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Cuts for Parsing Visual Shapes
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Many researchers have proposed that, for the purpose of recognition, human vision parses shapes into component parts. Precisely how it does so is not yet known. Some help is given by the minima rule (Hoffman & Richards, 1984). For silhouettes, this rule defines points at which to parse. But it does not tell how to cut silhouettes using these parse points, and therefore does not tell what the parts actually are. that is the test of this paper. We develop a part-cut rule which, for arbitrary silhouettes, gives those cuts (i.e., straight line cuts) which divide the silhouette into the most natural parts. This rule derives from a functional which rates each candidate part cut based on the positions of its two endpoints. This rating depends on unary and binary factors. The unary factors are: (1) the arc-length distance of each endpoint from its nearest negative minimum, or positive maximum, of curvature, and (2) the strength of this extremum. The binary factors are: (1) the Euclidean distance between the two endpoints, (2) the local symmetry of the two endpoints, and (3) the prominence of the local symmetry axis passing between the two endpoints, and (4) the requirement that at least one of the endpoints have negative curvature. We discuss each factor, give it a scale-invariant definition, and provide visual examples. A companion paper (Seyranian, Singh & Hoffman, 1997) provides psychophysical tests of the theory.