Fuzzy Logic:

A Critique of AAUW's Charge that "Schools Shortchange Girls"

Patricia Hausman
phausman@
digizen.net

That trouble has descended on America's schools is obvious to the most casual observer. The list of shortcomings attributed to the nation's educational institutions is long–and continues to grow. Increasingly, schools are perceived as being in nothing less than a state of crisis. And, according to some, one of their major faults is gender bias–a force allegedly so pervasive that it sabotages the future of female students.

How Schools Shortchange Girls (HSSG): the AAUW Report (CRW, 1996) is perhaps the most visible expression of this sentiment. It was prepared by Wellesley College's Center for Research on Women under a contract from the American Association of University Women. Since its release, it has become a bible for those who view the nation's schools as "hostile hallways" for girls.

From its earliest pages, the report minces few words. It alludes to "disturbing evidence that girls are not receiving the same quality, or even quantity, of education as their brothers" (p. x). In a related document, AAUW is even more critical, alleging that schools "set up girls to fail" (1991, p. 14).

Do AAUW's claims rest on solid scientific reasoning? This critique will examine the question as it pertains to the charge that girls are denied the same *academic* opportunities as boys. It will not address AAUW's complaint that school-based gender bias fuels a crisis in female self-esteem. That charge has been ably refuted elsewhere (Sommers, 1994; Sommers, 1996).

Where's the Beef?

At first glance, the basis for AAUW's plaint is elusive. For instance, the report acknowledges that girls receive better grades than boys across subject areas. It includes data showing that girls are more likely to finish high school–and less likely than boys to repeat a grade or to be sent to special education. In

---

In this critique, the qualifier "as a group" is implied whenever the terms "boys," "males," "girls," or "females" are used. Similarly, terms such as "outscore" or "outperform" are used only in reference to group means.

addition, large majorities of boys and girls polled by AAUW agreed that "teachers prefer girls" and/or "think girls are smarter" (Sommers, 1996).

Data from the College Board indicate that boys lag behind girls in the number of college preparatory courses and in college enrollment (ETS, 1997). These statistics show that females outnumber males in post-secondary education, where they represent 55% of all students. Notably, *HSSG* offers no evidence–not even anecdotal reports–indicating that females are denied admission to particular programs despite having qualifications as good or better than male applicants.

Thus, the overall picture shows girls faring better than boys on many measures of academic success. This is indeed difficult to reconcile with AAUW's claims that schools discriminate against girls. But, on careful reflection, the basis for AAUW's discontent becomes clear. It is standardized tests–or more accurately, sex-related differences in outcomes on these tests that emerge in adolescence.

Cognitive scientists have long recognized that, around the time of puberty, boys begin to outperform girls on standardized tests of math and science (Wilder, 1996). Career choices reflect this difference; at the college level, males still dominate fields such as mathematics, engineering, and the physical sciences (NSF, 1994). While female participation in these fields has increased somewhat, the change is modest as compared to professions such as medicine, pharmacy, and law. The latter require far less mathematical reasoning ability and visuo-spatial skill (Kempner, 1990).

Despite evidence that females and males have different interests prior to formal schooling (Goodenough, 1957), AAUW appears convinced that school-based gender bias is largely responsible for these disparities. Ironically, in presenting its case that schools underestimate the scientific potential of females, AAUW violates some of the most basic principles of scientific scholarship. The remainder of this critique will address three striking examples.

Correlation and Causation

Failing to distinguish between correlation and causation is a common mistake among the scientifically unsophisticated. Regrettably, AAUW has not overcome this tendency. Its report repeatedly presents correlative information in contexts that imply relations of cause and effect.

Nowhere is this classic error more disturbing than in the discussion of teacher-student interactions. Continuing a theme developed in previous publications (1989; 1991), AAUW again suggests that disparate outcomes favoring males are the result of teachers giving them more attention and encouragement. The implication conveyed in all of these documents is that teacher behavior *causes* adolescent girls to score lower on standardized tests of math and science.

