Supplementary Material
No evidence for active sparsification in the visual cortex

Pietro Berkes, Benjamin L. White, and Jozsef Fiser
Volen Center for Complex Systems
Brandeis University, Waltham, MA 02454

1 Experimental procedure

1.1 Ferrets electrophysiology

Neural activity was recorded from a linear array of 16 electrodes, spaced at 200 μm, and implanted in the primary visual cortex of the ferrets. Each electrode was a 12.5-mm-diameter tungsten wire with 2.5-mm H-ML insulation (California Fine Wire). The electrodes typically provided clear multi-unit signal on each channel with occasional single unit signal. Data acquisition was performed with custom-written Labview programs (National Instruments). Spike discrimination was done offline by manually setting a separate voltage threshold for each electrode. Stable recordings were maintained for 8–12 h. Recordings were initiated after 2–3 h of recovery from anesthesia, when the animal was fully alert. Heart rate was monitored and body temperature was maintained with a thermostatically controlled heating blanket. While the animal rested comfortably on a padded platform, the head was held in a fixed position with the use of a rigid metal post. The animal was free to make natural eye movements. A 4×3 foot stimulus screen, which was placed at a distance of 30 cm from the head, covered 130 by 100 degrees of visual angle. The trailer for the film *The Matrix* was used as the natural movie stimulus, and was presented at 24 Hz update rate and 720×480 pixels resolution.

1.2 Rats electrophysiology

Bundles of 16 nichrome/formvar microwires were chronically implanted into the primary visual cortex of adult Long-Evans rats. Placement of microwires was later confirmed by histological staining. The animals were allowed to recover from surgery, and were then placed on a water restriction protocol. Over the course of 3-5 weeks, animals were trained to tolerate restraint in a 8 by 4 by 6 inches plexiglass box. Neural signals were amplified, low-pass filtered (< 250 Hz removed), and recorded at 40 kHz sampling frequency using a Plexon recording system, Dallas, Texas. We also recorded local field potential (LFP) activity at 1 kHz.

All recordings were performed inside a sound- and light- attenuating box with flat black paint on the interior and a monitor set into one side. Isoflurane was delivered with oxygen under pressure through a clear plastic mask covering the rat's nose and mouth. Rats were anesthetized at four different levels, called "very light", "light", "medium", and "deep". Rats were stabilized for at least 15 minutes at each concentration before recording. Respiration rate, reflex response, peripheral oxygen concentration, and LFP patterns were monitored to ensure the proper level of anesthesia for each recording condition, and body temperature was maintained between 36.5 and 37.5 C. The very light level of anesthesia was just enough to keep the rats from moving, where the breathing rate was typically above 60 b/min, the reflex response was very strong, and LFPs were constant and had large energy in higher frequency bands. In the deep level, LFPs were mostly silent, with occasional large bursts, breathing was slower ($\tilde{4}3$ b/min) , and there was no reflex response. Each level of anesthesia was confirmed by the physiological parameters as well as the level of activity and

burstiness of the LFPs. Data was not recorded if the level of anesthesia was unstable or overlapped with the physiological values of different anesthesia levels.

Since tolerance to anesthesia varies somewhat across rats, actual concentrations of anesthesia varied slightly (up to 0.3% isoflurane) between rats at the same physiological anesthesia level. Across different anesthetic levels and rats, concentrations of isoflurane were as low as 0.6% for the very light state to up to 2.0% for the deep state. Each stimulus condition within each session was recorded for 2-3 minutes. All recording sessions lasted for less than 2 hours. Rats were allowed to wake up and recover from anesthesia for over two hours between recording sessions, and a maximum of two recording sessions were performed per day. Animal use procedures were approved by the Animal Care and Use Committee at Brandeis University.

We recorded from 39 mostly multi-units in 3 rats. Units were sorted offline using *Offline Sorter* software by Plexon. Stimuli were presented on a 17 inches LCD monitor set into the wall of the recording box, 6 inches in front of the rat's eyes. Recordings were made in two conditions: a control condition, where the animals were presented with a full screen white-black flashing modulation at 3.75 Hz, and a movie condition. The movie was a video containing forest scenes recorded from a camera head-mounted on a person walking. It was presented at 24 frames/sec, at a resolution of 1280 x 1024 pixels.