Current affairs

The rise to fame of the El Niño climate phenomenon.

Our Affair with El Niño: How We Transformed an Enchanting Peruvian Current into a Global Climate Hazard
by S. George Philander
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NGUYEN DONG/UNEP/STILL PICTURES

The El Niño effect: temperature changes in the Pacific can trigger severe droughts in Vietnam.

The 1997–98 El Niño was a watershed event in the history of climate research. It was by some measures the strongest El Niño on record and by far the most publicized. El Niño is a periodic disruption of the ocean–atmosphere system in the tropical Pacific that affects weather and climate around the globe. Once a scientific curiosity studied by a handful of specialists, by 1998 El Niño had become a household word recognized by people from every corner of the planet.

What accounts for the extraordinary public interest in El Niño? The answer lies in the scientific advances of the preceding two decades. The 1982–83 El Niño, which was the strongest of the century until then, was neither predicted nor even detected until nearly at its peak. This failure stunned the scientific community, which at the time was planning a major ten-year international research programme to study El Niño. The Tropical Ocean Global Atmosphere (TOGA) programme, when it was finally launched in 1985, placed a premium not only on developing a deeper understanding of El Niño, but also on implementing new observational and seasonal prediction capabilities. TOGA was largely a success. The observing system it engendered captured the explosive growth and epic magnitude of the 1997–98 El Niño in real time and, once under way, computer models were able to forecast the subsequent development of the El Niño two to three seasons in advance.

George Philander, author of *Our Affair With El Niño*, was part of the community of oceanographers and meteorologists who helped to shape this exciting period of rapid scientific progress. He writes with the enthusiasm of an eye-witness and the authority of an expert. The book skilfully weaves together descriptions of El Niño physics, the historical backdrop that led to widespread interest in El Niño, and philosophical perspectives on the role of scientific research in addressing present-day environmental problems.

A central purpose of the book is to describe simply but accurately what El Niño is, how it works, and what its consequences are. El Niño's hallmark attributes are unusually weak trade winds and warm sea surface temperatures in the tropical Pacific. It is the warm phase of what is often referred to as the El Niño/Southern Oscillation (ENSO) cycle, which results from dynamical feedbacks between the upper ocean and the overlying atmosphere. La Niña, the opposite phase of the ENSO cycle, is associated with stronger than normal trade winds and unusually cold sea surface temperatures in the tropical Pacific.

Deciphering the underlying physics of the ENSO cycle is an ongoing challenge for the research community, and explaining it coherently to non-specialists is even more difficult. Philander uses easily understandable analogies, such as that of a swinging pendulum, to highlight key aspects of the oscillation. He also draws on metaphors from literature, music and painting to illustrate some of the physical concepts and research methods used in the study of El Niño.

As Philander observes, however, our fascination with El Niño derives not only from the intricate interplay of oceanic and atmospheric dynamics, but also from its effects on patterns of weather variability around the world. El Niño changes the spatial distribution of tropical Pacific rainfall, the effects of which are felt directly in the tropics and indirectly at higher latitudes through atmospheric 'teleconnections'. It is through these impacts that El Niño science intersects with human affairs.

Disparate parts of the globe may experience droughts, floods, heatwaves and intense storms that can be causally related to El Niño during periods of unusual warmth in the tropical Pacific. Likewise, El Niño-related weather patterns can create environmental conditions favourable for wildfires, outbreaks of infectious diseases and the degradation of air and water quality. The many faces of El Niño that were highlighted in the press and on television in 1997–98 helped to inform the public about the phenomenon and its global consequences.

As the 1997–98 El Niño began to unfold, the ready availability of long-range forecasts prompted many individuals, businesses and governmental organizations to take preventive measures in anticipation of El Niño's impending onslaught. Unfortunately, there are many factors besides El Niño that govern the climate system. Also, El Niño forecasts are by their nature probabilistic, a concept that is difficult for forecast-providers to convey and for forecast-users to understand. Our climate crystal ball is, at best, still fuzzy, so there are inherent risks involved in using these forecasts to guide important decisions.

Philander offers a sceptic's view of the El Niño prediction enterprise, examining at length the failed 1997–98 drought forecast in Zimbabwe and its consequences, but not giving equal time to forecast successes elsewhere. The reader may therefore wish to refer to Stanley Changnon's book *El Niño 1997–1998* (Oxford University Press, 2000), which attempts to quantify forecast benefits in a case study focused on the United States.

Also, Philander portrays El Niño as predominantly perilous, hence the book's subtitle, *How We Transformed an Enchanting Peruvian Current into a Global Climate Hazard*. This characterization is fair but incomplete, ignoring the many opportunities that El Niño creates. The author refers to the positive aspects mostly in the nostalgic past tense, citing the *años de abundancia* (years of abundance) resulting from rains in normally arid regions of Peru, as described by nineteenth-century writers. Yet for the United States, the 1997–98 El Niño resulted

in far more economic gains than losses, and fewer fatalities, than during other years because of the reduced number and intensity of landfalling Atlantic hurricanes and the record winter warmth in the Midwest.

