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Morland, A.B., Brown, H.D.H. orcid.org/0000-0001-5128-9172 and Baseler, H.A. (2021) Cortical Reorganization: Reallocated Responses without Rewiring. Current Biology, 31 (2). R76-R78. ISSN 0960-9822

https://doi.org/10.1016/j.cub.2020.11.003

sweet or bitter substances. In effect, evidence showing the functionality of hotspots will need to be reconciled with accumulating evidence of sparse and distributed representation of taste stimuli in the cortex. Additionally, one must keep in mind that calcium signals are not spikes, only reflections of cellular activity. Because of the poor temporal resolution of this imaging technique, the issue of the contribution of firing dynamics to the neural code for taste is left out of the picture.

Chen *et al.*'s[3] results offer further and intriguing insight into the adaptive potential and multimodal sensitivity of cells in gustatory cortex. Historically, the literature contains several testaments to the fact that some gustatory cortical cells also respond to somatosensory, thermal, auditory and olfactory stimuli[12]. Chen *et al.*[3] extend these results to show that these multimodal responses are coupled to taste responses and are also widely distributed across the cortex. By presenting taste stimuli that were preceded by an auditory cue, their results revealed a rich array of responses to the cue, to lick initiation and to the tastant, as well as to various combinations of these stimuli. These data in particular underscore both the multimodal nature of gustatory cortex but also its ability to adapt to experience.

In conclusion, while the debate over whether neurons responding to the various taste qualities are clustered or scattered in the gustatory cortex remains lively, results reported by Chen *et al.*[3] offer fresh insights into this issue. By extending their inquiry to alert subjects and by using widefield calcium imaging, their data revealed that the pattern of neural representation of taste quality in gustatory cortex is distributed rather than topographically segregated, consisting of both narrowly and broadly tuned cells. Moreover, by using a behavioral paradigm that fostered expectation, Chen *et al.*[3] also documented the seamless integration of multimodal and adaptive responsiveness into the fabric of taste representation.

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Cortical Reorganization: Reallocated Responses without Rewiring

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https://doi.org/10.1016/j.cub.2020.11.003

Is the brain able to reorganise following loss of sensory input? New work on individuals with sight loss shows that, while brain areas normally allocated to vision respond to other sensory stimuli, those responses are unlikely to mean the brain has rewired.

Ask someone in the street about the capacity of the adult brain to take on a new processing role in the light of disease or damage and you will get an answer that would lead you to believe that the human brain is almost infinitely flexible. Careful scientific evaluation of the brain's plastic characteristics leads to a far more complex picture, however. A well-constrained way to address the question is to examine how the sensory areas of the brain change following the partial removal of the inputs they systematically map. Amputating a finger of an adult monkey, for example, resulted in the representation of the remaining fingers in the somatosensory cortex expanding into the neighbouring region that originally represented the removed finger[1]. Research has shown analogous remapping of the visual cortex following lesioning of the retina[2,3]; however, these findings were later questioned by some[4], while others have argued that even more remarkable reorganization of visual processing occurs in humans[5]. A paper by Masuda *et al.*[6] in this issue of *Current Biology* examines how signals in deprived parts of the visual cortex can arise and in so doing shows that the visual cortex does not undergo large scale remapping when individuals have lost their central vision.

Sensory brain areas largely share a common feature — they map the peripheral sense organ systematically. In somatosensory cortex, therefore, there is a map of the body, while in visual cortex there is a map of the retina. Removing input from the cortical maps can result in shifts within them to give more territory to the sensory inputs that remain[1]. In the body of work on the macaque visual cortex the shifts observed, while relatively modest, were linked to axonal sprouting[7]. It has been put forward that such reorganization of the brain could explain the phenomenon whereby individuals who lost vision as a result of retinal disease ‘fill in’ their regions of blindness[3].

When functional magnetic resonance imaging (fMRI) made examining the visual cortical map in living humans possible, the question of whether visual cortex remaps inputs that remain after visual loss resulting from retinal disease could be answered. The first study of a patient with loss of central vision due to macular degeneration found no evidence of a reallocation of the visual cortex to the vision that remained[8]. Later work showed that the area of the visual cortex that remained responsive after retinal lesions also caused by macular degeneration was entirely consistent with a stable and not plastic representation[9]. Moreover, when the issue of remapping was revisited in monkeys with both the electrophysiological techniques used in earlier studies and the fMRI studies that can be applied to humans, the results provided no evidence of reorganization of visual cortex[4].

