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## LETTERS

edited by Jennifer Sills

### Shopping for Explanations

WE WERE SHOCKED BY THE RANDOM SAMPLE “BORN TO SHOP?” (7 September, p. 1301). Such a study hardly deserves the notice of a premier science journal.

The Random Sample summarizes a “study” of sex-based differences in the ability of modern city dwellers to remember the locations of particular foods at a farmers’ market. Given the social bias in American culture toward meal preparation by women and meal consumption by men, such a difference is not surprising, but neither is it indicative of “hard-wired” biological differences in brain function between women and men. Still less can such differences be attributed to an evolutionary past “when men were the hunters and women the gatherers.”

While this gendered division of labor prevails (but is not universal) among ethnographically known foraging groups, such a pattern cannot be assumed



#### Response

BRUMFIEL *ET AL.* CRITICIZE C. HOLDEN’S summary (Random Samples, 7 September, p. 1301) of our research (1); we welcome the opportunity to respond.

Many studies document men’s superior spatial performance (2). We found that women excel on a spatial task mimicking the cognitive demands of plant-food gathering, even when we used a measure that normally gives men an advantage. Brumfiel *et al.* suggest that ancestral sex differences in hunting may be small; however, this is irrelevant to our theory of gathering-related spatial adaptations. What is relevant is whether, statistically, ancestral women gathered more than men. If so, they could be the target of stronger selection for cognitive mechanisms supporting gathering. This sex difference in gathering is universal among described hunter-gatherers (3), and chimpanzee data suggest that it extends back to our pre-hominin ancestors (4).

Citing cultural biases in shopping and cooking, Brumfiel *et al.* present a social-learning explanation for our results. Their theory is contradicted by other studies and our

ed for the period of human evolution. Archaeologists argue that with the invention of spear-throwers, bows and arrows, and poison darts, Paleolithic hunting probably involved herd surrounds and game drives, such as those practiced by Native Americans in the western United States at the time of European contact. These surrounds and drives involved all camp members: men, women, and children.

An important trait that distinguishes modern humans from other species is their “hard-wired” ability to learn a wide variety of socially transmitted patterns of thinking and acting. Surely *Science* was premature in drawing public attention to a study that purports to say something about universal differences between women and men based on observations made in a single culture. Studies such as this reinforce the American inclination to explain our own culturally based gendered division of labor (e.g., women shop and cook, men are mathematicians) in terms of biology rather than patterns of socialization and discrimination.

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The published article contained an editorial error. See next page for published correction.

data. First, studies show either no sex difference or a male spatial advantage in nonfood shopping environments (5). Second, counter

to the social-learning hypothesis, individual differences in shopping experience, taste preferences, and consumption frequency did not predict spatial performance in our study; women outperformed men controlling for these experience factors. Moreover, both sexes showed better performance on high-calorie food items. This is the signature of an evolved mechanism for efficient gathering, not one socially learned in contemporary environments.

Finally, only those who insist upon egalitarianism depend on claims of biological identity. The sexes differ. Men never gestate offspring. On average they are larger, less articulate, shorter lived, and better at mental rotation tasks (2, 6). Denying these and other differences will not make them disappear. But the science that explores these differences provides tools to combat

discrimination. For decades, researchers uninformed about our evolutionary history unknowingly constructed spatial tasks that favor men’s skills. It is only when we take seriously men’s and women’s evolutionary heritages that we can break through this inadvertent sexism and expose women’s unique abilities.

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carcinogenesis. Although not revealing a statistically significant effect, randomized trials with tamoxifen have aimed at blocking estrogen because male patients with chronic hepatitis present with a relatively hyper-estrogenic phenotype (1).

Second, exogenous estrogen therapy by means of oral contraceptives in women is the major risk factor for the development of hepatocellular adenoma (HA) (2), a benign liver tumor with malignant potential. In men, cases of HA after the chronic intake of exogenous steroid hormones have been reported (3).

Third, given that the development of HCC in men with hepatitis B or C viral infections or cirrhosis occurs after years of chronic inflammation, we imagine that chronic suppression of IL-6 levels by an estrogen mimetic in those patients would be necessary, and long-term estrogen treatment leads to an even greater risk of HA. In a cohort recently investigated at our institution, 94% of women with HA reported the use of oral contraceptives for a median duration of 15 years (4). Long-term estrogen treatment in males may also contribute to the development of liver masses. Tumor induction, even if benign, would complicate the clinical management, as any solid tumor in a patient with a history of chronic liver disease should primarily be considered malignant and would be an indication for surgical resection.

