er traits that improve overall fitness by a possible instance of genetic covariation.

But covariation is not the only genetic mechanism that can lead to the evolutionary preservation of seemingly maladaptive or nonoptimal traits. For example, a particular trait (or associated genes) may serve multiple functions and may maximize overall fitness without maximizing fitness on any single function. We refer to this as the "Handy-Dandy" evolutionary mechanism, by analogy to the celebrated Handy-Dandy kitchen device, without which no kitchen is complete. The Handy-Dandy slices, dices, and peels, plus opens cans and bottles. It thus performs multiple functions, although none, one might argue, especially well. The value of the device lies in the combined utility of its various functions. So long as this utility is sufficiently great, the device remains useful, even if it loses some of its original functions (for example, in time, the can-opener might break).

Similarly, a trait that subserves multiple functions need not be optimal on any one function to permit the trait to persist in the face of natural selection pressures. Indeed, it might serve some functions quite poorly, with a negligible or even adverse effect on reproductive fitness. Long mating calls, which appear to be of limited survival value, may represent but one of several Handy-Dandy functions that combine to enhance overall fitness. The solution to many evolutionary anomalies requires acknowledging the complexities of genetic interactions. The Handy-Dandy model provides an intuitive framework for examining the nature of such interactions.

Paul R. Abramson
Department of Psychology, University of California, Los Angeles, CA 90095–1563, USA. E-mail: abramson@psych.ucla.edu

Steven D. Pinkerton
Center for AIDS Intervention Research, Medical College of Wisconsin, 1249 North Franklin Place, Milwaukee, WI 53202, USA. E-mail: pinkrton@mcw.edu

Response

We agree with Abramson and Pinkerton's assessment of the evolutionary implications of a common genetic basis for distinct traits or of a single trait with multiple "functions." Nonetheless, their "Handy-Dandy" evolutionary mechanism is, in our opinion, just a new label for the venerable concepts of indirect selection and trade-offs among fitness components. When traits are genetically correlated by means of pleiotropy (a common genetic basis) or linkage disequilibrium (nonindependence of loci within a genome or population), selection acting directly on one trait will also act indirectly on the correlated trait (*1*). Thus, a trait can evolve or be maintained in a population not because it is valuable in itself, but because of its genetic association with a beneficial trait.

Furthermore, fitness—the ultimate target of selection—has many components, including growth, survival, and reproduction. A single trait may have opposite effects on different fitness components, so that optimizing total fitness is unlikely to maximize any one component of fitness [see (2) for a review].

Allison M. Welch
Raymond D. Semlitsch
H. Carl Gerhardt
Division of Biological Sciences, University of Missouri, Columbia MO 65211, USA. E-mail: awelch@biosci.mbp.missouri.edu

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Proprioception and the McGurk Effect

The report "Sensorimotor adaptation in speech production" by J. F. Houde and M. I. Jordan (20 Feb., p. 1213) demonstrates

that people adjust their speech production to compensate for acoustic feedback alteration. The fact that most of the study volunteers compensated incompletely for the acoustic changes, taken together with the fact that the volunteers were unaware that feedback was being altered, indicates a significant discovery not mentioned in the original report: a "proprioceptive McGurk effect" on the perception of one's own speech.

The well-known McGurk effect is the phenomenon of altered phonetic perception induced by the simultaneous experience of conflicting auditory and visual information (*1*). For example, hearing "ba" while viewing the mouth of a speaker saying "ga" causes one to perceive "da." Houde and Jordan's experiment illustrates an analogous effect in which the conflicting information is not visual, but proprioceptive. For example, in the condition in which the sound [e] was shifted toward [i], a volunteer intending to say "pep" produced an utterance similar to "pap" and received acoustic feedback approximating "pip," but nevertheless perceived "pep." The articulatory proprioceptive feedback was inconsistent with the auditory feedback, and a percept intermediate (in F1, F2 formant space) between the two types of feedback resulted.

While the McGurk effect has been a widely used tool in investigating multimodal integration processes, it has heretofore been limited to the interaction between visual and auditory modalities. The real-time acoustic feedback alteration paradigm of Houde and Jordan expands this useful tool to the proprioceptive modality.

Jay Moody*
Department of Cognitive Science, University of California, San Diego, La Jolla, CA 92093–0515, USA

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*Currently visiting the Vocal Tract Visualization Laboratory, Division of Otolaryngology, University of Maryland Medical School, 16 South Eutaw Street, Room 531, Baltimore, MD 21201–1593, USA. E-mail: jmoody@spring.ab.umd.edu

CORRECTIONS AND CLARIFICATIONS

In the Research Article "Overview and initial results of the Very Long Baseline Interferometry Space Observatory Programme" by H. Hirabayashi *et al.* (18 Sept., p. 1825), the correction factors for non-Gaussian brightness profiles, given as 0.43 and 0.36, respectively, in the second sentence of the third column of page 1827, were a factor of 1.56 smaller than they should have been. The correct factors are 0.67 and 0.57, respectively.