A discussion of "Improving seismic data quality by reprocessing and redesign of a 3D survey in an area of chaotically scattered source-generated noise" by Norman Cooper, Yajaira Herrera-Cooper, Eduardo Trinchero, Luis Vernengo, and Raúl Stolarza, CSEG Recorder, September 2017.

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It is interesting to see how the authors use an approach to survey design that is almost entirely different from my approach. In the original survey with unsatisfactory results the shot intervals are 50 x 350 m and the receiver intervals 50 x 250 m. As an alternative design the authors recommend either 48 x 240 m and 48 x 192 m or 42 x 168 m and 42 x 126 m for shot and receiver intervals, respectively. So, the improvements in their survey design are focussed on line intervals, and not on station intervals. They use super gathers to get an impression of the noise problem. However, such gathers are, unlike shot gathers, not suitable for quantitative analysis of the noise problem because these gathers are not a continuous subset of the 5D prestack wavefield.

In the following I make a few suggestions for more quantitative analyses that should benefit the quality of the final design. While doing so I assume that the authors' identification of the reason for the low-quality seismic is correct.

A first step in fighting noise is to get a thorough understanding of the properties of the noise. The problematic noise consists of diffracted energy from strong geophysical contrasts at the edges (and perhaps also internal discontinuities) of intrusions. Another problem is the blocking of energy by the basaltic layers, allowing only weak reflections from the underlying strata.

In areas with benign geology such as the plains in North America or the Gulf of San Jorge Basin the survey designer may get away with coarse station spacings of 50 m, although, even in those areas with subhorizontal geology, surprisingly better results may be achieved with much smaller station intervals. On the other hand, in areas with serious noise, it may be necessary to adapt sampling to the noise problem, so that the noise is optimally sampled for its removal. The authors state: "The 3D design focuses on proper sampling of the noise to improve signal to noise ratio." However, they confuse dense sampling with proper sampling. With sampling intervals of 42 m there is no domain in which the noise is properly sampled; the authors' focus is actually on increasing fold to improve noise reduction by stacking.

For a good choice of station intervals it would be necessary to have densely sampled shot gathers in which the steepness of the diffractions may be measured. Obviously, the existing data shown in Figure 1 of the paper are not sampled densely enough to make such measurements. The authors carried out data simulations based on geological knowledge of the area. If sampled densely enough, simulated shot records might be analysed (in *t-x*, or *f-k* domains) to get a reliable idea of the minimum apparent velocity V_{min} of the diffractions. Together with the desired maximum frequency f_{max} this leads with $\Delta x = V_{min} / 2 f_{max}$ directly to the desired station interval Δx. This sampling interval would be small enough to lead to nearly full suppression of the diffractions in prestack migration of offset-vector tile (OVT) gathers. An even better approach to analysing the noise problem would be to shoot some densely sampled shot records (noise spreads), or even cross-spreads, over areas with known noise problems. Such shot records would provide detailed and accurate information about the noise. They would also show the importance of ground roll.

OVT gathers are the means for singlefold prestack migration across the whole survey area. These gathers suffer from discontinuities at the tile edges leading to some migration artefacts; the discontinuities will be reduced by choosing smaller line intervals.

Thus, in my approach, I'd first choose a small enough station interval, followed by selecting the line intervals. For instance, if the minimum apparent velocity would be 3000 m/s and maximum desired frequency 75 Hz, I would select a sampling interval of 20 m. With a realistic model as used in the paper the effect of tile size (line intervals) on diffraction noise after prestack migration of OVT gathers might be established. Residual noise after prestack migration of properly sampled diffractions will be much less important than in case of coarsely sampled diffractions; hence, the noise problem would no longer require very small line intervals for satisfactory results. Yet, any reduction in line intervals will lead to some improvement of the end product and finally a compromise between quality and cost has to be found, as always.