Serious questions have been raised about the validity of a key body of work cited by AAUW as evidence that girls receive less teacher attention than boys (Sommers, 1994). Even without these concerns, however, the fallacy of AAUW's position is evident. One cannot simply take two observations–that adolescent boys receive more attention and better math/science test scores–and infer that the former *causes* the latter.

What one can do is apply standards for evaluating the likelihood that this observation reveals a causal relationship. This technique, usually described as the "criteria of the epidemiologic method," is best known as the basis for the Surgeon General's landmark report concluding that cigarette smoking causes lung cancer and other diseases (CSH, 1964).

The method requires that correlations be evaluated for strength, consistency, temporal sequence, independence, and coherence. Applying any of these criteria to AAUW's interpretations demonstrates the weakness of its argument. In the interest of brevity, only three criteria will be discussed here.

Evaluating the Charge

Statistically, the strength of an association is expressed as the coefficient of correlation, or *r*. An *r* of 1.0 indicates a perfect positive correlation between

variables; an *r* of -1.00, a perfect inverse correlation. The strongest correlations are those with *r* values at or near these maximums.

How strong is the correlation between teacher attention and math/science outcomes? Surprisingly, *HSSG* provides no clue. Its authors cite no statistical evaluation of the purported correlation. Rather, it appears that they simply decided that the simultaneous occurrence of less teacher attention and lower math/science test scores in adolescent females shows a relationship worthy of national alarm.

It is difficult to think of any case in the past half century when a scientist reported a correlation without calculating its direction and numerical strength. That AAUW has taken its observations a step further and inferred causality is therefore all the more extraordinary.

Also notable is AAUW's lack of attention to the criteria of consistency. Oddly enough, information presented within the report shows that the correlation–if real–is so inconsistent as to make a causal inference untenable.

If one concludes, based on AAUW's evidence, that less teacher attention *causes* adolescent girls to underperform boys on certain standardized tests, one must similarly argue that this dearth of attention causes girls to *outperform* boys on many counts. Absent such consistent reasoning, basic logic requires an explanation as to why the independent variable (teacher attention) is causally related to some dependent variables (math/science scores) but not others (e.g. reading/writing scores, grades, graduation rates).

AAUW offers no such insight. It does not explain how teacher inattention could cause girls to test more poorly than boys in math and science, while simultaneously causing them to achieve higher grades across subject areas–not to mention lower drop-out rates, greater presence in college, and other indicators of academic success.

Nor does AAUW notice that its conclusions fail a third criteria for causal significance–that of temporal sequence. Though the term may be unfamiliar to many, it is not a difficult concept to grasp. Simply stated, it holds that when A

and B are correlated, A must precede B in some logical fashion in order to have causal significance (CSH, 1964).

AAUW acknowledges that girls do as well–if not better–than boys on standardized math tests throughout their elementary school years. Yet, by its own admission, the influences that it blames for poorer female performance in adolescence–unequal teacher attention, sexist textbooks, gender stereotyping–are as present during grade school as in secondary education. No explanation is offered as to why these allegedly insidious forces would cause girls to perform as well or better than boys during their first six years of school, only to trigger a sudden reversal of fortune during adolescence.

In this regard, AAUW also ignores that the magnitude of these influences does not increase over time. If the relationship between teacher gender bias and math/science test scores were truly causal, one would expect to see exposure-related effects.

Smoking-related diseases again provide an apt illustration. The risk of various cancers and circulatory diseases rises as duration of tobacco use increases (CSH, 1964). In other words, the correlation between smoking and cancer shows a progressive temporal effect, or graded nature.

By contrast, performance on standardized math and science tests does not worsen progressively as adolescent girls receive additional exposure to allegedly sexist teachers and textbooks. An explanation of this phenomenon more consistent with its temporal course will be explored in a later section.

Science vs. Advocacy

In a cogent statement about science, the National Association of Biology Teachers (NABT, 1995) explains:

> Science is not teleological; the accepted processes do not start with a conclusion, then refuse to change it, *or acknowledge as valid only those data that support an unyielding conclusion* (emphasis added).

