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Males and Females and the Learning Process

Introduction

Individual children pursue different interests, learn about the world in different ways, and exhibit a wide variety of learning styles and levels of achievement. Because educators are committed to a curriculum and believe children cannot be left to their own devices, and also because our culture values the creation and dissemination of knowledge, educators have categorized children into groups. Such categories can merely represent a rough segregation of a classroom: good, medium, poor—often relabeled as bluebirds, robins, and orioles, or whatever. More recently these labels have become increasingly pernicious, not because teachers are nastier but because educational institutions have succumbed to an escalating tendency toward hierarchical organization. Somebody at the top must decide what everyone else is going to do. The someones at the top are the "professionals" who often have never seen a child at close quarters, much less in a classroom. But they know about such things as how to select and construct ineffective reading primers, how to draft inappropriate reading diagnostic batteries, and, more important, how to borrow medical jargon to make a strong argument for the relevance of scores on such batteries. Thus we have seen an explosion in the past decade of such concepts as "minimal brain dysfunction," "dyslexia," "childhood aphasia," "nonspecific CNS syndrome," "hyperactivity," and so on. These adumbrations are the result of having scored below a certain percentile on some test or other designed by someone to test something he or she doesn't understand.

Because of my research on sex differences, I was abruptly hurled into this milieu when someone finally let the cat out of the bag: All (or almost all) of those who are scoring "below" are boys—they make up 75 percent of our reading disability populations and 85 percent of the hyperactive populations. To understand what these high percentages mean it is important to understand how achievement tests are standardized and the meaning of the word "normal."

Normality is a statistical concept that refers to what "most people do." Technically what is "normal" encompasses two standard deviations of the Gaussian distribution or 68 percent of any given population, though this cutoff is arbitrary. Learning-disabled children are defined according to their deviations from age norms; that is, they must fall around or below one standard deviation from the mean.

Two examples will suffice to show the extent of the problem. Satz and Morris revealed nine identifiably distinct categories of children with respect to their scores on reading, spelling, and arithmetic tests.[1] Of the 230 ten-year-olds in the sample, two of the nine groups, representing 89 children (or 39 percent), were classified as clearly retarded when compared to the age norms for all tests. Given that 16 percent will be in the superior range on any given test and 16 percent will be in the inferior range, what can be said about the statement that 39 percent of a population are functioning well below "normal"? It only begins to make sense when one considers that Satz and Morris's entire population consisted of *boys* and that the tests' achievement norms are standardized for both sexes.

Take another example: The estimate for the incidence of hyperactive children in the population is 15 percent, with a male-female ratio of 6 to 1. This means that for every 100 children, 13 of the 15 children diagnosed as hyperactive will be male, indicating that 26 percent of *all males* are hyperactive, way beyond the "abnormal" 16 percent.[2] But hyperactivity is not a superior/inferior dimension. It refers instead to behavioral extremes and ranges from hypoactive (stuporous) to hyperactive (uncontrollable). Both ends of the distribution are equally deviant. If 26 percent is the cutoff for normality at the hyperactive end of the distribution, then it *must also* be the cutoff at the opposite end. This gives us a total of *52 percent of all males being abnormal!*

It seems clear that something is terribly wrong with a society that designates 39 percent or 26 percent (actually 52 percent) of its boys as abnormal, suggests that they all have either brain damage or antisocial tendencies, tars them with inscrutable labels such as dyslexia, minimal brain dysfunction, and aphasia, and forces them to comply with norms established for both sexes by largely female instructors. (The *only* diagnosis for hyperactivity is the teacher's or parent's tolerance for annoying behavior.) Having spent some years studying the reasons that females have difficulty in higher mathematics, I believe that assigning female deficits such as mathphobia to social factors like "male chauvinism" while attributing male deficits to "brain damage" reflects more on current politics than on scientific or intellectual acumen.

