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Stanovich's reply

One of the things that humans do that sea slugs do not is to engage in honest argument and debate about ideas and evidence. Indeed, the humanizing idea at the core of the scientific world view is that we can contest ideas and evidence without personalizing the conflict. Humans have a culture of critical discourse where ideas can be defeated without eliminating from the conversation the individuals who put forth the mistaken claims. The purveyor of a bad idea or an incorrect empirical generalization might have the right idea the next time around. This is why it is important to keep the idea purveyor in the game—if not the idea itself. Actually, Popper's (1972) famous example concerned the amoeba rather than the sea slug, but the point is the same:

> This is how we transcend our local and temporal environment by trying to think of circumstances beyond our experience: by criticizing the universality, or the structural necessity, of what may, to us, appear (or what philosophers may describe) as the 'given' or as 'habit'; by trying to find, construct, invent, new situations—that is, test situations, critical situations; and by trying to locate, detect, and challenge our prejudices and habitual assumptions. This is how we lift ourselves by our bootstraps out of the morass of our ignorance; how we throw a rope into the air and then swarm up it—if it gets any purchase, however precarious, on any little twig. What makes our efforts differ from those of an animal or of an amoeba is only that our rope may get a hold in a third world of critical discussion: a world of language, of objective knowledge. This makes it possible for us to discard some of our competing theories. So if we are lucky, we may succeed in surviving some of our mistaken theories (and most of them are mistaken), while the amoeba will perish with its theory, its belief, and its habits. (p. 148)

With the exception of a few rhetorical flourishes, Grundin responds in the spirit of my article by making his main point of contention an empirical one: He claims that studies examining the efficacy of training in phonological awareness and/or alphabetic coding have not demonstrated positive effects on comprehension of text reading. Grundin is simply wrong about this. There are numerous studies that have demonstrated that children given training in phonological awareness and/or alphabetic coding show superior outcomes on measures of comprehension and text reading (e.g., Bradley & Bryant, 1985; Brown & Felton, 1990; Cunningham, 1990; Evans & Carr, 1985; Hatcher, Hulme, & Ellis, 1994; Iversen & Tunmer, 1993; Juel, 1994; Lie, 1991; Olofsson, 1993; Pflaum, Walberg, Karegianes, & Rasher, 1980; Tunmer & Nesdale, 1985).

Grundin's repeated assertion that the outcome variables in these studies have not included measures of text reading or comprehension is demonstrably mistaken, as any reader can confirm by consulting the selection of relevant studies cited above. But his error provides an opportunity to reiterate a scientific lesson I discussed in my original article. As I outlined there, the liberating aspect of empirical science is that it generates knowledge that is in the public domain. The reader need not rely on my personal assurances. The literature is publicly available for teachers to consult and decide for themselves whether it is Grundin or I who is correct. Indeed, the teacher can do better than that. Many of the training programs described in the literature could easily be replicated by teachers themselves. One important aspect of the idea of publicly verifiable knowledge (see Stanovich, 1992a) is that another investigator can duplicate a set of reported results. And the term investigator here most definitely encompasses teachers. Thus, again, no one is reliant on my (or anyone else's) personal authority to support the claim that children given training in phonological awareness and/or alphabetic coding show superior outcomes on measures of comprehension. The claim can be supported by its own empirical replicability.

Contrary to Grundin's assertion, the investigators who have conducted the studies on phonological awareness and alphabetic coding have *not* assumed that "word recognition amounts to reading" and do not assert that "because a reader recognizes a word he or she has actually engaged in letter-sound recoding." Furthermore, I know of no investigator who has ever said that "the technology of reading is more important than children's long-term development as literate persons." These are all strawmen assertions—rehetoric plucked out of thin air in order to trigger negative associations in the reader. Note that these claims are not accompanied by any actual quotes from investigators asserting such things.

