LETTERS

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Combining Parenting and a Science Career

THE SOBERING NEWS FOCUS ARTICLE "FAMILY matters: Stopping tenure clock may not be enough" (Y. Bhattacharjee, 17 Dec. 2004, p. 2031) shows how little has changed in the last 20 years to make child rearing possible for a woman scientist who receives her Ph.D. or M.D. around age 27, completes her postdoc near her 30th birthday, and is then off on a 6-year race toward academic tenure with 60- to 80-hour work weeks.

The only new incentive for early parenting mentioned is a pilot program by the National Institute of Allergy and Infectious Diseases to "enable principal investigators (PIs) to hire a technician for up to 2 years to assist a postdoc in their lab who has primary caregiving responsibilities." I would suggest that such funds might be used more flexibly and more effectively when directed specifically to the mother herself.

Why not make available—on a competitive basis related to professional promise or performance—4-year grants (at a level of about $20,000 to $25,000 per year) for domestic child-care support? A woman scientist would be eligible to apply as soon as she has secured a postdoctoral or junior academic position, but actual payment and start of the 4-year grant would only commence a couple of months before the expected birth of the baby, which would have to occur within 3 to 4 years of the date the grant was approved. This support might attract women into demanding scientific careers when they are otherwise not prepared to do so because of their desire for childbearing and child care in the home.

When I made this suggestion in 1988 (*1*), I received many enthusiastic letters from readers who ranged from female graduate students to two female members of the U.S. National Academy of Sciences. But even though foundation heads, university presidents, and government officials commented in glowing terms when I approached them, all felt that financial implementation should come from someone else's purse. Has the time finally come to once more raise the issue?

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IN HIS NEWS FOCUS ARTICLE "FAMILY MATTERS: stopping tenure clock may not be enough" (17 Dec. 2004, p. 2031), Y. Bhattacharjee discusses the negative impact of childbearing on junior faculty due for a tenure decision. This issue affects women at every rung of the academic ladder. While there is abundant evidence for the health benefits of early childbearing and sustained breast-feeding for both mother and baby, the scientific "training period" now extends into what are likely to be the last reliably fertile years of a woman's life. An anxious new mother cannot be fully effective unless she can be at her infant's side at short notice. Thus, if women are to succeed in science without sacrificing their health or their chances of having healthy children, academic institutions must give this issue high priority. We suggest that the single best approach is to provide safe, affordable, easily accessible infant care.

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>
> –*LEWIS* ET AL.

Despite espousing "family-friendly" policies, many institutions either do not offer infant day-care or provide only a limited number of spaces. Many off-site facilities will not accept infants, leaving few viable options when the maternity leave is over—usually in 12 weeks or less in the United States. Attention to this issue will encourage the healthy development of a balanced career and family life, while promoting gender equity in the academic pursuit.

The primary barriers to adequate on-site infant care appear to be cost and liability. Rather than building centralized child-care facilities, we suggest that institutions build or renovate existing smaller spaces on-site, to be used as child-care cooperatives, run by the users. This would be more cost-effective and would ensure access to the infant at short notice. In addition to space, the institutions should provide basic financing and administrative support to coordinate resources for the project. As for liability issues, it should be possible to completely indemnify the institution and make these co-op facilities self-insured.

Some may wonder how academic institutions can garner the resources to initiate adequate child-care programs. The question really should be, how much do institutions have to lose in time and productivity before taking such steps to benefit scientists as well as science?

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THE WELCOME ARTICLE "FAMILY MATTERS: stopping tenure clock may not be enough" (Y. Bhattacharjee, 17 Dec. 2004, p. 2031) deserves further comment. As a person with a Ph.D. (physics) who has been employed in academia, in a government lab, in R&D departments of two private-sector firms, and self-employed since 1992, perhaps I can provide some perspective.

The tenure system is not just unfriendly to women. These days, two-career families are the norm, and thus, the tenure system is unfriendly to families with children.

The private sector has its own problems with family-friendliness. For example, a former boss once informed his department of his new policy that required all vacation days to be taken in week-long minimum increments scheduled at the beginning of the year. A private discussion followed, in which I pointed out that two working parents with three kids simply cannot do that; most of our vacation days get used up 1 to 2 days at a time tending to family emergencies.

