New Software for Scientists and Engineers

The good and the bad

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THE MONTH OF MAY BROUGHT SEVERAL REMARKABLE SOFTWARE RELEASES from two of my favorite companies, as well as a first experience with a new version of Windows from everyone's favorite whipping boy, Microsoft. A full review of Wolfram's new Mathematica 6 appears in this issue, and a review of SAS' new JMP 7 is coming soon. For now, I'd like to share a little enthusiasm for both new versions that are far from the simple cosmetics that go into the N.x to N.x+1 upgrades.

JMP 7

Let's start with JMP. This is statistical software that can be profitably and easily used by non-statisticians. Your editor was privileged to hear an introduction to version 7 by none other that John Sall, the original developer of the software and Executive VP of SAS. As this was at a local users group meeting, other speakers from JMP presented special topics using the new version so the audience was able to gain insight as to the power and flexibility of this new system, as well as to gage the company's ability to examine and understand its customers' needs.

JMP has long been known for its dynamic linking of instant graphics to analysis, and JMP 7 not only extends the variety of graphics, but the power as well. The new motion-enabled feature provides animation whereby variable changes may be instantly visualized and allows, for example, rapid recognition in patterns over time. A bubble plot that is multivariately-colored exhibited subset movement that quickly allowed researchers to zero in on the data drivers of the dependent variable under study.

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The ability to integrate SAS fully into any analyses from JMP allows those analysts with access to both programs a new level of speed and flexibility while integrating the dynamic graphics of JMP with the breadth and depth of SAS' analytic features. In addition, new scientific disciplines such as genomics, proteomics and chemometrics dictate the use of huge databases, which JMP 7 can handle. A 64-bit Windows or Linux system can now handle a nearly unlimited number of columns. The range of new features will be more fully addressed in my upcoming review. Now on to Mathematica….

Mathematica 6

The various blurbs at the Wolfram site strongly infer that this is far more than a new version. They claim that it is so radical an upgrade that an actual renaming of the package would be in order. Having just started using the new version, I couldn't comment on the hyperbole, but the increase in speed alone is breathtaking. Even for a program that is noted for its ease in dealing with large numbers, the facility for complex calculations in ever-decreasing time periods is rather amazing (to a guy who learned most of his calculating in the pre-PC/hand calculator era, basically pen and paper).

The "full" review that appears in this issue does not begin to do it justice, and I

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and the need to detect submarines during World War I. Unfortunately, those prevailing reasons are still with us today. Modern hydrophones can be very sensitive but, because of their reliance on longitudinal pressure waves, are omnidirectional. Hydrophones are arranged in both 2-D and 3-D arrays such that the arrival time of the pressure wave to each sensor can be triangulated to pinpoint both distance and direction to the source of the sound wave. According to the team of Research Engineer Francois Guillot, Professor Peter Rogers and Research Scientist David Trivett at the Georgia Institute of Technology, the U.S. Navy routinely tows hydrophone arrays that are thousands of feet long in order to obtain the desired directional resolution. Working under a grant from the Office of Naval Research, the Georgia Tech team developed a prototype underwater sound sensor able to measure both sound intensity and direction. The new device is sensitive to direction because it is based on the detection of the sound wave's transverse shear deformation, much like detecting waves on the surface. The device includes a small paddle made of special composite material that has the same density as seawater. The paddle is attached to the main housing by a hinge that permits it to oscillate back and forth as it flutters with the passing wave.

The magnitude of the transverse shear deformation is extremely small and the team needed a sensitive way to measure the paddle vibration. Their method is based on the "optical deception" discovered by Rittenhouse. When light passes through an array of thin parallel obstructions, its waves diffract around them and the resulting constructive and destructive interference spatially separates the wavelengths. In 1978, Dr. Kenneth O. Hill, a scientist at the Communications Research Centre (CRC) in Ottawa, published a method for creating an array of parallel lines within the core of an optical fiber. Named after 1915 Nobel Laureate William Lawrence Bragg, Hill's "fiber Bragg grating" transmits specific light frequencies while reflecting others back through the fiber. The frequency of the reflected light changes as the line spacing varies due to mechanical strain or temperature effects on the fiber's linear expansion. The Georgia Tech team attached a single fiber containing two Bragg gratings to their sensor; one situated on the paddle and the other on the main housing. As the paddle oscillates, the distance between the gratings changes and its effect on the reflected light is monitored by a photodetector. While sensitive to its orientation with the wave, an array of these sensors is again needed to pinpoint direction and range of its source; however, the team suggests an array of these sensors will be more than five times smaller, easier to handle and less costly to operate. These are important improvements no matter which way you look at it. SC

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strongly recommend viewing the Web site (www.wolfram.com/products/mathematica/newin6). Here the interested reader can see both a summary of new features and a detailed listing of new functions. During an introductory Webinar, it seems that, among all of the new features in Mathematica 6, the developers are most willing to highlight the adaptive graphics capabilities whereby an analysis may be quickly made into a dynamic graphic with suitable controls. As with JMP, the analyst can easily call up these visual manifestations of the equations, but now over the full range of Mathematica's considerable range of functions.

As a long time laborer over many a mathematical proof and demonstration (at the sophomore level it would seem!) it was thrilling to see the *FullSimplify* command extended to allow automated proving with symbolic operators. As a statistician, the addition of many matrix and linear algebra functionalities was exciting. I have rarely used this software for routine statistics, but in the area of mathematical statistics, there is much to make life easier. Enough of the good, now on to the bad….

Vista

My minor rant this month concerns Microsoft's new Vista operating system. There is actually much to appreciate in this new tool. However, once we can get by its paranoia with pseudo-security measures, analysts may have a major gripe in terms of running their standard software. A recent column in my local newspaper had the resident computer columnist loudly complaining that the new OS would not run older versions of his popular, non-technical software and that it seemed to be telling him "Get an upgrade, cheapskate!" This philosophy is barely palatable for $50 to $100 programs, but for those in the $1,000 to $5,000, it is totally unreasonable.

Unfortunately that is what happened to this technical analyst. As I migrated to the new system, only half of the software would load and, of the half that wouldn't, only two of the companies were working on compatibility patches for their older versions. I'm talking about either the newest versions that happened to come out before Vista or versions only one back from the latest and greatest. To me, this is almost as maddening as software that demands you register each installation! (*Notice to software marketers:* I may not be the only one objecting to this foul practice.) SC

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