In other words, sound scientific work recognizes data that are inconsistent with its findings. Ideally, it attempts to reconcile them with observed outcomes. However, this time-honored principle is another that AAUW violates all too frequently. Selective presentation of facts abounds.

As noted above, *HSSG* assumes, without statistical evidence, that a correlation exists between teacher attention and math/science scores. The absence of statistical data cannot be blamed on a lack of information. Several reports relevant to the existence of such a correlation were available when *HSSG* was being prepared.

Specifically, these studies investigated differences in test scores between girls attending single-sex schools and those in coeducational schools. This research is germane to the issue of teacher-student interaction. Girls in single-sex schools cannot be the victims of teachers who preferentially acknowledge and encourage boys. Accordingly, if teacher attention is a significant factor in female achievement, girls in single-sex schools should outscore those in coeducational schools.

Two studies published 7 to 12 years before *HSSG* show no difference in girls' performance based on school type (Finn, 1980; Steedman, 1985). A third found higher scores among girls in single-sex institutions; on further analysis, this was attributed not to more teacher interaction, but to the selectivity of such schools (Bell, 1989). In other words, data available to, but ignored by AAUW had already cast considerable doubt on its central theme. (It should be noted that if any statistical analyses showing a correlation between single-sex education and test scores existed at the time of *HSSG*, these, too, went unmentioned.)

Failing to acknowledge data such as these is contrary to standards of fair debate. Even more curious, however, is that these studies are mentioned in a later AAUW report, *Separated by Sex* (AAUWEF, 1998). Based upon these (and other reports), this new publication states:

> Girls' documented preferences for single-sex classes have not translated into corresponding gains in achievement. Studies that attempt to assess the effects of single-sex schools and classes on achievement–whether through grades, test scores, or standardized aptitude tests–have so far found few correlations between the two (p. 22).

If AAUW had acknowledged as much in *HSSG*, much unsubstantiated hand-wringing about the nation's schools–as well as the diversion of attention from truly well-established problems–might have been prevented.

Another Example

Another questionable aspect of AAUW's scholarship derives from its tendency to summarize findings rather than present actual data. There is nothing inherently wrong with this approach. However, when doing so distorts the true meaning of results, scientific standards are once again violated.

In this regard, one must question whether AAUW has gone too far in shading the issue of sex differences in performance. Its discussion of sex differences in verbal ability is illustrative.

Verbal ability carries great significance. Those blessed with it have a strong advantage in tasks requiring persuasion, reading comprehension, and writing skills. Professions such as law, politics, and journalism require a strong measure of verbal skill, and the weight of evidence has long shown that females have considerable advantage in key areas of verbal ability (Bock & Moore, 1986; Stumpf, 1995). This advantage is not contradicted by the slightly better verbal scores received by males on the SAT, as college-bound students are not representative of the population as a whole (ETS, 1997).

Obviously, AAUW's case weakens considerably if male advantage in math is offset by female advantage in verbal ability. Perhaps this is why the authors of *HSSG* attempt to minimize–if not misrepresent–female advantage in certain verbal tasks.

For example, *HSSG* acknowledges–almost in passing–that data from the National Assessment of Educational Progress (NAEP) "do indicate that girls consistently outperform boys on writing-skills assessment." Notably, *HSSG* fails to disclose the degree of this better performance by girls. Moreover, the "implications" of the current data are described as showing that:

> It is important that *equal* attention be given girls and boys in teaching reading and writing skills. *The assumption that boys are in greater need of instruction in these areas should not be made* (p. 59; emphases added).

On reviewing the actual data from the NAEP, the justification for this statement is difficult to imagine. Because *HSSG* was originally published in 1992, the most recent NAEP results available to its authors were for 1990. Data for that year show that, among 17-year-olds, females outscored males in reading *by 13 points*. Among 11th-graders, girls outperformed boys on the writing test *by 22 points* (NAEP, 1996).

