

TOWARDS A READER-FRIENDLY FONT:

RATIONALE FOR DEVELOPING A TYPEFACE THAT IS FRIENDLY FOR BEGINNING READERS,

PARTICULARLY THOSE LABELED DYSLEXIC

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ABSTRACT

A critical step toward becoming a fluent reader is learning to recognize, name and distinguish the letters of the alphabet. This difficult task is often a point of failure. The task, however, can be made easier and less prone to failure. This article, based on research by cognitive scientists, provides guides for how to design a font that will help children to learn to read. The article also summarizes the latest research that indicates that slowness in learning the initial steps toward fluent reading, for example, the ability to distinguish letters, has profound, lasting effects on the organization of the brain. Developers of fonts, therefore, can make a significant contribution to the intellectual development of our children by using their skills to design a lettering system, along the lines suggested here, that will be easier to learn.

INTRODUCTION

WE WANT ALL CHILDREN TO LEARN TO READ WELL. WE HAVE A NATIONAL goal that no child should be left behind. Unfortunately, reality falls far short of our aspirations. Developmental reading disorders, not explainable by mental retardation, by grossly inadequate schooling or by vision or hearing disorders, occur among about four percent of the children in the United States (American Psychiatric Association, 1994). Developmental dyslexia is not rare. Further, it is the most common problem among those referred to clinics specializing in learning disabilities. Also, we have many teenagers and adults who, although they can read, are not fluent, expert readers.

Many children who initially have problems learning to read eventually develop reading skills. Nevertheless, there is mounting evidence showing that initial failures in learning to read and write, at the times most children learn these skills, have profound, lasting effects. A consistent observation is that children who have difficulty learning to read in the first grade later have (e.g., in their senior years of high school) fewer academic, cognitive skills than their counterparts. Stanovich and his colleagues (1992, 1992) have data to indicate that part of the reason for the persistent deficit is related to

the observation that children who have difficulty learning to read do not like to read and eventually spend considerably less time reading than their counterparts. Our general knowledge of expertise indicates that the critical variable in becoming an expert is time on task.

Evidently, the same general rule is applicable to becoming an expert reader. It is time on task that is the salient variable and, typically, children who are initially slow learners never spend sufficient time on task to become fluent readers.

In Portugal, in the past (circa 40 years ago), the first-born girl was kept out of school and at home to attend to younger children and hence failed to learn to read and write. Girls and boys born later were sent to school, at about six years of age, and learned to read and write. Castro-Calsas and Reis (2000) took advantage of this situation and modern technology, in order to study the cognitive and neural processes that follow from becoming literate. A conclusion that can be drawn from their work is that the processes that are learning to read and write are also processes that lead to a rather dramatic reorganization of the brain. They found, for example, that the major fiber tract connecting the two halves of the brain (corpus callosum) was smaller, at some segments, among illiterate adults than literate controls. So, children who do not become fluent readers and writers may, in fact, have different brain development than those who are fluent readers and writers. This difference, however, is not because of some inherent maturational process that was apt to occur regardless of the kind of education the child were to receive, but because the child did not learn and practice the skills inherent to fluent reading and writing.

Another line of research supports the conclusion that the acts of learning to read are sufficient to modify the structural features of brain. Recently, Simos et al. (2002) showed that 1) children with reading problems (i.e., showed dyslexia) had a different brain organization as manifest in patterns of electrical activity across certain cortical areas of brain and 2) intensive training in learning to read modified that pattern of activity so that it became very similar to that of reading children. These data complement those of Castro-Calsas and Reis (2000). The structure of the brain might be different between readers and non-readers, but that difference is not fixed.

The complicated process of learning to read and write is not only a process to master, but also a process that sets into motion other processes that are critical to developing the brain for reading-fluency. We also surmise that such development is critical for the development of other cognitive skills. This perspective makes it imperative that we make the process of learning to read as easy and as failsafe as possible.

The research (Adams, 1990; Snow, 1998) is sufficient to draw some reasonably definitive conclusions regarding the first steps in learning to read and write. Bond and Dykstra (1967) found that the best predictor of those who will be reading at the end of the first grade of school is knowledge about letters. Meta analyses of the literature accumulated subsequently confirm that observation (Snow, 1998). Merely measuring how many letters a kindergartner can name successfully predicts future reading success. The next best predictor was ability to discriminate phonemes. Barker (2001, 424) commenting on these findings said, “These are not mutually exclusive skills. If the letters b and p are to be learned, the child has to hear the differences between these two sounds as well as recognize the differences in their letter shapes.”

We generally do not remember how difficult it was to learn to read. What seems obvious to adults may not be so obvious to a child just learning about letters and words. As adults, for example, we often presume it is obvious that the spaces between groups of letters denote words. Research, however, has indicated that for many children that is not obvious. Meltzer and Herse (1969) printed sentences on long strips of paper while exaggerating the space between words. They then asked children to count the number of words and to cut with scissors between words. What seems obvious to readers did not seem obvious to nonreaders. Sometimes “words” were just a string of a few letters (short words are the words of the beginning books for children). Sometimes “words” were individual letters. Sometimes “words” were letters with a tall letter at the beginning of a string of letters. So, even what may appear to be obvious probably should be taught. We should plan on attending to everything that might be necessary to becoming a reader.

