Abstractions

FIRST AUTHOR

That humans use visual information in processing speech is well known, as is the fact that people produce tiny puffs of air when making certain speech sounds. But until now nobody had succeeded in determining whether listeners use the tactile information produced by those puffs in speech perception. Now, phonetician Bryan Gick and his colleague Donald Derrick at the University of British Columbia in Vancouver, Canada, have shown that humans do combine tactile information with auditory information to help them perceive human speech (see page 502). Gick tells *Nature* more.

What inspired your study?

For the past 30 years or so, tight coupling has been assumed to exist between what people see and hear because of shared experience between these two senses. If there's a discrepancy, most people go with what the eyes perceive, because the eyes usually are a more reliable source than the ears. However, many in the field suspected that there might be a looser coupling between what people feel and what they hear. We wanted to find out whether a listener could integrate tactile information to help them hear.

Why did you use puffs of air as the tactile input?

We wanted to test whether a listener would use their tactile sense without being aware of it. When you make certain speech sounds in English, such as 'pa', you release a puff of air. When you say 'ba', you don't. The question was, if a listener were to hear someone saying 'ba' but was also touched by a puff of air — so lightly that they were not conscious of it — would their brain trick them into thinking they had heard 'pa'?

How did you generate the air puffs?

We started out with a pilot test, using a turkey baster to produce puffs of air. For the main experiment, we used a standard air compressor and tubing to deliver air puffs with about half the amount of pressure produced in regular speech, so that a lot of volunteers weren't consciously aware of any air puffs at all. Even in the initial pilot, which wasn't very accurate, we saw evidence of auditory override. This is indicative of the robustness of the tactile effect.

Why is this finding important?

Instead of the conventional model, which states that we perceive sound with our ears and eyes alone, we now have a model based on the integration of several senses. The implication is that we're able to take any information that our body s receives from any sense and use it to tell us what's going on in the world. ■

MAKING THE PAPER

Josef Penninger

Protein involved in bone breakdown helps regulate body temperature.

One of the unwelcome effects of menopause is loss of bone density, or osteoporosis, which also affects patients with HIV and is a side effect of treatments for diseases such as prostate cancer and leukaemia. The protein RANKL, discovered only 12 years ago, quickly became a target for treatments against osteoporosis because it was shown to be a key regulator of bone physiology. In August, two phase III clinical trials showed that a therapy directed against RANKL reduced bone fractures in postmenopausal women and in men with prostate cancer[1,2].

Work leading up to these trials included research by Josef Penninger, a functional geneticist and the founding scientific director of the Institute of Molecular Biotechnology of the Austrian Academy of Sciences in Vienna. His group was the first to demonstrate *in vivo* that RANKL stimulates the development of cells called osteoclasts, which break down bone tissue[3]. But RANKL and its receptor RANK are also produced in the central nervous system, where their functions were unknown. "It was a complete black box," says Penninger. On page 505, his group reports the surprising finding that, in the brain, RANKL is a key regulator of body temperature.

This more recent work had its origins in what Penninger admits was something of a fishing expedition. Shortly after joining Penninger's lab in 2005, postdoc Reiko Hanada proposed injecting RANKL into the brains of rats, "to see what would happen". What happened was that the rats became inactive and they became hot to the touch. The scientists realized that the animals were suffering from a severe fever.

To investigate this puzzling response, Hanada, Penninger and their colleagues had to study thermoregulation in rodents. This complex homeostatic mechanism incorporates information from a range of inputs, and is tuned to account for factors such as normal fluctuations in body temperature that occur when, for example, an animal's activity level changes. The authors also had to engineer ways to knock out expression of the *Rankl* gene selectively in neurons and astrocytes — the brain's two main cell types.

"We had to be really thorough, because this was so entirely new. And if you come up with something really novel, you'd better do your controls — as many as possible," Penninger says with a laugh. "This paper probably breaks my record — 26 supplemental figures."

Their experiments slowly revealed a pathway in the brain that starts with proinflammatory molecules called cytokines turning on RANKL. The same cytokines also activate RANKL in bone cells, but when the protein binds to its receptor in astrocytes in the central region of the brain, it initiates a protein cascade involving cyclooxygenase-2 and prostaglandin E2 to generate a fever response.

The ability to delve into such uncharted research waters fits in with his institute's philosophy, Penninger says. "Our vision is to hire great people with interesting ideas and provide them with a candy store of facilities where they can just jump around from technology to technology, to allow them to play with an idea." ■

1. S. R. Cummings *et al. N. Engl. J. Med.* **361,** 756-765 (2009).
2. M. R. Smith *et al. N. Engl. J. Med.* **361,** 745-755 (2009).
3. Y.-Y. Kong *et al. Nature* **397,** 315-323 (1999).

FROM THE BLOGOSPHERE

In the ninth instalment of "The Scientific Tourist in London", Matt Brown explores the London School of Hygiene and Tropical Medicine (http://network.nature.com/hubs/london/blog/2009/11/12/the-scientific-tourist-in-london-9-famous-men-of-public-health). Built in 1926, the building's art deco elegance "has been tastefully matched with a modern atrium and theatre complex", writes Brown.

He is particularly impressed with the details on the building's exterior. "The most striking features are the golden representations of animals that adorn the window balconies. Each one is a disease vector, such as the mosquito and flea."

The building is also decorated by a frieze that "sports the names of 23 eminent names in the field of public health," writes Brown, pointing out that none of them is a woman. The guide to the frieze notes that Florence Nightingale was short-listed, but that her surname proved too long — even though the designers managed to squeeze in Max von Pettenkofer.

Other installments of Brown's series describe scientific landmarks such as the Edmond Halley Memorial and Robert Hooke's grave. ■

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