Perhaps the book's most important message is that: "The solutions to serious environmental problems will elude us unless we are all aware of, and respect, the profound differences between the world of science and human affairs." This harks back to C. P. Snow's lectures on the 'two cultures' but with a twist: whereas Snow viewed science and technology as a panacea for solving the world's great social problems, Philander recognizes that science and technology are only part of the solution. Effective use of scientific information to benefit society must also reckon with prevailing cultural values and political imperatives.

Our Affair with El Niño is a very readable, entertaining and instructive book that will appeal to scientists and non-scientists alike. The author does not shy away from controversy in expressing his opinions about the sociological and political aspects of climate research. Whether or not you share his opinions, Philander unquestionably excels at describing the physics of the ocean, the atmosphere and El Niño in lucid terms. ■

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A helping hand

Hearing Gesture: How our Hands Help us Think
by Susan Goldin-Meadow
Belknap Press: 2003. 304 pp. $29.95, £19.95, €27.70

Eve Sweetser

BOB ROWAN/PROGRESSIVE IMAGE/CORBIS

Handy hints: gestures provide information that can make it easier to understand speech — or even replace it entirely.

Over the past two decades, researchers have produced overwhelming evidence that the gestures we use as we speak are integrally connected to both our speech and our thought processes. Susan Goldin-Meadow has been at the forefront of this new scientific direction. In *Hearing Gesture*, she provides a synthesis of her decades of work on gesture studies. It is a welcome scholarly arrival for gesture researchers, and should be important news to social and cognitive scientists, who so far have paid little attention to the gestures that accompany speech.

Hearing Gesture is an engaging (even suspenseful) read and, with its clear and informal style, should be largely accessible to non-experts. It centres around four primary questions. First, is gesture really a window on thought? If it is, do most people (as opposed to just researchers) read gesture? Does gesture also help the speaker's own cognitive processes — and if so, how? And finally, what are the differences between the gestures that accompany speech and visual gestures used on their own? Goldin-Meadow examines these questions — her answer to the first three is 'yes', by the way — in the lab and in everyday settings such as the classroom. In so doing, she looks at the communication of infants, children and adults, including sighted and blind, deaf and hearing, and normal and cognitively impaired subjects.

Goldin-Meadow has pioneered ways of studying gesture, one of her signature methods being the comparison of 'matched' gestures, which overlap in meaning with the accompanying speech, and 'mismatched' gestures, which either complement or conflict with the linguistic meaning. With Breckie Church she observed children explaining their answers to piagetian conservation tasks (conservation of mass, number or volume when physical appearance is altered). Some children produce mismatched gesture–speech pairings. For example, they say that a tall, thin container has a large volume "because it's taller", but simultaneously make a gesture indicating width; this shows awareness that the container's width, as well as its height, is relevant to the quantity of water it holds. These children, it turns out, are the ones who are most ready to learn about conservation, either by instruction or experimentation (*Cognition* **23,** 43–71; 1987).

The contrast between matches and mismatches turns out to be a remarkable tool. Goldin-Meadow's later studies show that matched gestures lower the cognitive load on the speaker and speed the listener's comprehension, whereas mismatched gestures raise the load on both sides of communication, which makes sense because they bring in another cognitive model besides that presented in speech. However, Goldin-Meadow argues that mismatches are advantageous in other ways. Because hearers do 'read' gestures and process the information expressed (as also shown in earlier work by David McNeill and Adam Kendon), mismatched gestures not only allow speakers to express models that are inaccessible to speech but also give listeners access to those models, with the added advantage of providing potential feedback to speakers.

The use of the term 'mismatch' presents difficulties from time to time — it is regrettably not always clear which kind (complementary or conflicting) is most relevant in a given study. The author remarks that gestures rarely correspond precisely with words in meaning. Taken to its logical conclusion, this should mean that complementary mismatches, like matches but not like conflicting mismatches, show overlap between gestural and linguistic meaning — the boundary between matches and mismatches is perhaps presented as more tidy than it really is. However, there is careful differentiation in some crucial cases, such as the examination of cognitive load, and Goldin-Meadow comments that apparently conflicting mismatches often reflect different aspects of a potentially unified larger cognitive framework.

Another strand of Goldin-Meadow's work has been the examination of purely gestural communication, including that of deaf children with hearing parents. She compares their individual gestural systems with conventional signed languages and with hearing gesture that has taken over the communicative load. This provides rich evidence from several domains for McNeill's claims that gesture becomes 'language-like' when it takes on the primary informational load of communication. Gesture becomes conventionalized, segmented and even 'grammaticized' — the gestural systems of orally raised deaf children have a basic grammatical structure.

I have touched on only a few of Goldin-