

[HOME](#) > [SCIENCE](#) > [VOL. 323, NO. 5920](#) > THE ROLE OF FINGERPRINTS IN THE CODING OF TACTILE INFORMATION PROBED WITH A BIOMIMETIC SENSOR

 **REPORTS**



The Role of Fingerprints in the Coding of Tactile Information Probed with a Biomimetic Sensor

J. SCHEIBERT, S. LEURENT, A. PREVOST, AND G. DEBRÉGEAS [Authors Info & Affiliations](#)

SCIENCE 13 Mar 2009 Vol 323, Issue 5920 pp. 1503-1506 [DOI:10.1126/science.1166467](#)



Abstract

In humans, the tactile perception of fine textures (spatial scale <200 micrometers) is mediated by skin vibrations generated as the finger scans the surface. To establish the relationship between texture characteristics and subcutaneous vibrations, a biomimetic tactile sensor has been designed whose dimensions match those of the fingertip. When the sensor surface is patterned with parallel ridges mimicking the fingerprints, the spectrum of vibrations elicited by randomly textured substrates is dominated by one frequency set by the ratio of the scanning speed to the interr ridge distance. For human touch, this frequency falls within the optimal range of sensitivity of Pacinian afferents, which mediate the coding of fine textures. Thus, fingerprints may perform spectral selection and amplification of tactile information that facilitate its processing by specific mechanoreceptors.

RELATED UNDEFINED

Fingerprints Enhance the Sense of Touch

BY GREG MILLER • SCIENCE • 30 JAN 2009

Register and access this article for free

As a service to the community, this article is available for free.

LOG IN

CREATE A FREE ACCOUNT

Access the full article

View all access options to continue reading this article.

 CHECK ACCESS

ALREADY A SUBSCRIBER OR AAAS MEMBER? SIGN IN AS AN [INDIVIDUAL](#) OR VIA YOUR [INSTITUTION](#)

Supplementary Material

File (scheibert_som.pdf)

DOWNLOAD

1.36 MB

References and Notes

- 1 L. A. Jones, S. J. Lederman, *Human Hand Function* (Oxford Univ. Press, 2006).
[GOOGLE SCHOLAR](#)
- 2 I. Darian-Smith, in *Handbook of Physiology: The Nervous System: Sensory Processes* (American Physiological Society, Bethesda, MD, 1984), vol. **3**, chap. 17.
[GOOGLE SCHOLAR](#)
- 3 K. O. Johnson, J. R. Phillips, *J. Neurophysiol.* **46**, 1177 (1981).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 4 D. Katz, *The World of Touch*, I. E. Krueger, Transl. and Ed. (Hillsdale, NJ, Erlbaum, 1989; original work published 1925).
[GOOGLE SCHOLAR](#)
- 5 M. Hollins, S. J. Bensmaïa, S. Washburn, *Somatosens. Mot. Res.* **18**, 253 (2001).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 6 M. Hollins, S. J. Bensmaïa, *Can. J. Exp. Psychol.* **61**, 184 (2007).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 7 S. J. Lederman, M. M. Taylor, *Percept. Psychophys.* **12**, 401 (1972).
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 8 M. A. Srinivasan, J. M. Whitehouse, R. H. Lamotte, *J. Neurophysiol.* **63**, 1323 (1990).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 9 J. C. Makous, R. M. Friedman, C. J. Vierck, *J. Neurosci.* **15**, 2808 (1995).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 10 S. J. Bensmaïa, M. Hollins, *Somatosens. Mot. Res.* **20**, 33 (2003).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 11 S. J. Bensmaïa, M. Hollins, *Percept. Psychophys.* **67**, 842 (2005).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 12 R. S. Johansson, *J. Physiol.* **281**, 101 (1978).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 13 M. Hollins, S. R. Risner, *Percept. Psychophys.* **62**, 695 (2000).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 14 M. Cartmill, *Am. J. Phys. Anthropol.* **50**, 497 (1979).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 15 N. Cauna, *Anat. Rec.* **119**, 449 (1954).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 16 R. S. Fearing, J. M. Hollerbach, *Int. J. Robot. Res.* **4**, 40 (1985).
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 17 Materials and methods are available as supporting material on *Science Online*.
[GOOGLE SCHOLAR](#)