There is no question that in two major domains of school difficulties—learning disabilities and hyperactivity—boys are overwhelmingly represented. Various hypotheses have been generated as to why this should be the case, and the data are accumulating. Before setting out to review them in some detail, I would like to dispose of four popular theories.

The Brain-Damage Theory

To adopt the view that over a quarter of all young boys have brain damage is, to say the least, to make an astonishing assertion. In fact, no specific neural anomaly has ever been discovered that correlates with learning disabilities. But a sex effect robust enough to produce a ratio of three to one that holds up across many studies in many countries must have something to do with male and female brains. This is not because the brains of one sex or another are "damaged" but rather because they are structurally *different*. McGuinness and Pribram have reviewed the evidence on sex differences in cerebral organization and brain uptake of hormones.[3] Marion Diamond at the University of California, Berkeley, has recently demonstrated striking differences in cortical thickness of the two hemispheres in male and female rats. Diamond found that the developmental curves for changes in left-right cortical ratios were *completely* different in the two sexes, and there was strong evidence of structural differences in the CNS between males and females reared in identical environments. In addition, she found that the environment operates upon a plastic cellular network, setting up patterns of activity that in turn produce further anatomical changes in the CNS.[4]

Cultural Determinism

Culture-only theorists suffer from the grave misapprehension that blaming the culture explains all, when in fact it explains nothing. It just obscures the problem. We know there are limits to our capacity to learn (a biological bias) but that learning *is* possible. The environment does make a difference, yet teaching cannot produce an Einstein (in his case it was even counterproductive).

Apart from instilling values, passing on knowledge, and developing techniques for training the mind, the culture can also produce labels for certain kinds of behavior it does not admire, wishes to ridicule, or wishes to eradicate. Unfortunately, in the case of young boys with learning problems, it is more often the child who is eradicated than the behavior.

If teachers promote maximum self-respect and self-confidence in children while teaching at a pace and style suited to each student, they can do no more. What goes on in the culture, in this instance, is irrelevant. The problem is really what does suit each student? If we discover boys have trouble with certain tasks and girls do not, then the key question is, "What are the girls *doing* that makes learning more efficient, and what are the boys *doing* that makes it inefficient?"

Developmental Lag

There is no longer any logical or experimental basis for a *global* theory of developmental lag in intellectual function to explain male deficits. Several studies have demonstrated that males are developmentally *accelerated* in tasks requiring three-dimensional visualization. Sophistication in three-D tasks in young males has been found in Scotland, in Ghana, and in the Pakeha of New Zealand. Piagetian conservation tasks, especially those involving quantity and area, are solved at a *higher* developmental age by U.S. white boys and by boys in grades three through six in Papua New Guinea. In the conservation tasks, though Papuan boys were considerably below U.S. and European norms, they were two years ahead of girls. One must ask: What, then, is "lagging"?

Attention

Problems in controlling and focusing attention are at the core of the difficulties exhibited by the hyperactive child. But there are two grave difficulties with the term "attention." The first, and perhaps more crucial, issue deals with the question, "Attention to what?" That is, it *does* matter what you ask a child to pay attention to. In most studies purporting to analyze attentional deficits in hyperactive or learning-disabled children, the tasks in question are utterly boring, repetitive, and monotonous; vigilance tasks are a prime example. The staying power of the child, the ability to maintain attention over time, is considered a major indicator of hyperactivity. Suppose instead, one measured the length of time the child spent kicking a ball against the garage door or the number of attempts made to negotiate a steep slope on a skateboard. How would the criterion of time spent on a task fare?

The second issue is that attention in these studies is often defined *exclusively* in terms of the amount of time one is able to concentrate on a task. But there are other aspects in the regulating of attention. An important factor is the ability to inhibit reactions to distractions.

The problem in studies of attention, therefore, is to disentangle variables about the task from elements reflecting the efficiency, or lack thereof, of the systems controlling attention. As there is not a single

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study among over one hundred I have reviewed that has successfully accomplished this, and the diagnosis of hyperactivity is completely arbitrary, I conclude there is no such thing as hyperactivity, at least as it is currently defined. Hyperactivity accompanies certain brain lesions. But to assume there is a connection between this form of behavior and naughtiness is to strain the imagination.

