine patterns of survival among passengers, treating age as the principal input variable. He wrote out a single line of code, entered it and proceeded to talk about features of this loess regression graph while using his computer cursor to index locations as he spoke. The following short transcript is followed by a copy of the graph taken from the lecture notes (Figure 2).

The next thing we're going to do is some non-parametric smoother. This is gonna relate age to survival and put a rug plot on that graph. So you see we have less data in the young people and we have a very steep age drop here. This is, uh, like a sixty-five percent survival, down to forty percent survival and then it gets to be kind of odd. This is, this is what confounding looks like. So these are people of different class and sex and we're mixing those all in. We don't account for that in this kind of plot. But we're starting to see at least overall, once you get to about age twenty, maybe that gets counted as an adult, but there's a lot of slope here saying there's no unique cut off for what is a child. It's just the closer you are to being an infant, you have a higher chance of getting put on the lifeboat. So now we're gonna start to stratify that.

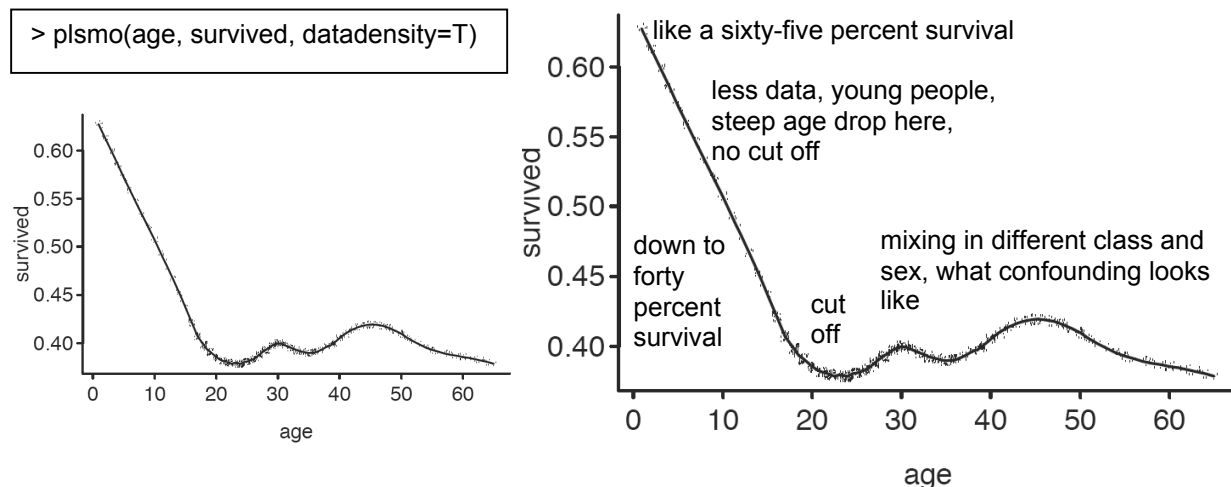


Figure 2. The R code (boxed above) used to generate the graph at left. At right are the areas he indexed.

The graph is a loess regression plot with a dot near the curve for each person by age, enigmatically depicting people as having survival probabilities intermediate between 0 and 1. Briefly put, this is a difficult artifact to use as a material anchor for most medical researchers and arguably for many biostatisticians as well. Leonard invited his audience to entertain (by means of computer cursor movement) different locations where people reside within the Cartesian space. The liminal world at times merges Cartesian space with a space not of people and boat, but filled with other such graphs, with many possible graphical trends, some of which look like this undulating and “confounding” trend.

Distinctive Professional Visions

We find in Steve's narrative an attempt to bring the experimental setting into Cartesian space in order to teach researchers how to deploy SPSS outputs as interpretive tools. In contrast, though Leonard does narrate liminal worlds uniting Cartesian space with the people on the Titanic, he also describes places where “confounding” occurs, a space where only other biostatisticians can enter and only R can help produce. Though these are only two short episodes, selected for purposes of contrasting similar situations (biostatistical talk about regression graphs), they are representative of talk from each

biostatistician over the hours of video gathered from each. Steve never creates spaces that medical researchers cannot enter through Cartesian space, whereas Leonard often does so. Professional visions differ where practice differs, especially where routine practice is under fire from reformers, as is certainly the case in biostatistics (Sterne & Smith, 2001). These biostatisticians stand on opposite sides of the controversy. Steve needs his clients to do most analysis by themselves and therefore needs for there to be such a thing as routine analysis, a task for which the user-friendly SPSS is designed. Leonard advocates more computationally intensive and more assumption-free approaches that have become increasingly influential in the last twenty years but that entail dependence on biostatisticians for grants to be funded or papers published. Each narrates stories that correspond to his understanding of how future work is to be shared with clients. How experts narrate over Cartesian space reveals distinctive professional visions (ways of seeing) that correspond to distinctive views on how professionals do the discipline. Close analysis can be an effective tool for understanding technoscientific work practices, especially where parallel information about participants' practice can be used to provide a broader picture.

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