- 18 J. Scheibert, A. Prevost, J. Frelat, P. Rey, G. Debrégeas, *Europhys. Lett.* **83**, 34003 (2008).
[CROSSREF](#) • [GOOGLE SCHOLAR](#)
- 19 A comparable spectral amplification is observed with finely abraded glass substrates (see fig. S5).
[GOOGLE SCHOLAR](#)
- 20 R. D. Howe, M. R. Cutkosky, *IEEE Trans. Robot. Autom.* **9**, 140 (1993).
[CROSSREF](#) • [GOOGLE SCHOLAR](#)
- 21 K. L. Johnson, *Contact Mechanics* (Cambridge Univ. Press, Cambridge, 1985).
[GOOGLE SCHOLAR](#)
- 22 N. Wiener, *Nonlinear Problems in Random Theory* (MIT Press, Cambridge, MA, 1958).
[GOOGLE SCHOLAR](#)
- 23 F. Rieke, D. Warland, R. de Ruyter van Steveninck, W. Bialek, *Spikes: Exploring The Neural Code* (MIT Press, Cambridge, MA, 1999).
[GOOGLE SCHOLAR](#)
- 24 K. Dandekar, B. I. Raju, M. A. Srinivasan, *J. Biomed. Eng.* **125**, 682 (2003).
[GOOGLE SCHOLAR](#)
- 25 Q. Wang, V. Hayward, *J. Biomech.* **40**, 851 (2007).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 26 J. P. Jones, L. A. Palmer, *J. Neurophysiol.* **58**, 1233 (1987).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 27 R. Crowder, *Science* **312**, 1478 (2006).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 28 V. Maheshwari, R. F. Saraf, *Science* **312**, 1501 (2006).
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 29 This project was supported primarily by CNRS basic funding and in part by the EU-NEST (New and Emerging Science and Technology) program, MONAT (Measurement of Naturalness) project (contract 21, number 29000). We are grateful to D. Chatenay and L. Bourdieu for fruitful discussions and careful reading of the manuscript.
[GOOGLE SCHOLAR](#)
-

eLetters (0)

eLetters is a forum for ongoing peer review. eLetters are not edited, proofread, or indexed, but they are screened. eLetters should provide substantive and scholarly commentary on the article. Neither embedded figures nor equations with special characters can be submitted, and we discourage the use of figures and equations within eLetters in general. If a figure or equation is essential, please include within the text of the eLetter a link to the figure, equation, or full text with special characters at a public repository with versioning, such as Zenodo. Please read our [Terms of Service](#) before submitting an eLetter.

[LOG IN TO SUBMIT A RESPONSE](#)

CURRENT ISSUE

ADVERTISEMENT

Sign up for ScienceAdviser

Get *Science's* award-winning newsletter with the latest news, commentary, and research, free to your inbox daily.

[SUBSCRIBE >](#)



Long-term isolation and archaic introgression shape functional genetic variation in Near Oceania

BY PATRICK F. REILLY, STEPHEN RONG, ET AL.

Super-earths and mini-neptunes follow different orbital period–eccentricity relations

BY KE-TING SHIN 辛科霆, DONG-SHENG AN 安东升, ET AL.

Global density and biomass of arbuscular mycorrhizal fungal networks

BY JUSTIN D. STEWART, CORENTIN BISOT, ET AL.

[TABLE OF CONTENTS](#) >

LATEST NEWS

CAREERS | 12 JUN 2026

New documentary follows researchers' increasingly fraught career path

SCIENCEINSIDER | 11 JUN 2026

After years of opposition, Mexico's president is reconsidering fracking

SCIENCESHOTS | 11 JUN 2026

Deep-sea vehicles spot 'alien' sharks deep beneath the waves in the Pacific

NEWS | 12 JUN 2026

Metal-driven chemical reaction in deep sea may explain origin of life

NEWS | 11 JUN 2026

How did the cruise ship hantavirus outbreak start? Scientists are investigating new scenarios

NEWS FEATURE | 11 JUN 2026

The ocean current that warms Europe may be more resilient than feared

ADVERTISEMENT

ADVERTISEMENT

[View full text](#) | [Download PDF](#)

Science

Science
Advances

Science
Immunology

Science
Robotics

Science
Signaling

Science
Transla
Medic

FOLLOW US



GET OUR NEWSLETTER

NEWS

[All News](#)

[ScienceInsider](#)

[News Features](#)

CAREERS

[Careers Articles](#)

[Find Jobs](#)

[Employer Hubs](#)

COMMENTARY

[Opinion](#)

[Analysis](#)

[Blogs](#)

JOURNALS

[Science](#)

[Science Advances](#)

[Science Immunology](#)

AUTHORS & REVIEWERS

[Information for Authors](#)

[Information for Reviewers](#)

[Donate to News](#)

Science Partner Journals

Librarian FAQs

Post a Job

Science in the Classroom

Prizes and Awards

Contact Us

© 2026 American Association for the Advancement of Science. All rights reserved. AAAS is a partner of HINARI, AGORA, OARE, CHORUS, CLOCKSS, CrossRef and COUNTER. *Science* ISSN 0036-8075.

[Terms of Service](#) | [Privacy Policy](#) | [Cookie Preferences](#) | [Accessibility](#)