Reading Disabilities

The reading disabilities problem is more pertinent, and certainly it is more productive to pursue this issue because of the quality of studies in the literature and the amount of crosscultural research.

Environmental Factors in Reading Difficulties

In school populations, the sex ratio for dyslexia is around three to one. However, in clinical or remedial settings the ratio is as high as five or six to one. These figures strongly suggest there are two factors at work. One, I believe, is a biological factor that is outside culture; the other is *environmental*, proving that males are subject to environmental factors that predispose against acquiring fluent reading skills.

In societies where reading is highly stereotyped as male or highly valued among males, sex differences in reading ability disappear. Other data suggest that almost any aspect of environmental manipulation affects male scores. When the reading material is matched to the interest of individuals, boys do as well as girls on reading tests, but when low-interest material is involved, they do remarkably worse. Testing procedures are important. Rowell tested 240 third through fifth graders on oral and silent reading comprehension.[5] Girls did equally well on both tests, but boys did better on oral reading. When emphasis is on vocabulary rather than fluency and comprehension, males are often found to be superior. Training methods also make a difference. In phonics-oriented classrooms females improve significantly over males. Gies found vocabulary scores were significantly higher for boys in closed classroom environments than for those in open class environments. Girls scored higher than boys on other language abilities regardless of type of classroom.[6]

Lanthier and Deiker's study of 117 adolescent in-patients found that male, but not female, reading and math achievement scores were significantly correlated to parent scores, especially to those of the *mother*. The effect of the sex constitution of families turns out to be an extremely important variable in male reading achievement.[7] Cicirelli studied 600 middle-class white families. In the population as a whole females were superior on various language tests. When Cicirelli looked at the sex of siblings in two-, three-, and four-child families he found the boys' performance on language tests and their IQ scores increased noticeably if they had at least one female sibling, especially in three- and four-child families. Here males had a mean increase in IQ of seven points and one stanine higher on reading scores.[8]

An obvious conclusion from these data is that females are more *spontaneously* gifted in language and reading skills, and their abilities are not diminished by type of instruction or size or sex constitution of the family, whereas male reading ability is affected by these factors.

These data bring us to the crux of the nature-nurture issue. In a constant environment sex differences emerge—a biological program. In extreme environments the performance of males, not females, swings dramatically. Males are at *risk* to many environmental situations, at least in regard to reading.

The remainder of this paper explores the evidence for sex differences in auditory and motor skills and the correlates of language function and reading achievement. A theory is proposed that motor functions develop differently in boys and girls and that it is in sensory-motor integration that the sex differences become most pronounced.[9]

Sex Differences in Auditory and Fine-Motor Skills

The evidence supports the contention that females show greater aptitude in speech development, auditory integration, and fine-motor control. Sensitivity to loudness is significantly greater in female children and young adults.[10] Threshold shift—an effect that shows auditory sensitivity to noise—is greater in females than in males at ages four to eleven. Males over fifty with no known hearing deficit were found to have significantly more hearing loss and poorer speech discrimination scores than females. These findings confirm those in a survey carried out by Corso in which females were found to have superior hearing to much later ages. These data suggest a greater sensitization to auditory signals in females.[11]

However, the auditory system is not a unit exhibiting equal facility in all domains. In one study, males and females had similar performances on the threshold task up to approximately 4,000 Hz and identical ones on a difficult pitch-discrimination task when years of musical training were taken into account.[12] The overwhelming sex difference was in sensitivity to loudness. Should this sex effect be maintained in loudness discrimination, this difference would indicate that females have a considerable advantage in processing information concerning the *dynamics* of speech, which convey emotional quality. In that case females would extract information about the emotional aspects of speech before semantic processing had begun. Support for this view comes from studies showing female musicians have greater awareness of musical dynamics than males and from investigations of mother-infant interactions showing females are more consoled by their mothers' speech and that speech increases their babbling rate. This interaction is of primary interest because it has not been found that mothers speak differently to sons than to daughters.[13]

