Sequential Sensitivity Analysis
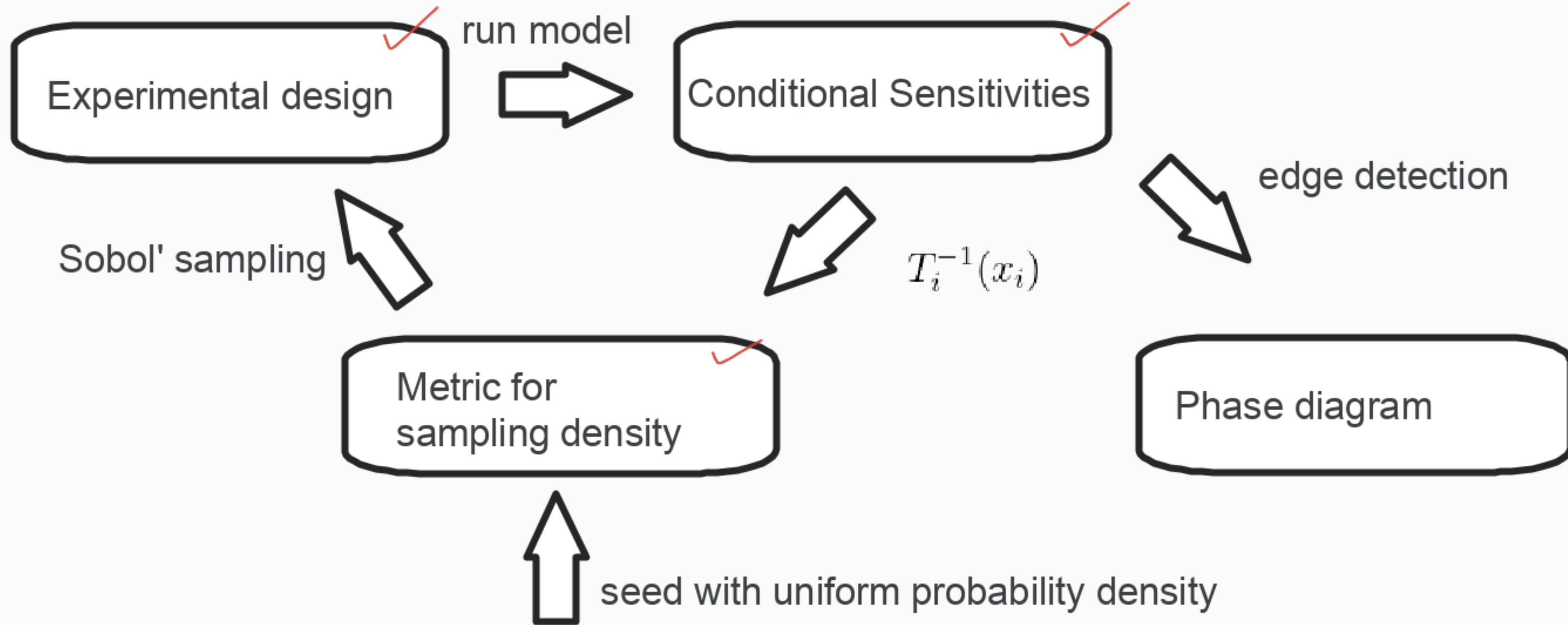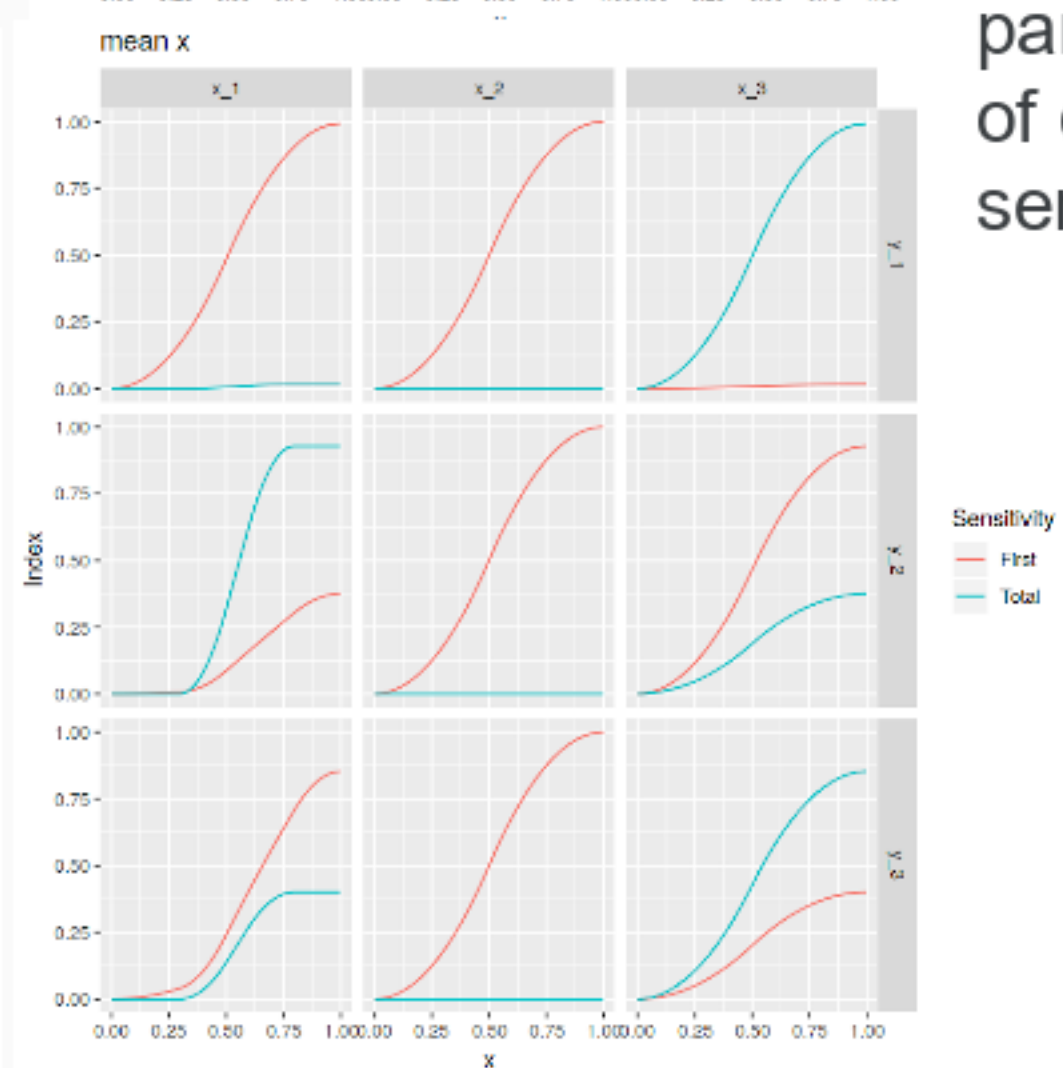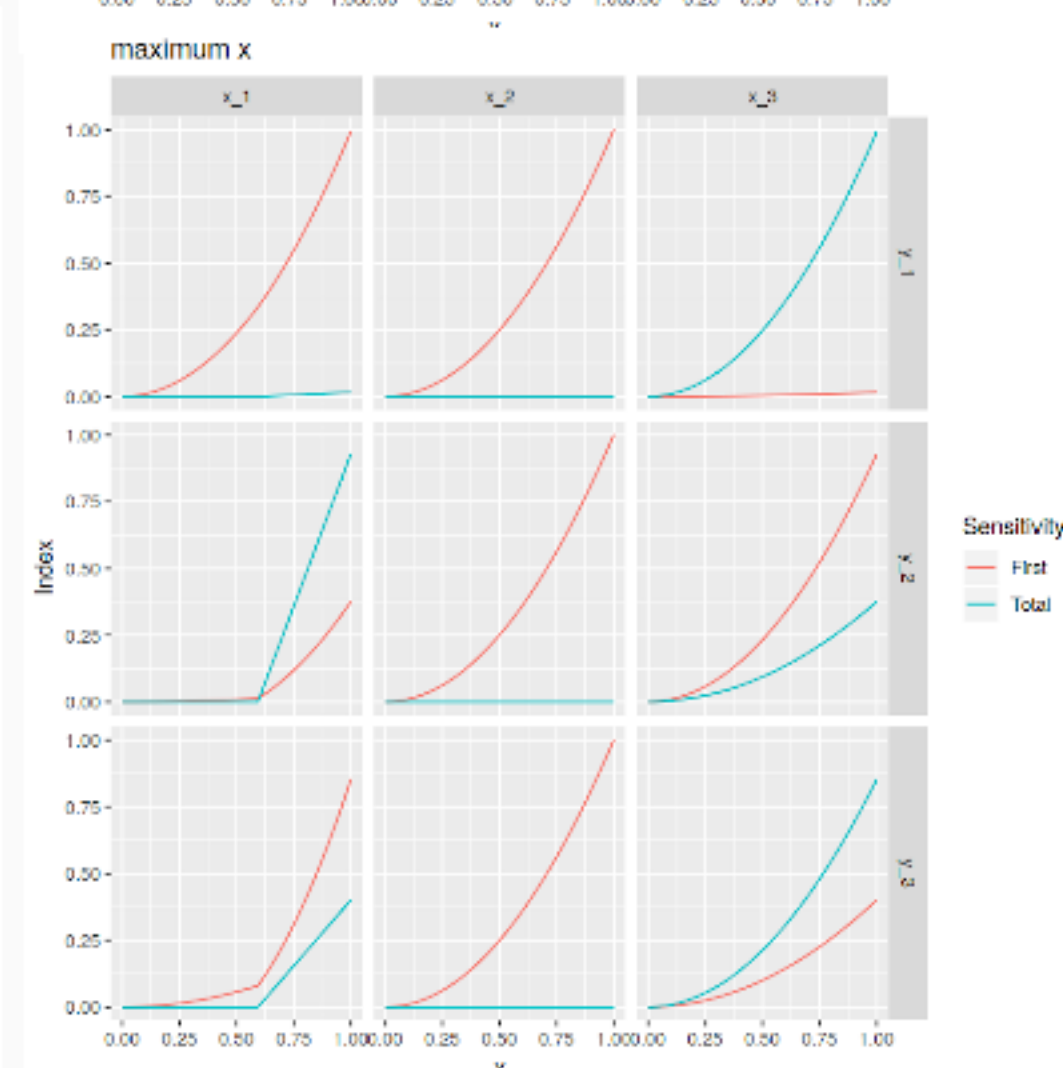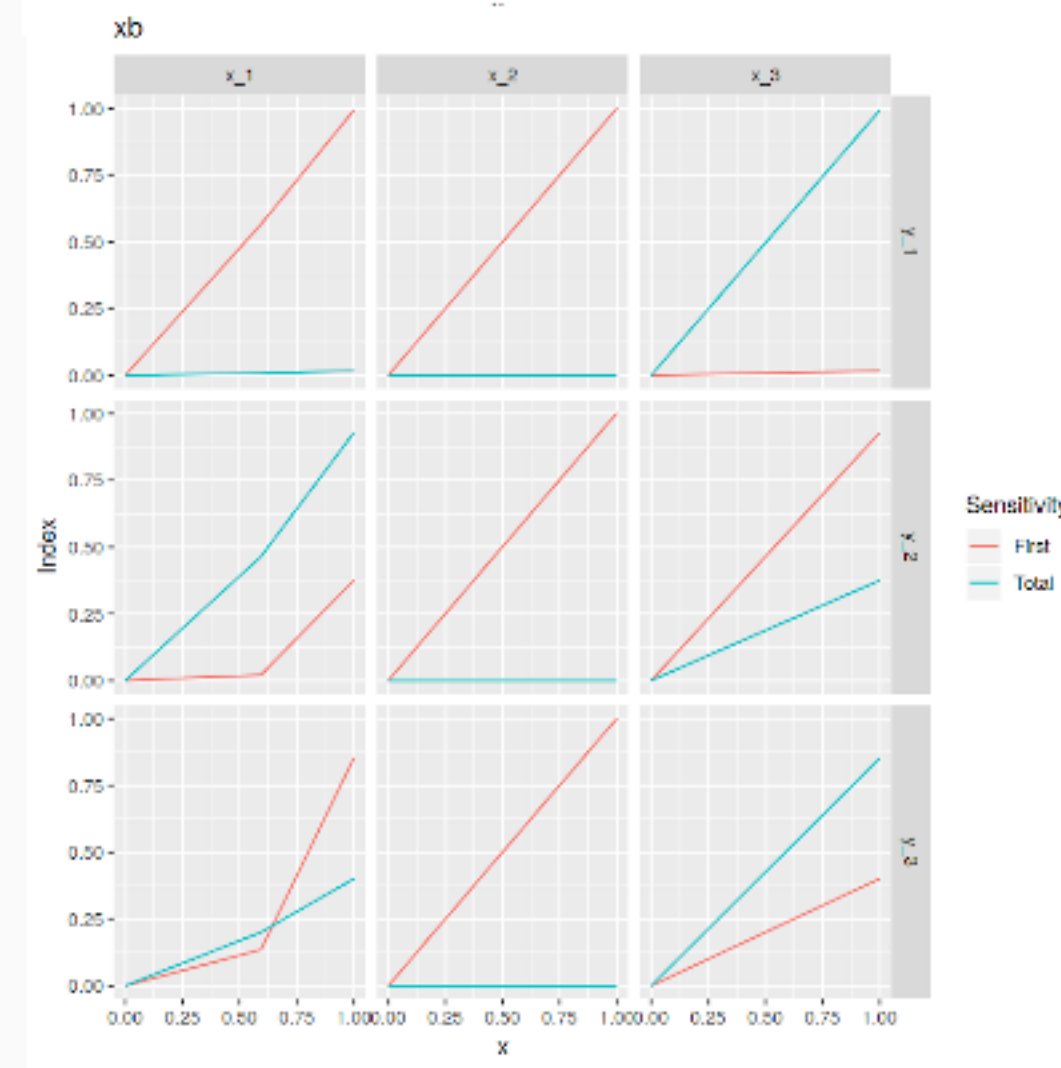
