# Predicting the Shape of Arbitrary 2-dimensional Drums

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For this project, random convex shapes were generated according to the efficient algorithm presented by Valtr (1995). Concave shapes were individually generated using a set of $n$ random cartesian products, centred around the origin, connected to their closest neighbours according to $\arctan\left(\frac{y}{x}\right)$. The dataset itself was formed around a Bernoulli distribution of these two algorithms. Given that the latter algorithm, used to create concave shapes, has a measurable probability of also returning a convex shape (Valtr, 1995), we can assume that the distribution of $n$ sided convex drums will be equivalent to

$$p_n = \frac{1}{2} + \frac{1}{2}\left(\frac{\binom{2n-2}{n-1}}{n!}\right)^2$$

where $n$ is determined by a uniform distribution ranging from 3 to _.

For the physical model itself, parameters were defined according to _. The variable $\lambda$ is used to represent the Courant number (Courant et al., 1967).

## References

Courant, R., Friedrichs, K., & Lewy, H. (1967). On the partial difference equations of mathematical physics. *IBM Journal of Research and Development*, *11*(2), 215–234.

Valtr, P. (1995). Probability that n random points are in convex position. *Discrete & Computational Geometry*, *13*(3), 637–643.