A review of the the field for assigning the footprints to a point set.

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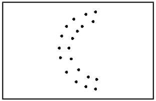
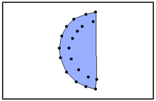
This review concerns itself with the field of attempting to achieve representational shape for a set of dots in a plane. Specifically it centres on algorithms that can display a *perceived* shape from the set.

Why

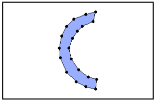
The need for a method to find the *perceived* shape is best explained by first looking at the most commonly used form of shape generation. Commonly the shape is found by finding the convex hull [1]. One of the first examples of this was in R.A. Jarvis' 1973 paper [2] in which the 'Jarvis March' or 'Gift-Wrapping Algorithm' was proposed. The issues inherent in the use of the convex hull relate to its inability to achieve the *perceived* shape Fig.1.



(a) Point set



(b) Convex Hull



(c) Likely Perceived Shape

Figure: When a convex hull is inappropriate

[1] *"A subset S of the plane is called convex if and only if for any points p, qϵS the line segment $\overline{pq}$ is completely contained in S. The convex hull $\mathcal{CH}(S)$ of a set S is the smallest convex set that contains S. To be more precise it is the intersection of all the convex sets that contain S."* 'Computational Geometry, Algorithms and Applications' Berg et al.

[2] On the identification of the convex hull of a finite set of points in the plane

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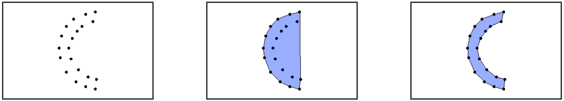

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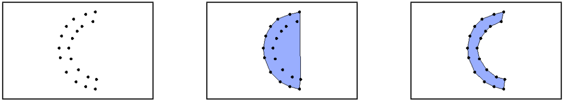

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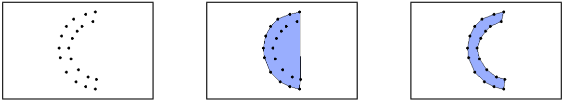

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Terms

Dots not points, **Footprints** not shape, concave hull (Moreira and Santos), χ-hull or non-convex etc...

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[2] On the identification of the convex hull of a finite set of points in the plane

Nearly all the papers present algorithms for the generation of the footprints with little reference to any real research into what makes a perceived shape perceivable. The only paper that focuses on this is Galton's 'Pareto-Optimality of Cognitively Preferred Polygonal Hulls for Dot Patterns' in which he aptly points out:

> *The evaluation of this behaviour [[3]] is typically very informal, often amounting to little more than observing that the shape produced by the algorithm is a 'good approximation' to the perceived shape of the dots. While lip-service is generally paid to the fact that there is no objective definition of such a 'perceived shape', little is said about how to verify this, or indeed, about exactly what it means.*

[3] The behaviour of the algorithm when used on various dot patterns.

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