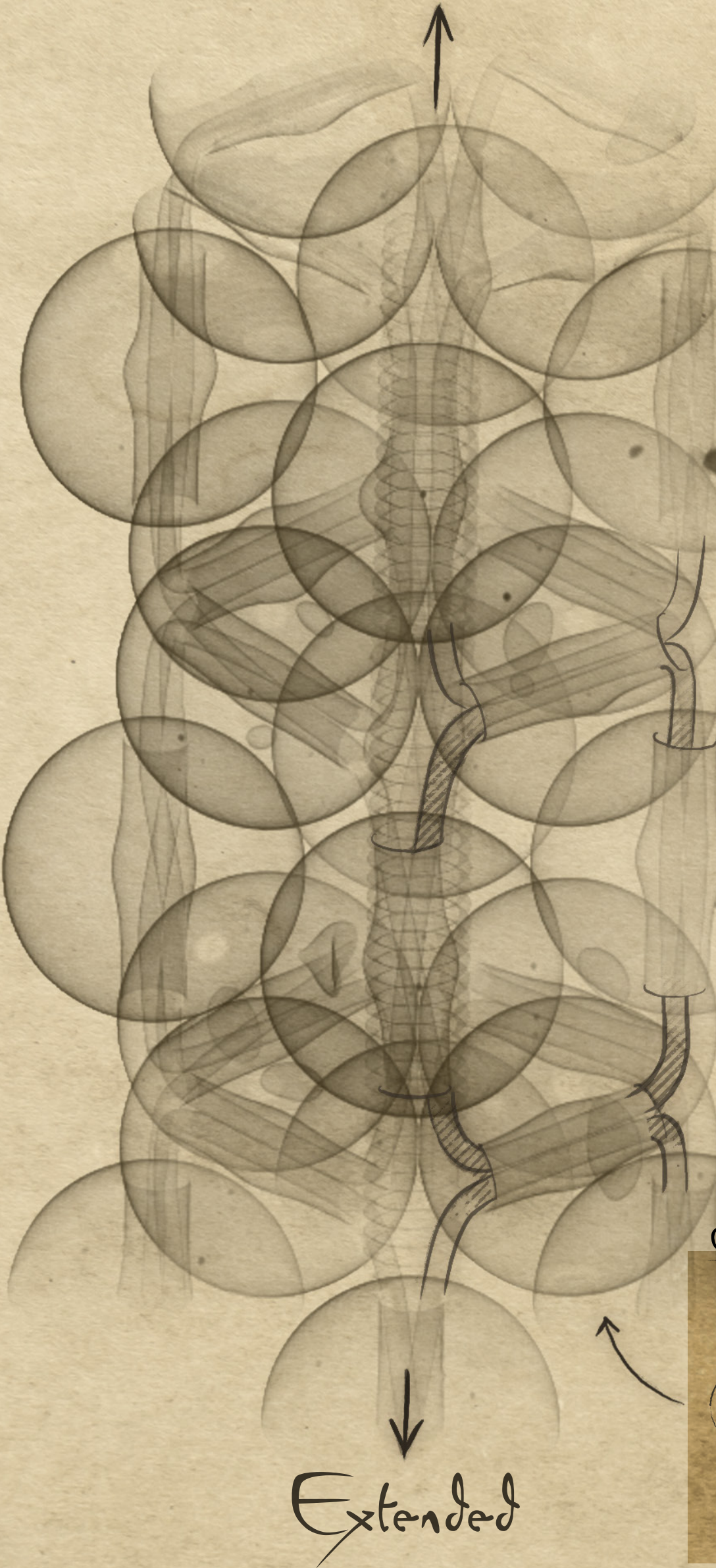
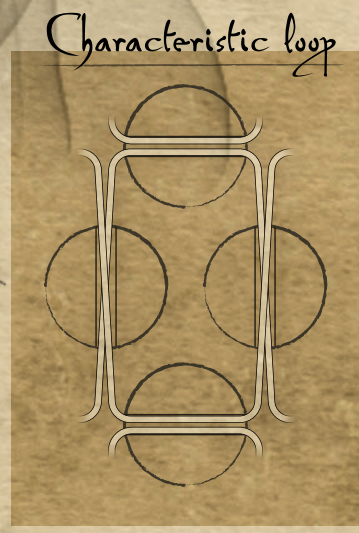


