

The Meeting of Territories (CROCODILE 04), The Unwritten Laws, 110 x 145 cm

Where a crocodile's skin splits as it grows, computed from the science of how its face takes shape.

The data

The data are the published science of how a crocodile's face forms. A study of Nile crocodiles (Milinkovitch et al. 2013, Science 339:78-81) found that the scales on the face and jaws are random plates that appear when the embryo's hard skin cracks as its jaws grow fast. Studies of cracking in drying layers (Goehring et al. 2010, Soft Matter 6:3562; Goehring 2013, Phil. Trans. R. Soc. A 371:20120353) show that a later crack meets an older one at a right angle.

The method

A computer grows the outline of a crocodile head step by step, faster along its length than across it. At each step, any piece of skin that has become too long along its main direction of stress cracks straight across, and the new crack stops where it meets an older one, so cracks meet in T shapes:

a piece cracks when $\ell / L_c > 1$ (ℓ = its length along the main stress, L_c = the critical length)

The critical length varies gently across the head. The whole simulated head ends with 237 cracks; this work shows the 56 plates at the tip of the jaw. An AI image model (OpenAI) then chose the colors on the fixed plates, and the print was rendered from the exact geometry.

What the checks found

A computer compared the finished painting with the computed pattern: 61/61 regions matched one to one, 153/153 adjacencies kept, with nothing added, and the light and dark of the image follow the pattern closely. Before any of this, the checking software was tried on 14 self-test images that were deliberately altered (plates moved, merged, added or mirrored), and it caught every one. The full technical record is available on request.

Sources & verification

Every plate in the finished image matches the geometry computed from the published model of cracking skin. All 61 regions of the pattern, the plates and the paper around them, are there, each in its place, and nothing was added. The checking software was first tried on deliberately broken copies and caught every one. The full record is available on request, so anyone can rerun the checks.

What the checks establish: every shape in the finished image matches the geometry computed from the data or the published model. They do not test the model against nature itself; that rests on the data and the published science named above.