Auditory sensitivity is accompanied by more precocious speech development in girls. Moore found that scores on the Griffiths Speech Quotient were higher in girls at age six months and that by eighteen months this difference was statistically significant. The speech quotient scores were highly correlated with subsequent language development in girls but not in boys.[14]

By age two to two and a half children are completing their repertoire of consonants. In 90 children Paynter and Petty found no significant difference between boys and girls at age two, but by age two and a half many more girls had added the most complex sounds—s, l, st, and r—to their repertoire. In 90 percent of all cases, boys had five consonants, girls seven.[15] Males consistently have more hesitations and revisions, have considerably more trouble singing in tune, and are subject to speech disorders more often than girls.[16]

Various studies have indicated that the primary female aptitude in both receptive and productive language is the ability to process temporal sequences, suggesting a general *motor* program for language. For example, evidence supporting the idea of a generalized motor capacity underlying language comes from Gattney's study of five- to seven-year-old deaf children investigating receptive language in response to signing. Girls were significantly better overall in processing complex linguistic aspects of syntax, word order, inflection, and interrogation. This superiority was independent of IQ, hearing impairment, and months of schooling.[17]

Females show a greater aptitude in fine-motor sequencing ability but not in tapping speed. Girls' superiority over boys actually increases from ages five to ten. Boys do not improve after age eight.[18] An unpublished study found that teaching a simple sixteen-bar dance sequence to eight novice females required only one or two trials. By contrast, several males of the eight tested were unable to make transitions between movements although they understood the patterns and the sequence.

Some studies investigating sex differences show that the effects are most pronounced when information has to be translated between sensory modes. Majeres concludes from his data on speeded crossmodal tasks that the translation to a *verbal* code is what produces the efficient response in females.[19] In my own study, college-age males and females were asked to search for target letters (A or I) or target sounds (eh or ae) in words presented visually or auditorily. In the visual condition, the sexes did not differ noticeably in reaction time or error scores. However, when asked to identify a sound in a spoken word, males made significantly more errors than females, and they performed *at chance levels* when asked to determine whether a target *letter* was present in a spoken word. These are surprising results for a highly verbal university population in Great Britain; they suggest males have great difficulty translating an auditory phonemic code into its visual counterpart.

A wide range of data shows that naming (semantics, the lexicon, etc.) and syntax (the *rules* of generating linguistic strings) are systems independent of those that receive and generate speech. The skills important to reading are acknowledged to be fluent phonic analysis and auditory comprehension.

Although females are somewhat more advanced in learning letter names, the problem in learning to read is not one of *remembering* which sounds are attached to which letters. It is, rather , the problem of being able to make the letter-sound transform *at sufficient speed* to be able to generate a word. The sex effect appears to be determined in large part by the speed at which these transform operations occur. It is not surprising that if one is efficient in performing faster and with less effort a perceptual-motor skill that underpins a cognitive process, one will favor that cognitive process over others. This reasoning may explain why females persist in adopting verbal strategies when they are inappropriate to a task, such as one requiring spatial reasoning; it also provides a hypothesis about why females do poorly in algebra and even worse in geometry and trigonometry. Mathematics, a language describing objects in space, is more closely related to syntax than to phonics. It is impossible to "talk mathematics" or communicate it verbally, which is why mathematicians inevitably retreat to blackboards or table napkins when asked what they are "talking about."

This has been an attempt to untangle the factors that might underlie sex effects in reading disability out of a maze of snarled threads. So far, many of the studies on auditory processing deficits in poor readers have not reported sex effects except in spelling scores. Often where the sex of the subjects has been reported, subjects were selected because they were "poor readers" or "good readers." For example, one study reported no sex differences, stating only that one child of each sex was selected from both above and below the class median—thus biasing the sample to an excess of poor females and good males. Furthermore, motor sequential fluency has never been tested in conjunction with reading in normal students.