A new look at an ancient art: micro-computed tomography of a beaded column



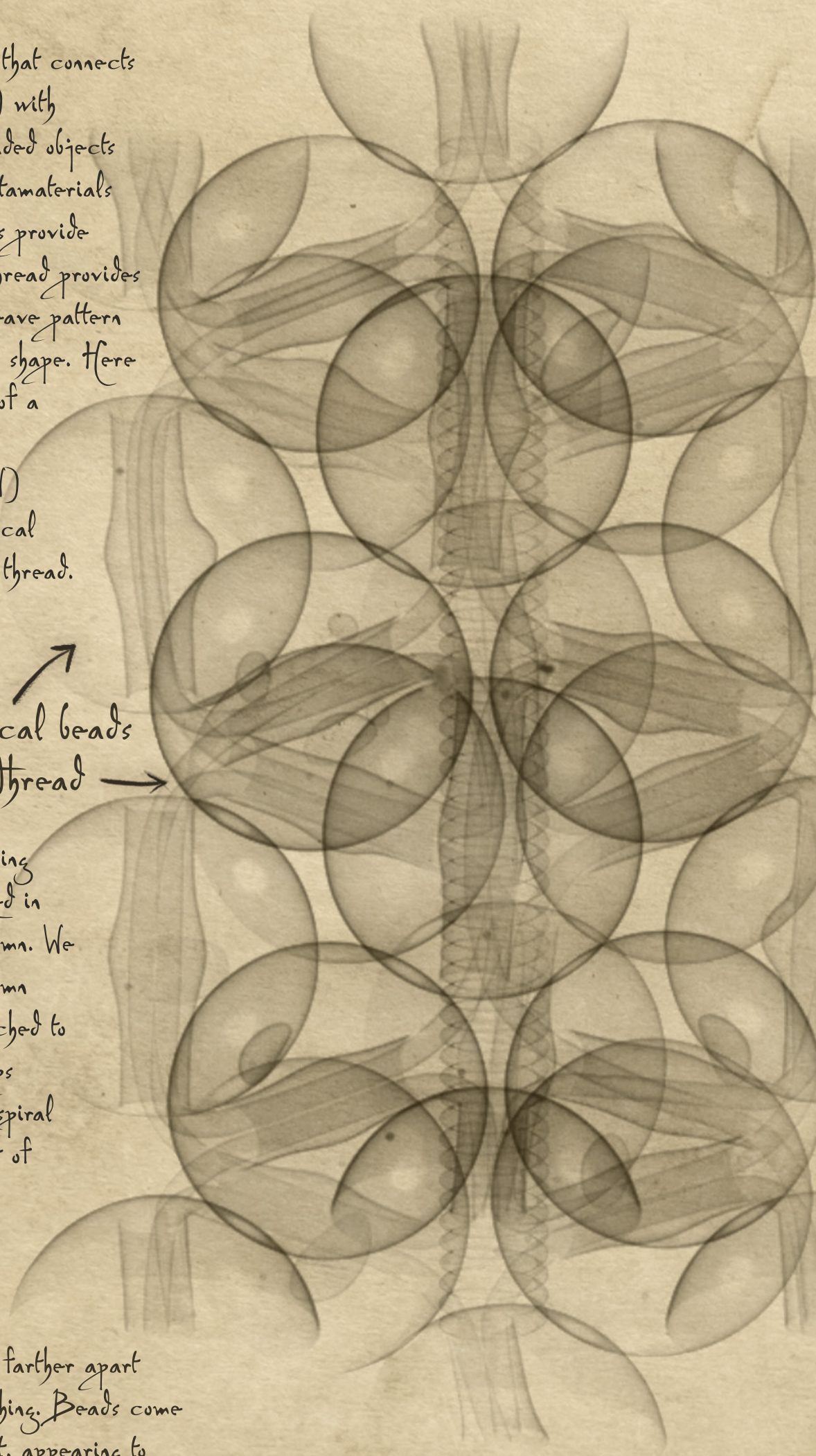
"Beading" is a textile technique that connects discrete, rigid elements (beads) with compliant thread. We study beaded objects as a class of mechanical metamaterials with unique properties: beads provide compressive strength, the thread provides tensile strength, and the weave pattern prescribes an ordered 3D shape. Here we show micro-CT scans of a column made with a "cubic right-angle weave" (C-RAW) stitch, using ready-made spherical acrylic beads and elastomeric thread.

The pattern consists of adjoining loops of 4 beads and is worked in the z-direction to form a column. We compress and stretch the column in-situ by moving clamps attached to the top and bottom. The clamps travel along a threaded rod (spiral structure), which is not part of bead assembly.



Moving ends farther apart causes stretching. Beads come out of contact, appearing to 'float' in the middle of stretched thread loops.