Comparison of different parameterizations of cumulative sensitivities

local sensitivity:

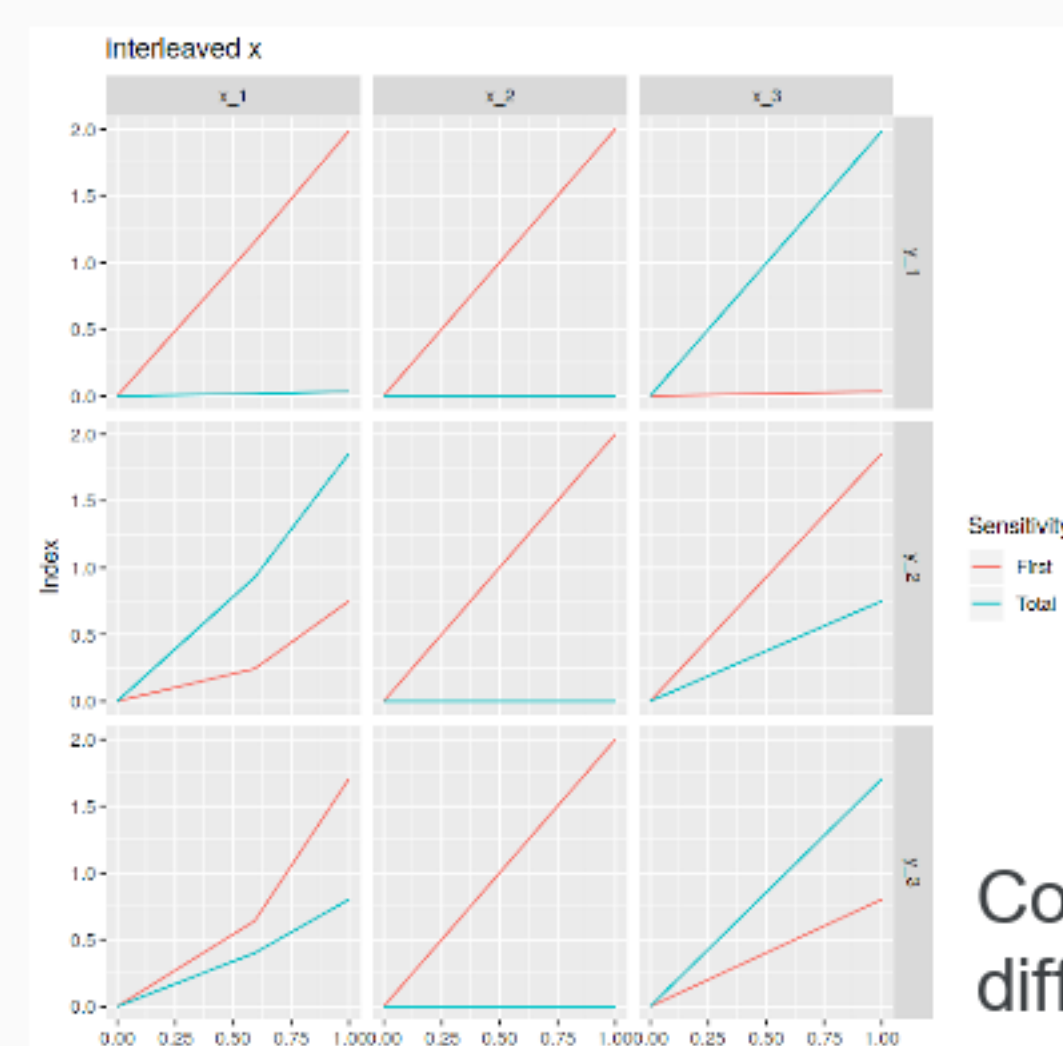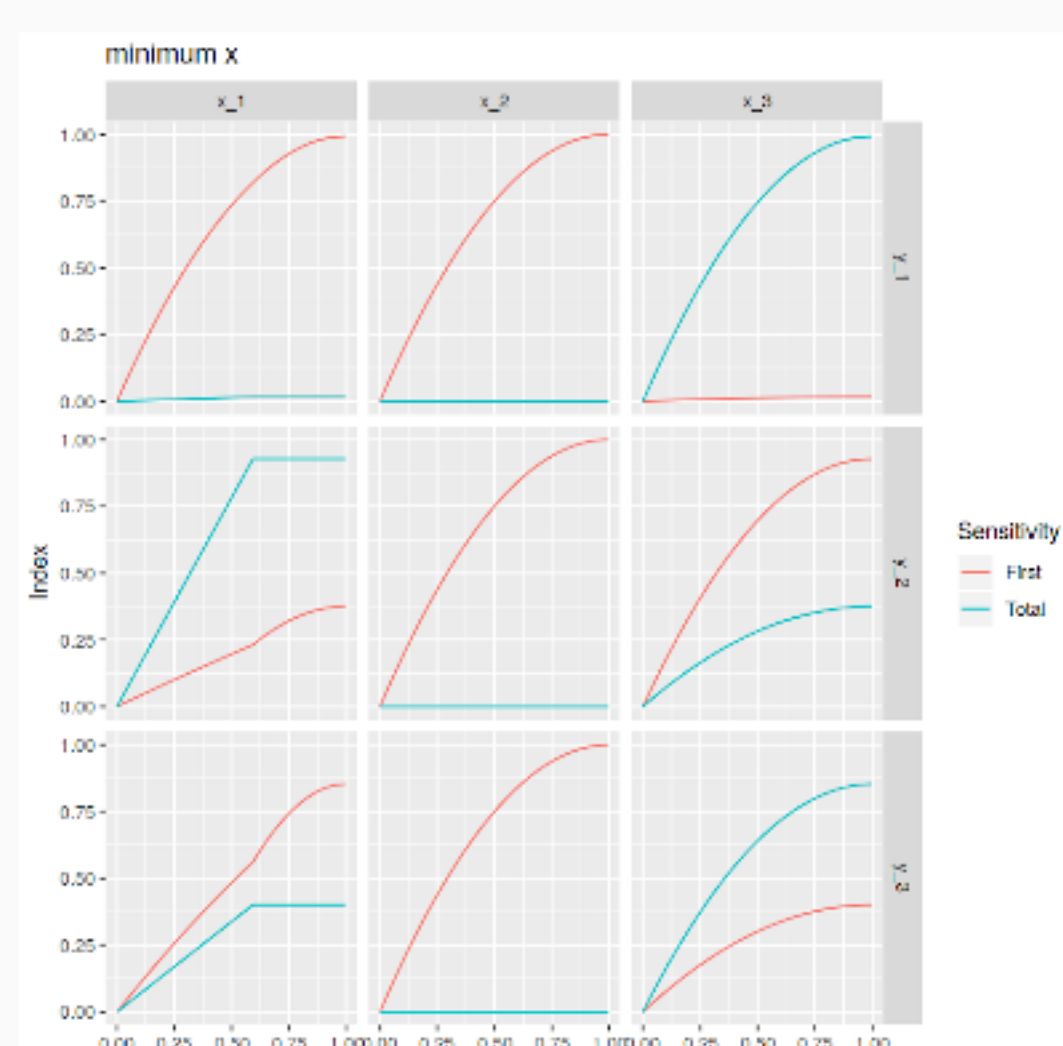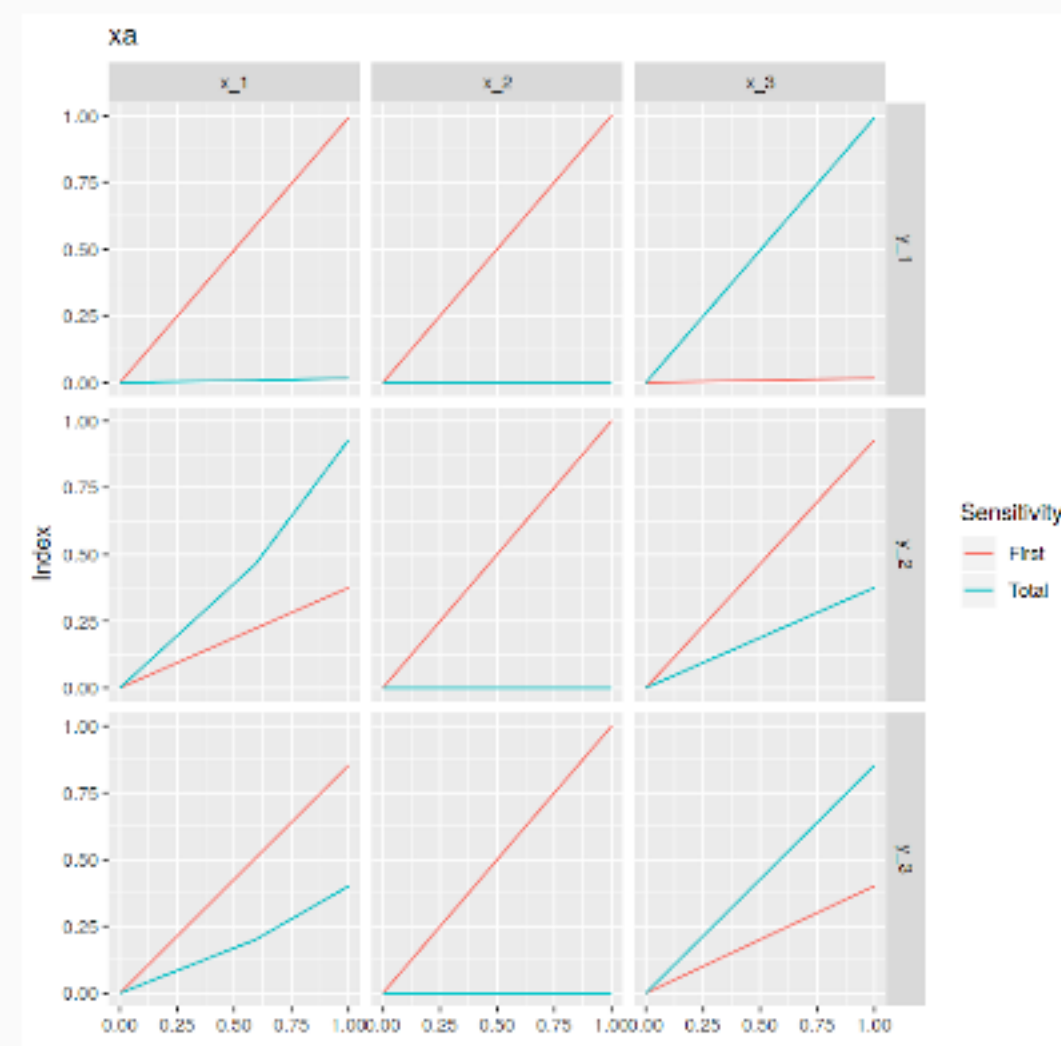