Is this 22-point advantage favoring girls consistent with AAUW's claims that girls need writing instruction as badly as do boys? Two professors from the University of Chicago think otherwise. They describe the sex difference in writing ability as "alarming . . . putting males at a rather profound disadvantage in the performance of this basic skill" (Hedges & Nowell, 1995, p. 45).

Their view, of course, can be discounted as a mere difference of opinion. Not so easily dismissed is the magnitude of female superiority in writing as compared to male advantage in math and science. The numbers–all too conveniently omitted from *HSSG*–speak for themselves.

Among 17-year-olds participating in the 1990 NAEP, the male advantage in science was 10 points. In math, it was a mere 3 points. These differences pale in comparison to the pattern of female superiority in writing–which, as noted above, favored girls by 22 points.

That AAUW succeeds at leaving the impression that girls have no real advantage over boys testifies to its ability to disguise inconvenient facts. Good science, however, demands quite the opposite–the willingness to present actual outcomes in a full and fair context.

Examining Alternative Explanations

A third scientific principle is essential to evaluating the merits of *HSSG*. It is the expectation that scholars will address the possibility of multiple explanations for a given set of facts.

As noted earlier, female disadvantage in mathematics and related fields is not a life-long characteristic. Rather, it emerges around the time of puberty. This temporal phenomenon logically raises the question of hormonal effects–specifically the role of sex hormones.

Considerable research supports a role for pubertal hormones on cognition. This is particularly notable relative to spatial ability–generally recognized as a component of mathematical skill (Bock & Moore, 1986).

The large body of relevant research includes epidemiologic studies that correlate spatial ability in females with their age at puberty and with specific hormonal profiles (Nyborg, 1983). In addition, clinical research has documented that spatial competence in females fluctuates with their menstrual cycles (Hampson, 1990a; Hampson, 1990b). Ability appears strongest during the phase of the cycle when levels of estrogens are lowest.

Clinicians have also found improvements in spatial skill among female-to-male transsexuals, as well as a decline in this ability in male-to-female transsexuals (Van Goozen, Cohen-Kettenis, Gooren, Frijda, & Van de Poll, 1995; VanGoozen, 1994). The former, of course, receive masculinizing hormones as part of their treatment; the latter, feminizing hormones.

Evidence that hormones modulate the pubertal decline in certain female abilities is at least as compelling as AAUW's argument that schools are responsible. Actually, this is an understatement; in scientific terms, the former is far more convincing. Yet, contrary to any reasonable standard of scientific scholarship, AAUW makes no mention of this alternative explanation.

One might hope that its exclusion could be defended as a simple oversight. Alas, it appears that AAUW was aware of this evidence well before it released *HSSG*. In a position paper published three years earlier, AAUW noted, "Some researchers have suggested that differences in intellectual functioning are caused by . . . the effect of sex-linked hormones on brain development before birth and at puberty" (1989, p. 2).

Admittedly, its earlier statement downplayed this concept on the (inaccurate, and indeed ironic) grounds that it "hypothesize[s] cause based on correlation." Nonetheless, it demonstrates AAUW's awareness of this research–knowledge that, scientifically, translates into an obligation to be considerably more forthcoming.

Conclusion

The debate over "gender equity" is fueled, in part, by disagreement about the meaning of this term. To some, it means equal opportunity to pursue a given interest. For others, it is nothing less than equal outcomes by sex–whether measured by test scores, career choice, or income.

This difference of opinion appears unlikely to be resolved soon. Nonetheless, both sides hopefully would agree on one basic point. It is that the concept of gender equity requires that those who participate in scientific debate–be they male or female–adhere to the same basic, time-honored principles of scholarship.

Regrettably, *HSSG* falls short on this count. By confusing correlation with causation, omitting contrary data, and ignoring alternative explanations, it does little to promote an image of females as competent scientists. Moreover, in presenting girls as education's victims, it denies them their due for achievements and commitment to learning often surpassing that of their male peers.