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All one can conclude so far is that the strongest predictor of reading ability is phonological encoding and a general "language" facility and that females appear adept in both.

Conclusion: Sex Differences and Knowledge

Where, then, is knowledge, and how is it derived? The main question is how a complex world view can be constructed from a limited subset of energies impinging on our senses; it can be answered in part by noting that the nervous sytem is set to respond to *patterns of regularities* in the external environment. Without these regularities, chaos would ensue. Knowledge begins with the predictability derived from the regularities in the world being mapped onto the regularities in the CNS. This means that knowledge consists of three basic aspects: (1) what exists in the world, (2) what sensitivities we possess inherently, and (3) which of those external signals or patterns we *choose* to monitor.

The world-out-there is in two basic modes: objects or entities that do *not* generate information, and objects or entities that do. An inert object in space does not transmit information about itself; information can be derived only by operating upon the object in a number of ways. By contrast, other human beings transmit information or *believe* they are doing so. In order to "know" people, one must operate upon the *information* they believe they are generating as well as the information actually generated in the listener. Note that "information" is used here in the classic sense: to reduce uncertainty. No static object will reduce any uncertainty unless it is operated upon. An operation may be as primitive or minimal as noting the object's relationship to other objects in space.

In focusing on the differences between the sexes, we see that in boys, at least in the West, the predisposition is to be biased toward the world of objects—where knowledge can only be gleaned by action. In girls the predisposition is a bias toward the world of persons where knowledge is gained from *nonaction*—by tuning in. Nonaction does not mean passivity or *no* action. It is "active suppression of motion," a motor readiness.

These very different modes of generating knowledge lead to further predictions about *what* is learned. First, girls are easier to teach, and they find information about persons in complex social settings easier to process. Second, males know more about the physical properties of objects and object relations. Finally, these differences will be reflected in the nature of thought. If the "regularities" from the world are essentially stable and predictable over time, one's thought will become more and more "homogenistic," that is, schematic, hierarchical, and categorical. If, on the other hand, "regularities" only arise by correlating information (statement), belief (assumption behind the statement), and behavior (outcome), one's thought will become "heterogenistic" and interactive. This kind of thinking is pragmatic, context-dependent, and tolerant of multiple ambiguities.

As one's thought is, so is one's language. A homogenistic thinker uses language as a means for naming objects and events, generating rules, and so on. A semantic language user often comes to believe that the name *defines* the object; for such an individual, as Cassirer has noted, description can become magically synonymous with the thing itself. The name *becomes* the thing. A further stage in this process is to name a name and believe one has the meaning *in* the name. Ultimately this can be elaborated in ritual—for a ritual is nothing more than an extension of naming; a ritual is a "name" to magically create an event. The ritual becomes the event and an end in itself. A ritual is the ultimate in referential naming because it must be carried out in exactly the same way, in the same sense that a name will cease to exist if its phonemes are rearranged.

Contrast the homogenistic thinker to the heterogenistic thinker, who uses language as a means to an end. That end is always the sharing of meaning. Language itself doesn't have meaning, but it is used to generate or refer to meaning outside language. A name will never "define" anything, simply because definitions are not at issue. Nor will language define meaning. Meaning can only be approximated by a variety of linguistic and nonlinguistic expressions. Meaning is superordinate to language, never embedded in it; it refers instead to intentions and feelings.

A homogenistic thinker will make remarks like, "Now that you have defined your terms, I see we are in agreement," or "This afternoon we will discuss the meaning of 'knowledge.'" A heterogenistic thinker in similar settings will note, "Gentlemen, you have been talking for an hour and you have said nothing," or apropos of a whining child, "His cry doesn't *mean* anything. Just leave him alone."

It is of some considerable interest that Western society is moving towards a more heterogenic position, especially in science and philosophy. In this we will begin to approach a balance between the masculine and feminine perspectives.

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