

# 17,000 Years of Depicting the Junction of Two Smooth Shapes

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## **Background:**

European prehistoric cave art, dating back 17,000 years has, as its primary subject matter, large mammals. Viewpoint invariant or "nonaccidental" properties of simple parts, such as horns, expressed as variations of generalized cylinders (Binford 1971; Biederman 1987), are accurately depicted.



Examples of horn depictions in cave art from in Lascaux.

**Top:** Drawing of an animal with horns with a straight axis (Vialou 1992) (left) likely depicting an oryx (right).

**Bottom:** Drawing of an animal with horns with a curved axis (Clottes and Lewis-Williams 1996) (left), likely depicting a sable (right).

• In contrast to the nonaccidental aspects of depiction, the rendering of metric properties, such as aspect ratio and texture (e.g., a deer's antlers) are poorly represented.





• In 1982, Koenderink and van Doorn proved that another invariant must be present for articulated smooth surfaces: a V-shaped singularity of the occluding boundary, containing a T-junction and a contour termination.

• The singularity is due to a negatively curved area which serves to bound "object-like" convex or concave areas. The transversality-regularity (Hoffman and Richards 1984) performs a similar function in defining a basis of segmenting parts.

#### **Question:**

• What is the relative frequency in which our prehistoric brethren depicted this concave terminator?

• Is the incidence of this feature in drawings by contemporary individuals, with little or no formal education in depictive art, greater than the prehistoric rate?

#### Method:

• 215 instances of profile views of animals in which the front or hind legs or both were depicted as joining the body were examined in a collection of caveart photographs (Vialou et al 1992; Clottes and Lewis-Williams 1996; Bahn and Vertut 1997).

 $\bullet$  Ten raters judged whether the concave terminator was present, absent or ambiguous in each instance.

• 67 subjects were asked to make a realistic drawing of the rear half of a profile view of a horse.





**Top:** Lascaux art (Vialou 1992; Clottes and Lewis-Williams 1996) and

**Bottom:** Contemporary drawings.

The red arrows point to where the concave terminations should be and the black arrows point to the concave terminations

### **Results:**

· Subjects with minimal art training produced the concave

terminator at about the same relative frequency as cave artists.



• Regardless of whether or not subjects depicted the concave terminator, all reported that it made for a better drawing.

## **Conclusion:**

• Examination of drawings made in 2007 by those with minimal art training and cave artists 17,000 years ago show nearly equivalent tendencies to produce the concave terminators.

• Object concepts typically include a representation of the parts and their relations (Biederman 1987), not the space between the parts. Therefore it may be that without explicit disengagement of the figure-like parts within an object (possibly through training), depiction of this ground-like feature is often neglected.



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(From Hoffman & Richards, 1984)