EFFECTS OF IMAGE QUALITY ON CRATER POPULATION STATISTICS;
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Many studies have attempted to define the size-dependent losses of craters as crater saturation is approached (see 1, 2, and reference therein). Those studies generally found the slope index (**A**) in a differential distribution

$$\text{Number of craters} = (\text{constant})\ (\text{Diameter})^{\mathbf{A}}$$

becomes less negative with increasing crater density because of a preferential loss of small craters. But unexamined factors such as the quality of the imagery and ability of the practitioner to recognize craters from fragmentary rim segments may also be important in changing the observed value of **A** from its production-function value. Furthermore, the validity of comparisons of crater populations may be jeopardized solely by differences in imagery-resolution limits.

The simplest case to examine is where the recognition of a crater rests solely on the percentage of its rim that is present; namely, if more than some critical percentage of the rim is present the crater is recognized and measured, if less than that critical percentage is present then the crater is missed. (The critical percent is assumed to be independent of crater size in this first study.) Recognition levels are most sensitive when crater densities are high and craters are badly battered.

The simulation maintained the proportion of the rim present for each crater as successive crater overlap degraded them. The results plotted in Figure 1 relate the mean slope of the crater population to the critical rim percentage necessary for crater recognition (solid lines). The slope is, indeed, likely to be a function of both image resolution and the ability of the practitioner to recognizing badly battered craters.

For an **A** of -2 (differential) large craters occupy more surface area than do small ones, and most small craters are either nearly totally preserved or totally obliterated. The change in slope index with changing critical rim percent is a result of the battered but preserved large craters. (The many small craters tend to peck away at the rims of large craters, badly degrading them, but only slowly totally removing them.) For an **A** of -3 or -4, progressively fewer large craters occur and small craters are frequently partially obliterated by other craters of like size. However, large craters are battered even more by the greater number of small craters, and the results mimic those of the -2 production function (although the detailed shape of the response curves clearly differ).

Mullins [3] proposed that the production function could be recovered even at saturation if craters were counted as fractions of craters, the value of the fraction being the proportion of the rim present. Figure 1 (dashed lines) also shows the results of using Mullins's method where a critical rim percentage enters into the data. Compared to the simpler method, Mullins's method does provide a better estimate of the

production slope when crater recognition is very good (as his theory presumed it would be), but if the quality of the images is poor and craters must be well preserved to be recognized, then Mullins's method provides no substantial improvement over the standard technique.

The findings of this study are of particular importance where crater populations are taken for comparison from images of varying quality. Specific instances are the comparison of Venus radar images with high-quality spacecraft images of the terrestrial planets, or comparison of low-resolution satellite images with higher-resolution images of other satellites in the same system. In such instances (assuming a densely cratered surfaces), the estimated slope indices on the low resolution images will always be more negative than if they had been derived from better-quality images.

REFERENCES:
1. Woronow, A. (1977), J. Geophys. Res., 82, 2447-2456.
2. Woronow, A. (1978), Icarus, 34, 76-88.
3. Mullins, W.W. (1976), Icarus, 29, 113-123.

Figure 1: As image quality is degraded, craters will have to be more nearly pristine in order to be measured. This will lead to an underestimate of the slope index of the population.