At odds with the findings that visual cortex did not undergo a large scale remapping were contemporaneous studies which showed that when visual stimuli were presented to intact peripheral locations of the retina, the cortical representation of the diseased retina responded robustly in some, but not all, patients similarly affected by retinal disease[5]. The methodology differed from previous studies, however, by using images of faces, other objects and their scrambled counterparts as stimuli, and patients were asked to make a response if the same image was presented in succession (the one-back task). Multiple possible explanations of the result were proposed, including a large-scale reorganization of the cortex, much bigger than those observed in the previous work on animal models, and/or feedback from higher order visual areas of the brain to primary visual cortex[5].

The latter, feedback hypothesis was supported by a subsequent study[10] performed by some of the authors of the new Masuda *et al.*[6] paper. They used a variety of stimuli, including more realistic objects, and had patients view them while doing the task and while simply viewing passively. The results were clear: responses from the regions of the brain that would normally represent areas of lesioned retina only responded when patients were actively engaged in the task.

Masuda *et al.*[6] addressed a fundamental question — are the responses in representations of lesioned retina present only during visual stimulation or can they be detected during stimulation of other senses? The question has significant theoretical importance because, if responses are found in the absence of any visual stimulation, they largely rule out remapping retinal inputs to visual cortex and instead very much favour feedback as the source of responses in representations of lesioned retina. The authors presented individuals with loss of central vision and controls with tactile and auditory stimuli with and without the task. The results were again clear: responses from the representations of lesioned retina were present only during the task for both tactile and auditory stimuli, while responses from similar locations were uniformly absent in controls.

The experiments were first performed with participants’ eyes closed, but the authors followed up with further experiments with participants’ eyes open. As a result, responses were diminished, indicating that input to the visual cortex is sufficient to reduce, in patients, and remove, in controls, modality-independent task-related responses. Taken together the results effectively rule out the possibility of a large-scale rewiring of the primary visual cortex, perhaps through an enlarged version of the lateral spread of axonal connections described in animal models[7].

A far more likely explanation of the results comes from the existing interconnectivity of the brain. It has been shown, for example, that even in control participants, who were artificially deprived of vision for five days, there were responses to tactile stimuli in visual cortex, presumably arising from the upregulation of existing connections rather than establishing new ones[11]. What connections are there that could generate modality independent task-related responses in primary visual cortex? Masuda *et al.*[6] point us to the frontal eye fields, which they show exhibit task-related responses and others have shown influence responses in primary visual cortex[12]. An alternative source of feedback could come from extrastriate areas, which have been shown to not only represent visual information but also capture information from other sensory modalities[13]. This seems less likely, however, in the present study as extrastriate responses themselves were frequently smaller than those detected in primary visual cortex[5].

The work of Masuda *et al.*[6] shows that we must exhibit caution when interpreting brain responses that arise in one group of individuals whose sensory function is compromised and not in another with intact sensory function. The specific caution is that, while it is tempting to conclude that the human brain is capable of large-scale rewiring, it is essential that the existing wiring properties of the brain are excluded as explanation of the results before doing so[14]. In the study of Masuda *et al.*[6], and likely others too[4,15], it is the normal organization of the brain rather than its reorganization that provides the more likely explanation of the results.

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Plant Camouflage: Fade to Grey

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https://doi.org/10.1016/j.cub.2020.11.061

A new study finds that human collecting may have driven the evolution of background-matching camouflage in an alpine medicinal plant.

Online computer gaming experiments are opening up novel approaches to understanding evolution and complex interspecies relationships. One source of complex relationships is visual ecology where the seeing capabilities of an observer may directly influence the colour or patterns of another species[1]. Take for example camouflage, which has been studied for a century[2,3]. An animal that closely resembles its background manipulates the visual sensory system of the observer in such a way that it can no longer detect the camouflaged organism as a potential target[4,5]. This ‘background matching’ strategy is the most widely studied mechanism for camouflage in animals with evidence from cephalopods[6] to lizards[7]. Animal coloration may alternatively enhance signal processing when a species needs to be highly visible, as in the context of sexual displays of birds[8]. Despite progress in our understanding of visual ecology principles[9], the potential effects of humans on the biological adaptation of other species can be challenging as there are potentially many confounding factors in our complex societies, and the time frames for data observations may require many generations. With the introduction of industrialised society, steam train soot on trees resulted in peppered moths with darker coloration having better camouflage, which reduced bird predation compared with lighter coloured moths, providing strong evidence of Darwinian natural selection processes operating over a relatively short time frame[10,11]. In a new study in this issue of *Current Biology*, Yang Niu, Martin Stevens and Hang Sun[12] show how human harvesting may have driven the evolution of camouflage in a plant.

Niu and colleagues[12] use a variety of innovative approaches, paired with records of Chinese herb collecting traditions, to tackle how human visual behaviour might directly influence evolutionary processes. The plant they study, the alpine herb *Fritillaria delavayi*,