NON-CONVEX TILES AND TILINGS

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Several classes of non-convex tiles derived from 2-dimensional projection of n-dimensional cubes are presented. Here n is any integer greater than two, and non-convexity is defined by the occurrence of at least one concave interior angle (>180^{o}) between two adjacent edges. All tiles shown here have equal edges and their interior angles are multiples of the central angle of a regular 2n-sided polygon. The tiles can also be seen as dissections of regular 2n-sided polygons. The classes shown here include singly-concave, doubly-concave and multiply-concave tiles. For each class an infinite number of tiles exist. The singly-concave tiles include crescent-shaped tiles, the doubly-concave tiles include bow-shaped and kite-shaped tiles. A special class of S-shaped tiles are also shown. The tiles fill the plane by themselves or in combination with other tiles derived from the same 2n-gon. The plane-filling arrangements are periodic or non-periodic and include tilings with a central symmetry. The matching rules for forced non-periodicity of non-convex tilings remain to be found. Randomly non-periodic tilings are shown as desirable examples from a designer's standpoint. The tilings can be converted to upright or inclined prisms which can be stacked periodically or non-periodically. Various design and architectural applications follow.

Some of the tilings illustrated here were first presented at Bielefeld Univ. in 1985, and some others have been developed since. The work of Lindgren (1972), Simonds (1978) and Hatch (1978) has come to author's attention via Grunbaum and Shephard's Tilings and Patterns (1987).