Certainly it is obvious that to emphasize the importance of word recognition in the reading process is not to deny that the ultimate purpose of reading is comprehension. But perhaps some logical clarification is needed here. We have all learned that to say that all A are B is not to imply that all B are A. Similarly, although it is possible for adequate word recognition skill to be accompanied by poor

comprehension ability, the converse virtually never occurs. It has never been empirically demonstrated that some instructional innovation could result in good reading comprehension without simultaneously leading to the development of at least adequate word recognition ability. Because word recognition skill will be a by-product of any successful approach to developing reading ability—whether or not the approach specifically targets word recognition—lack of skill at recognizing words is almost always a reasonable predictor of difficulties in developing reading comprehension ability. Simply put, skill at recognizing words is a necessary but not sufficient condition for developing good reading comprehension ability. It is this—and only this—that is a background assumption of much of the work cited above and in my original article.

Grundin's secondary point of contention concerns whether cognitive models of reading treat word recognition and comprehension as separable processes. Here we enter the complicated domains of cognitive psychology and neuroscience, and the evidence is somewhat less clear cut. But, contrary to Grundin's assertion, much recent work in cognitive neuroscience *does* support the notion of the separability of the cognitive/brain processes concerned with lexical access from those concerned with postlexical comprehension (e.g., Carr, 1992; Posner & Carr, 1992). Not only do separate brain architectures subserve word recognition and comprehension but even *within* the word recognition module, subprocesses are subserved by separate and localizable brain areas (e.g., Peterson, Fox, Posner, & Raichle, 1988; Posner, 1992; Posner & Carr, 1992; Posner, Peterson, Fox, & Raichle, 1988). Posner et al. (1988) conclude that:

> The elementary operations forming the basis of cognitive analyses of human tasks are strictly localized. Many such local operations are involved in any cognitive task. A set of distributed brain areas must be orchestrated in the performance of even simple cognitive tasks. The task itself is not performed by any single area of the brain, but the operations that underlie the performance are strictly localized. This idea fits generally with many network theories in neuroscience and cognition.... In this article we review results of studies on cognitive tasks that suggest several separate codes for processing individual words. (p. 1627)

Posner and Carr (1992) review considerable evidence indicating that "visual, orthographic, semantic, and phonological-articulatory mechanisms clearly dissociate in the PET studies, which localize these coding systems in discrete (and widely separated) cortical regions" (p. 8). They argue that:

> There appears to be at least a one-to-one correspondence between basic linguistic properties in need of computation and anatomically separated computational systems....These imaging and lesion results show that the human brain computes linguistically relevant properties of words in a complex set of isolable systems (p. 11)... To the extent that a computational model fails to incorporate this separation of mechanisms, it will lose at least biological fidelity and probably computational adequacy as well. (p. 12)

I would agree with Grundin that the development of phonological awareness is in part a result of the acquisition of reading skill. But this is not a new point. The reciprocal relationship between phonological awareness and reading acquisition (that phonological awareness facilitates reading acquisition and that reading acquisition, in turn, facilitates the development of phonological awareness) has been widely recognized since Ehri's (1979) classic paper and is a fundamental tenet of most models of early reading acquisition (e.g., Brady & Shankweiler, 1991; Goswami & Bryant, 1990; Perfetti, 1985; Stanovich, 1986, 1992b).

Finally, Grundin quotes my statement that children who begin school with little phonological awareness have trouble acquiring alphabetic coding skill and thus have difficulty recognizing words and then states that "this does not tell us what to do to help those children." But there have recently been plenty of very good suggestions for what to do to help these children, some of them published in this very journal (Blachman, 1991; Cunningham, 1992; Felton, 1993; Griffith & Olson, 1992; Spiegel, 1992; Stahl, 1992; Trachtenburg, 1990; Yopp, 1992).

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Summer ends and school begins

Summer days are winding down.
It's time to come to school.
Nighttime shadows drop their veil
And evenings start to cool.

School bells ring a happy tune
As laughter fills the air.
Smiling teachers greet their class
And welcome them with care.

Everything seems strange and new.
Will I make new friends?
Will my teacher smile at me?
I feel a little nervous, too.

But soon the newness slips away
And a cozy feeling stays.
I'm learning such exciting things
And I'm awfully glad I stayed.