Nothing in this critique is intended to imply that all is well in America's schools. Clearly, these institutions are beset with numerous problems. However, *HSSG* notwithstanding, it is clear that invidious discrimination against girls is not one of them.

References

AAUW. (1989). Equitable treatment of girls and boys in the classroom. Washington, D.C.: American Association of University Women.

AAUW. (1991). Shortchanging girls, shortchanging America. Washington, D.C.: American Association of University Women.

AAUWEF (Ed.). (1998). *Separated by sex: a critical look at single-sex education for girls*. Washington, D.C.: American Association of University Women Educational Foundation.

Bell, J. (1989). A comparison of science performance and uptake by fifteen-year old boys and girls in co-educational and single-sex schools–APU survey findings. Educational Studies, 15(2), 193-203.

Bock, R. D., & Moore, E. G. J. (1986). *Advantage and disadvantage: a profile of American youth*. Hillsdale, NJ: Erlbaum.

CRW. (1996). *How schools shortchange girls: the AAUW report*. New York: Marlowe & Company.

CSH. (1964). *Smoking and health: report of the advisory committee to the surgeon general of the public health service*. Washington, D.C.: U.S. Department of Health, Education, and Welfare.

ETS. (1997). College-bound seniors 1997. On-line: http://www.collegeboard. org.

Finn, J. (1980). Sex differences in educational outcomes: a cross-national study. Sex Roles, 6(1), 9-26.

Goodenough, E. W. (1957). Interest in persons as an aspect of sex differences in the early years. Genetic Psychology Monographs, 55(8), 287-323.

Hampson, E. (1990a). Estrogen-related variations in human spatial and articulatory-motor skills. Psychoneuroendocrinology, 15(2), 97-111.

Hampson, E. (1990b). Variations in sex-related cognitive abilities across the menstrual cycle. Brain Cogn, 14(1), 26-43.

Hedges, L. V., & Nowell, A. (1995). Sex differences in mental test scores, variability, and numbers of high-scoring individuals. Science, 269(5220), 41-5.

Kempner, T. D. (1990). *Social struscture and testosterone: explorations of the socio-bio-social chain*. New Brunswick: Rutgers.

NABT. (1995). Statement on teaching evolution. On-line: Available http://www.nabt. org/Evolution.html.

NAEP. (1996). Report in brief: NAEP 1996 trends in academic progress. On-line: http://nces.ed.gov/naep/96report/97986f4.shtml.

NSF. (1994). *Women, minorities, and persons with disabilities in science and engineering*. Washington, D.C.: National Science Foundation.

Nyborg, H. (1983). Spatial ability in men and women: review and new theory. Advances in Behavior Research and Therapy, 5(2), 89-140.

Sommers, C. H. (1994). *Who stole feminism: how women have betrayed women*. New York: Touchstone.

Sommers, C. H. (1996). Pathological social science. In P. R. Gross, N. Levitt, & M. Lewis (Eds.), *The flight from science and reason* (pp. 369-81). Baltimore: Johns Hopkins University Press.

Steedman, J. (1985). Examination results in mixed and single-sex schools. In D. Reynolds (Ed.), *Studying school effectiveness* . London: Falmer.

Stumpf, H. (1995). Gender differences in performance on tests of cognitive abilities: experimental design issues and empirical results. Learning and Individual Differences, 7(4), 275-87.

Van Goozen, S. H., Cohen-Kettenis, P. T., Gooren, L. J., Frijda, N. H., & Van de Poll, N. E. (1995). Gender differences in behaviour: activating effects of cross-sex hormones. Psychoneuroendocrinology, 20(4), 343-63.

VanGoozen, S. H. M. (1994). *Male and female: effects of sex hormones on aggression, cognition, and sexual motivation*. Amsterdam: University of Amsterdam.

Wilder, G. Z. (1996). Correlates of gender differences in cognitive functioning. Report 96-03. New York: College Entrance Examination Board.