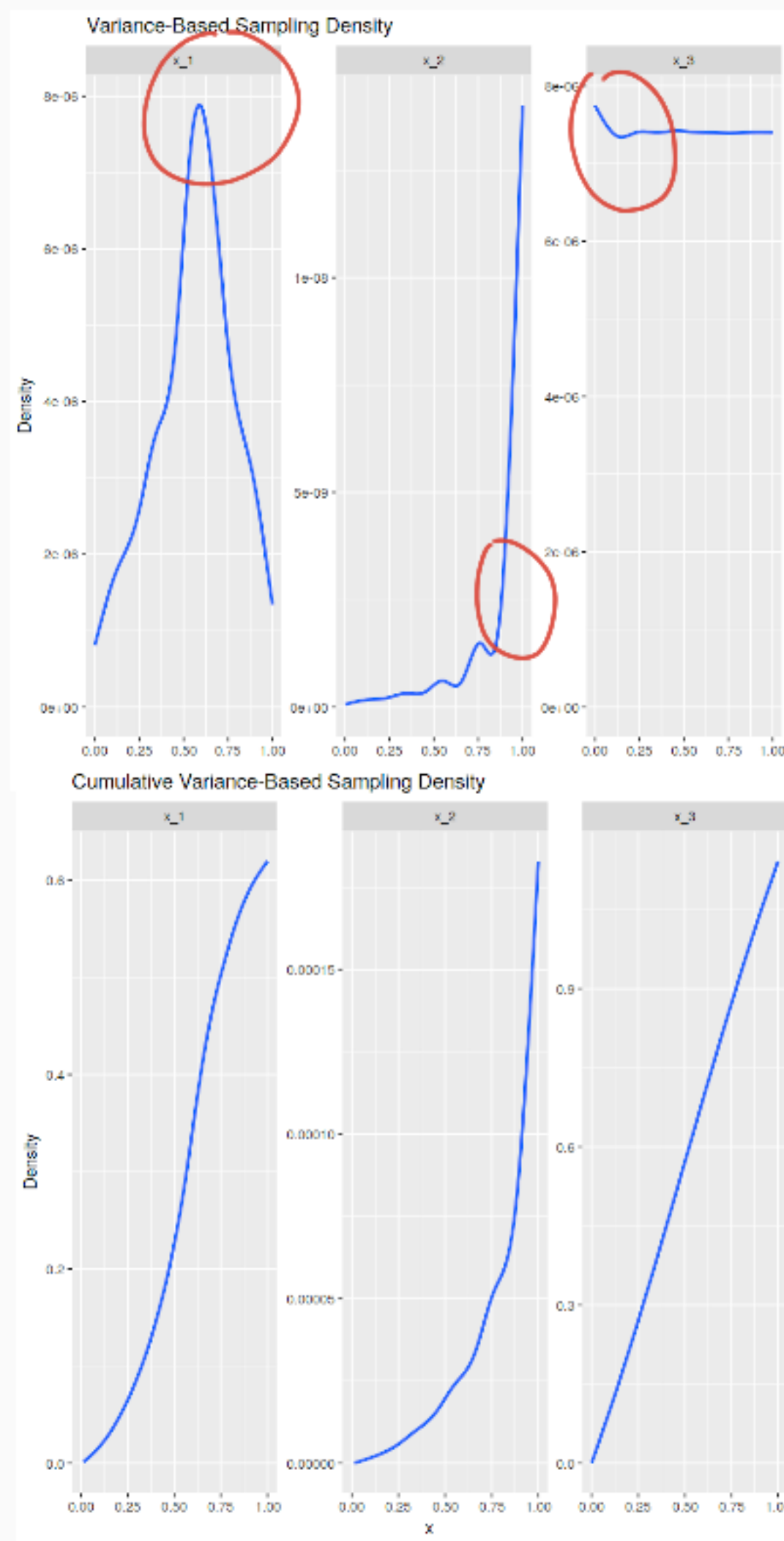$$v_{i,j}^{(\alpha)}(x) = \sum_{k=1}^{N} 1_{\min\left\{x_{A,i}^{(k)}, x_{B,i}^{(k)}\right\} \leq x \leq \max\left\{x_{A,i}^{(k)}, x_{B,i}^{(k)}\right\}} \frac{\left| y_{A,j}^{(k)} - y_{A_{B_i},j}^{(k)} \right|^{\alpha}}{\left| x_{A,i}^{(k)} - x_{B,i}^{(k)} \right|}$$

sampling:

$$w_{i,j}(x) = \sum_{k=1}^{N} 1_{\min\left\{x_{A,i}^{(k)}, x_{B,i}^{(k)}\right\} \leq x \leq \max\left\{x_{A,i}^{(k)}, x_{B,i}^{(k)}\right\}}$$

sensitivity density:

$$\rho_{i,j}^{(\alpha)}(x) = \frac{v_{i,j}^{(\alpha)}(x)}{w_{i,j}(x)}$$

The sole free parameter □ determines the intensity of the focus on areas of higher sensitivity. Setting □ = 2 corresponds to a variance-based sensitivity.

The sensitivity-density method has identified the discontinuities in the toy model: x_1 = 0.59 (order 0), x_2 = 0.95 (order 1), x_3 = 0.10 (order 2).

We use the sensitivity-density as the metric for further samples of the Sobol' sequence.