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#### Response

THE CONTRIBUTIONS OF SEX STEROID DYS-regulation to the development of hepatocellular cancer (HCC) has been debated for decades, spawning several trials studying estrogen modulators (such as tamoxifen) in the treatment of HCC. None of the trials has convincingly shown any benefit of tamoxifen in the treatment of HCC, as Van der Windt and colleagues note. Our study, however, does not address the treatment of existent HCC; it focuses instead on the factors that influence HCC incidence.

We found that estrogen administration markedly diminished the inflammation and injury associated with a chemical carcinogen, which translated much later into a decreased incidence of HCC in mice.

#### CORRECTIONS AND CLARIFICATIONS

**Letters:** "Response to 'Shopping for explanations'" by M. M. Krasnow *et al.* (2 November, p. 745). The first line in the fourth paragraph was incorrect, due to an editorial error. The line should have been, "Finally, only a weak commitment to egalitarianism depends on claims of biological identity."

#### TECHNICAL COMMENT ABSTRACTS

#### COMMENT ON "Roadless Space of the Conterminous United States"

**Evan H. Girvetz, Jochen A. G. Jaeger, James H. Thorne**

Watts *et al.* (Reports, 4 May 2007, p. 736) introduced a metric of landscape pattern called roadless volume (RV). However, as with most previous metrics, RV does not explicitly address ecological processes. We demonstrate that RV can produce results inconsistent with the notion of landscape connectivity and contend that more ecologically relevant metrics are available. Full text at [www.sciencemag.org/cgi/content/full/318/5855/1240b](http://www.sciencemag.org/cgi/content/full/318/5855/1240b)

#### RESPONSE TO COMMENT ON "Roadless Space of the Conterminous United States"

**Raymond D. Watts, Roger W. Compton, John H. McCammon, Carl L. Rich, Stewart M. Wright, Tom Owens, Douglas S. Ouren**

Girvetz *et al.* criticize our work and the value of the roadless volume (RV) metric, basing their arguments on the artificial imposition of wildlife habitat connectivity as the context. We counter that in our intended contexts, both practical and geographic theoretical considerations make RV an appropriate measure of the space between roads.

Full text at [www.sciencemag.org/cgi/content/full/318/5854/1240c](http://www.sciencemag.org/cgi/content/full/318/5854/1240c)

Furthermore, when we administered tamoxifen prior to chemical injury, the injury was amplified rather than diminished, suggesting that tamoxifen, already known to be useless in the treatment of established HCC, is also unlikely to prevent the occurrence of HCC.

Although the malignant potential of hepatic adenomas is controversial (1), there is little question that these neoplasms are associated with prior oral contraceptive use in women (2). As Van der Windt *et al.* point out, the use of estrogen mimetics for prevention of HCC in clinically relevant situations (e.g., chronic liver inflammation such as that produced by hepatitis B or C infection) would be long-term and could lead to the development of adenomas. We agree that this would complicate the care of such patients, likely precluding the use of such a strategy.

Another risk of an estrogen mimetic would be the feminizing side effects in extrahepatic tissues. This includes not only the breasts and testes but also the coagulation system, as estrogens predispose to thrombus formation.

Our results suggest a possible alternative to estrogen-mimetic therapy. The mechanism by which estrogens diminish liver injury is through down-regulation of IL-6 production, indicating that strategies to decrease IL-6 signaling in the setting of chronic liver inflammation may decrease HCC development. Down-modulation of the IL-6 signaling pathway may circumvent the

problems of possible adenoma development and feminization inherent in long-term estrogen use, while still providing the benefit of decreasing HCC incidence in men.

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## Virtual Reality and Telepresence

IN THE 24 AUGUST ISSUE, TWO TEAMS OF cognitive neuroscientists used video-based immersive virtual reality systems to induce an "out-of-body" experience in healthy volunteers (Brevia, H. H. Ehrsson, p. 1048; Reports, B. Lenggenhager *et al.*, p. 1096).

An important implication of this work, not fully discussed in the papers, is the role of virtual reality (VR) in inducing these experiences. VR is usually presented as a collection of technological hardware, such as computers and head-mounted displays. However, as underlined by Steuer (1) more than 15 years ago, the core of VR is more experiential than technological; "virtual reality" can be defined as a simulated environment in which a perceiver experiences the feeling of presence by means of a communication medium, a phenomenon referred to as telepresence.