Primary sensory cortices are anatomically organized according to physical distance

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Primary sensory areas are considered the inputs of cortical circuits. Primary somatosensory cortex (S1), which receives signals pertaining to tactile sensation, divides the frontal lobe from the parietal lobe. That is, sensations from the surface of the skin, which physically divides what is internal versus external to our bodies, also divides the cerebral cortex into front and back. Anterior to S1, we find senses reflecting what is substantially inside the body: cortical inputs for taste at the anterior insula/frontal operculum reflect what is going into the mouth/digestive system, and cortical inputs for smell at the medial temporal lobe reflect what is going into the nose/respiratory system. The reality of this physical proximity is tied to emotional significance: what you eat and inhale can potentially cause death because it is already physically inside the system. Posterior to S1, the senses in the back of the brain reflect what is conceived as further out in physical space: inputs for hearing at the posterior lateral sulcus include sound sources up to kilometers away (e.g. storms), inputs for sight in the medial occipital lobe include objects that are the most distant detectable by the sensory mechanisms, up to light years away (i.e., stars). Unlike smell, taste, and touch, sights and sounds are not lethal unless the source becomes proximal enough to make tactile contact. In this sense, the sensory cortices are anatomically organized in a way that reflects our conception of a physical internal/external spatial continuum, such that as we move more posterior in the brain, we find sensory domains that attend further out in physical space. This physical proximity also reflects a gradient of emotional significance for the sensory domains. Overall, this framework suggests physical space is an organizing principal for both conscious experience and brain anatomy.

Sense	Max physical distance	Anatomical location
Visual	Light years	Occipital lobe
Auditory	Kilometers	Posterior temporal lobe
Tactile	On body's surface	Anterior parietal lobe
Taste	In digestive system	Anterior insula
Smell	In respiratory system	Anterior temporal lobe

Figure 1. The physical range of the five major sensory domains corresponds to the anterior-posterior anatomical positioning of the primary sensory cortices. Note that only the tactile sense is on the lateral surface, the other primary areas are more medial. This illustration is meant to highlight the anterior-posterior positioning only.