Initiatives such as stopping the tenure clock, part-time positions, and others mentioned in the article are steps in the right direction. Nevertheless, rethinking the whole tenure system should not necessarily be ruled out.

Looking back over the years, I've had many a guilt-trip over whether pursuing my

scientific interests came at the expense of our kids by somewhat limiting the time I could spend with them, and whether they would have been better off if I had chosen a simpler way of making a living. In the end, the benefits of providing an intellectually rich environment became clear. All three turned out well.

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Crying "Whorf"

SOME OF THE MOST STRIKING DISCOVERIES IN the study of language and cognition are also the hardest to interpret. Peter Gordon's Report on innumeracy in a remote Amazonian tribe is no exception ("Numerical cognition without words: evidence from Amazonia," 15 Oct. 2004, p. 496). Although this study invokes a fascinating question about the relation between language and numerical cognition, the data presented do not support Gordon's answer.

Gordon reports that the Pirahã of Brazil lack words in their language for numbers greater than two and also appear unable to match exact quantities larger than two or three. He takes this coincidence to be evidence for a version of the Whorfian hypothesis (*1*) that he calls strong linguistic determinism: If you don't have a word in your language, you can't entertain the concept. Two fundamental problems render Gordon's results uninterpretable.

First, the study fails to compare Pirahã speakers' exact quantity matching performance to performance on a control task, or to performance in an appropriate control group. In this case, appropriate control subjects might be members of another tribe whose culture and habitat are similar to the Pirahã's, but whose language includes exact number words. Suppose that their performance turned out to be indistinguishable from that of the Pirahã speakers, despite their enhanced number vocabulary? Suitable controls might be difficult to implement for practical reasons, but without them it is impossible to tell whether Gordon's results reveal a limitation of the Pirahã's numerical competence or only a limitation of the tasks used to measure their competence.

A second shortcoming is the failure to provide evidence that the Pirahã's impoverished number vocabulary causes their (putative) numerical incompetence. The core of strong linguistic determinism appears to be a causal relation between language and concepts. Gordon writes that the availability of number words "enables exact numeration" in speakers of some languages and that the lack of counting words "precludes" exact numeration in speakers of other languages like Pirahã. Yet this causal claim is simply not supported, nor is it potentially supportable by the experiments reported in this paper. It is often challenging to demonstrate causation experimentally, and researchers must sometimes argue cause from correlational evidence that is structured so as to make one direction of the causal arrow seem overwhelmingly more plausible than the other. How is this accomplished in Gordon's study? The results are consistent with the Whorfian claim that Pirahã lack number concepts because they lack number words, but results are no less consistent with the opposite claim, which is arguably more plausible. Gordon's data suggest that keeping track of large exact quantities is not critical for getting along in Pirahã society. In the absence of any environmental or cultural demand for exact enumeration, perhaps the Pirahã never developed this representational capacity—and consequently, they never developed the words.

There are good reasons why the Whorfian hypothesis fell into disrepute. Many of the linguistic and behavioral studies that have sought to validate it are badly flawed (*2*). These days,

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the Whorfian hypothesis is experiencing a renaissance, and cognitive science is finally finding ways to pose the Whorfian question clearly (*3*). But crying "Whorf!" when there's no Whorfian effect in sight only clouds the issue.

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3. D. Gentner, S. Goldin-Meadow, Eds., *Language in Mind: Advances in the Study of Language and Thought* (MIT Press, Cambridge, MA, 2003).

Response

IN MY REPORT, I ASKED WHETHER THERE ARE some concepts that cannot be translated from one language to another and if this could preclude speakers of one language from entertaining the untranslatable concepts of another. Casasanto paraphrases this position as "if you don't have a word in your language, you can't entertain the concept," which is almost certainly false (for example, most people have a concept of the thing on top of a trolley car that connects to the cables, but few people know its name, including me) and is much more general than I intended.

