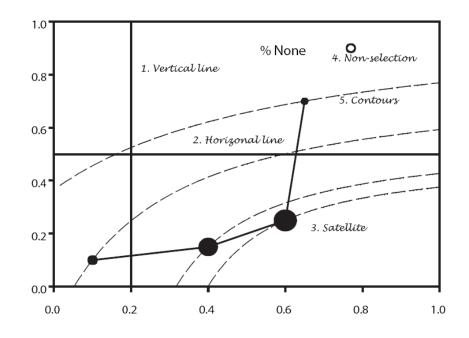
Satellite Plots John D. Cook^{*}

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"Satellite plots" are a way of visualizing EffTox simulation results. These plots are so named because they resemble the orbits of satellites around a planet. The horizontal axis represents true probability of response and the vertical represents true probability of toxicity. The "planet" in these plots is the lower right corner representing the ideal dose certain response no chance of toxicity. Each "satellite" is a disk representing a dose. The location of the disk is given by the true probabilities of response and toxicity. The size of the disk is proportional to how often that dose was selected in a given simulation. Each "orbit" is an efficacy-toxicity trade-off contour.

Satellite plots first appeared in [1] but without the orbits, which were added in [2].



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- 1. The vertical line in the plot gives the response cutoff for the design. A dose is inadmissible if π_E has too little posterior probability to the right of this line.
- 2. The horizontal line gives the toxicity cutoff. A dose is inadmissible if π_T has too much mass above this line.
- 3. The location of the center of a disk corresponding to a dose is (p_E, p_T) , the true probabilities of efficacy and toxicity in a given scenario. The area of the disk is proportional to the percentage of simulated trials in which that dose was the final selection.
- 4. A hollow disk is given whose area is proportional to the percentage of times no dose was selected, unless the early stopping percentage is negligible. The location of the hollow disk is arbitrary and can be placed where space is available.
- 5. The "orbits" of the plot are efficacy-toxicity trade-off contours through the coordinates of each dose. The contours are described by

$$\left(\frac{x-1}{x^*-1}\right)^p + \left(\frac{y}{y^*}\right)^p = r^p \tag{1}$$

where x^* , y^* , and p are constants. (These constants are determined by first selecting (p_E, p_T) pairs $(x^*, 0)$ and $(1, y^*)$ of equal desirability and then selecting a value p to determine the shape of the curve connecting these two points.) To determine the equation of a contour line through a point (x_0, y_0) , set $x = x_0$ and $y = y_0$ in equation (1) to determine r^p . Solving for y we obtain

$$y = y^* \left(r^p - \left(\frac{x-1}{x^*-1} \right)^p \right)^{1/p}$$
(2)

which is then plotted for $x_0 \le x \le 1$.

See [3] for further details regarding the efficacy-toxicity trade-off contours.

References

- Peter F. Thall and John D. Cook. Dose-Finding Based on Efficacy-Toxicity Trade-Offs. Biometrics 60, p684-693, September 2004.
- [2] Peter F. Thall, John D. Cook, and Eli Estey. Adaptive dose selection using efficacy-toxicity trade-offs: illustrations and practical considerations. J Biopharmaceutical Stat. 16: 623-638 (2006).
- [3] John D. Cook. Efficacy-toxicity trade-offs based on Lp norms (2006). Technical Report UTMDABTR-003-06. Available at http://www.bepress.com/mdandersonbiostat/paper29/.