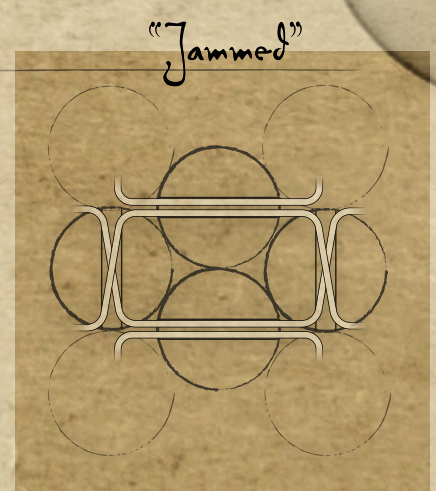
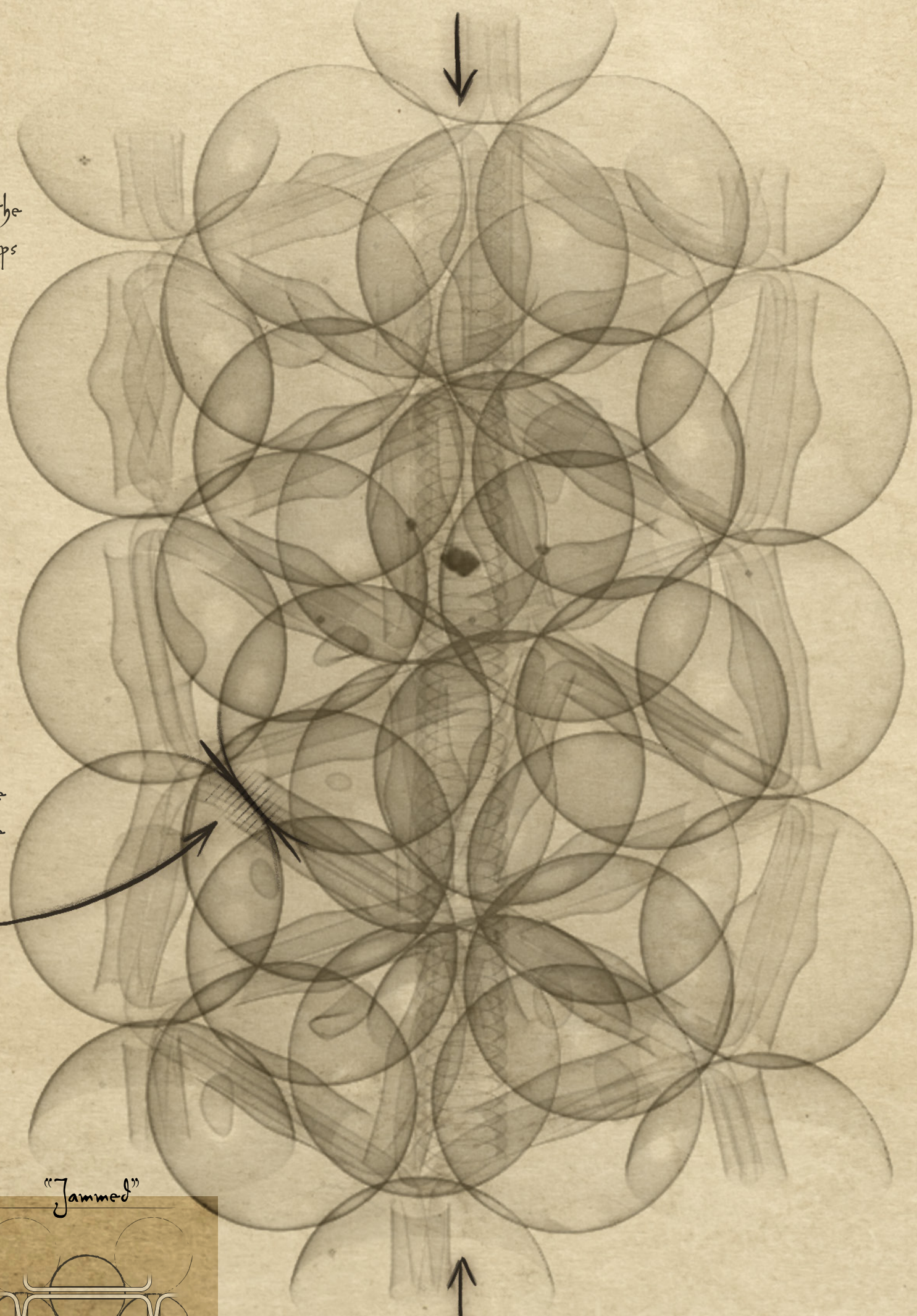
Spherical beads
Thread



The column relaxes in a neutral position where each bead touches four others per the weave topology and thread loops are minimally stressed.

10 mm

Under compression, the thread stretches and beads pack vertically. Jamming is possible in this conformation, where the column is able to withstand large forces despite the thread's inherent softness.



Neutral

Compressed