Casasanto criticizes my research design for not employing a "control group," which would require finding a tribe exactly like the Pirahã, except that they would have words for exact numbers. Even if such a tribe could be found, they would not constitute a "control group" in the strict sense, but a comparison group. Members of a culture that could count with exact number words would not be comparable to the Pirahã, precisely because they could count. If the comparison tribe were to perform perfectly on my tasks, one could still argue that they differed in important respects from the Pirahã on dimensions other than numerical competence. If the comparison tribe performed no better on the tasks than the Pirahã, then the conclusions would still be ambiguous. One could not be sure that the comparison tribe failed for exactly the same reasons as the Pirahã. This is not to say that such a comparison group would be unhelpful, but the interpretation of results would not be straightforward.

Casasanto's second criticism concerns my failure to show causation between the lack of number words and lack of numerical abilities in the Pirahã. He cites my report as claiming that "the lack of counting words 'precludes' exact enumeration…" and appears to equate "precludes" with "causes." But these are not the same thing. I do not claim that lack of number words directly causes the lack of number concepts, because this assumes a kind of causal directionality that is not realistic. Casasanto suggests that causality might be reversed: "perhaps the Pirahã never developed this representational capacity—and consequently, they never developed the words."

In framing the issues in this way, Casasanto changes the debate into one about cultural history, which is totally irrelevant to an argument about synchronic cognitive ability. The question is not how the Pirahã culture might or might not have evolved, but what the consequences are of being born into the culture, as it currently exists. To ask what is the cause of the Pirahã, as a culture, not acquiring exact numerical representations is an exercise in imagining all of the counterfactual possible worlds in which the Pirahã might have acquired such knowledge. The failure of each of those possible worlds to become the actual world then becomes the "cause" of the missing concepts. Casasanto writes as if there were one and only one such counterfactual state of affairs that can be pinned down as the final cause of Pirahã innumeracy, but that is surely wrong.

My own position does not entail a simple cause-and-effect mechanism whereby possession of words for numbers provides all of the necessary and sufficient conditions for the acquisition of exact numerical concepts. It is unlikely that the acquisition of numerical concepts can be characterized in terms of unidirectional cause-and-effect relations. Word meanings tend to be embedded within systems of knowledge. To know the meanings of integers is to know about the basic arithmetic relations between them, which in turn requires some symbolic representation of the integers themselves. In the absence of core components of a system, it is unlikely that the system will develop to its full potential and might emerge relatively unchanged from its original form. I suggest that Pirahã numerical competence emerges with the innate numerical systems of small exact number competence and large number approximation. If we go chasing our tails to find single causal explanations, then I think we will be forever chasing those tails without resolution.

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CORRECTIONS AND CLARIFICATIONS

ScienceScope: "Italy pulls out of Global Fund" (4 Feb., p. 655). The item incorrectly reported that the Italian government was withholding its contribution to the Global Fund this year. In fact, Italy decided in late January to allocate 180 million euros for 2004–05 to the fund, a partnership of private and public bodies fighting AIDS, tuberculosis, and malaria. *Science* regrets the error.

News of the Week: "Cash-short schools aim to raise fees, recruit foreign students" by E. Marshall (4 Feb., p. 656). The vice chancellor of Oxford University was incorrectly identified. His name is John Hood.

Recombinant Virus Bank for Gene Delivery

VIRAL VECTORS HAVE BEEN DEVELOPED AS therapeutic agents for the introduction of exogenous genes into living cells (*1*), and clinical trials of gene therapy and the use of viral vectors in the laboratory have been reported with increasing frequency during the past decade (*2–4*).

We have established a Recombinant Virus Bank at RIKEN BioResource Center in Japan to supply researchers with more than 300 infectious recombinant viruses and 500 recombinant vectors with replication-competent viruses (RCVs) free, which should help to ensure the safety of recombinant viruses and vectors in laboratory experiments and in preclinical trials of human gene therapy. The Bank includes recombinant viruses that carry cDNA for cytokines, regulators of the cell cycle, transcription factors, enzymes, and apoptosis-related proteins. We have already dispatched more than 730 recombinant viruses or vectors to scientists worldwide through our database (see www.brc.riken.jp/lab/dna/rvd/). To maintain high-quality stocks of recombinant viruses and related vectors, these genetic materials have been subjected to stringent quality control (*5–7*). They are distributed to scientists who have a material transfer agreement (MTA) with the Bank. The Bank is a nonprofit organization, and the only charges are for handling and shipping. The Recombinant Virus Bank should be useful to large numbers of molecular biologists, as well as in human gene therapy.

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