A prerequisite for learning to read is to be aware of text in print as something distinct from other features of the environment. The child needs to appreciate that print conveys information. This basic understanding can be accomplished by a parent reading to a child. There are, however, children who arrive at school without the experience to have gained this basic insight. So, the first step in learning to read is to gain something called print awareness (Adams, 1990), i.e., awareness that text in print is an important feature of the environment.

LETTER IDENTIFICATION IS CRITICAL

THE NEXT TASK FOR THE BEGINNING READER IS LETTER IDENTIFICATION.

It is not easy to learn the names of the 26 letters of the English alphabet. They are symbols that are graphically abstract having no iconic significance. The child must learn that the name of the upper case letter is the same as the lower case letter even though they may not look alike. Then, there are the 10 digits of the numbering scheme. Also, one must learn about punctuation marks. After the names of the letters have been mastered, there is the chore of learning that these letters connote sounds. Of course, letter identification is critical to recognizing and spelling words, hence is critical to the entire process of gaining reading fluency.

After making the point that an initial step in learning to read is recognizing individual letters accurately, Adams (1990, 130) makes a second, related point that is relevant. She said, "... for the development of word recognition proficiency to proceed at its optimal rate, young readers must be able to recognize individual letters relatively quickly." Letter identification, that is, must be "over learned" and free of confusion and hesitation.

There are teachers who have tried to simplify the learning by not teaching the names of letters but labeling letters with sounds that they will eventually connote. Adams (1990, 351) reviewed the available evidence germane to assessing the success of this approach and decided that it was not particularly helpful. The main point of the discussion seemed to be that "there is, in itself, pedagogical power in having a label for a to-be-learned concept." The label becomes a focus of the many associations that will be used as the learning proceeds.

THE LEARNING PROCESS FOR LETTER IDENTIFICATION

BARKER (2001, 424) ECHOES ADAMS (1990) IN COMING TO THE conclusion that “no special cognitive mechanism facilitates the learning of the elements of the printed language.” The learning of letters follows the same basic learning principles that characterize other instances of rote learning. There is no magic here, just practice under conditions that allow learning. There has to be attention given to elements such as contiguity, recency, frequency and similarity of stimuli. Consistency and predictability are highly salient. This learning, like other learning, is a product of both discrimination and generalization. The child must learn the invariants of letters across situations as well as learn the distinctive characteristics of the letters.

Given the importance of flawlessly learning the letters and the demand characteristics of that learning, what can the typographer do to make the learning easy rather than difficult? Can the art of lettering be brought to bear on issues of learning to be literate? We obviously believe that the answer to the latter question is yes.

TYPOGRAPHERS AND DESIGNERS OF WRITING SYSTEMS CAN MAKE A DIFFERENCE

A GOAL FOR TYPEFACE DESIGNERS MAY BE TO DESIGN FONTS THAT appeal to certain aesthetic standards. There is a marked tendency, for example, to use the same graphic elements over and over again in order to create visual consistency across the entire font. A consequence is that letters are often difficult to distinguish from one another, particularly for novice readers. The lower cases o, c and e of many fonts, particularly those used in material presented to beginning readers, are often designed from the same graphic element. If a child primarily attends to the left or right of letters or the bottom or tops, as they might initially, these letters will not be distinguishable.

To eliminate this potential source of confusion, we urge typeface designers to use their aesthetic expertise to design letters that are distinct. This will take creativity and a willingness to diverge from certain aesthetic standards in type design. A slight divergence from some rather arbitrary standards, however, seems a small price to pay for the benefit of helping children to learn to read. The goal should be to design letters that are distinct from one another and distinct

from numerals and punctuation marks. This will aid children in learning to name and distinguish letters and to use letters to form words. One can guess that it might even be critical for some children, because, for example, it is very confusing to perceive a shape and know it is an o and then be told it is a c and then later to perceive it is a c and be told it is an o and to have that happen time and time again for letter after letter. It is enough to frustrate almost anyone.

As mentioned, there is a necessity for some speed in letter identification. Such a requirement dictates that letters should be distinct and clearly legible. As will be discussed shortly, there is also the confusion that occurs with letters being tightly kerned (i.e., too close to one another) which can be remedied by skillful design.

The acts involved in learning to print are conducive to learning to identify letters and to learning that letters are elements of words. Given this circumstance, the typeface developed to be friendly to beginning readers should correspond to the templates that are used to teach children to print. Unfortunately, the templates used to teach printing do not correspond to the goal of having letters be distinct from one another. The resolution is to “morph” the two, i.e., the standards for the templates for printing can be modified slightly and the typeface can be slightly different from the templates. The goal is not necessarily to have perfect correspondence, but merely to have easy generalizations from one rendering of a letter to another. There should be positive transfer between learning to identify and name letters to learning to write letters by hand. Unfortunately, occasionally, the typeface used to teach reading presents the circumstance for negative transfer, i.e., the learning of one task interferes with the learning of the other.

We are advocating that the developed letters of a friendly font should be distinct from one another, but not widely different from templates used to teach writing. There should also be easy generalization, for a given letter, between upper and lower case letters. The circumstance with the letters c and x are nearly ideal. They are clearly different from one another. Between upper and lower case, they look alike, except in size. Further, the standards for these letters for printing and even cursive script are similar to the letters in most fonts.

Unfortunately, the differences between c and other letters, e.g., o and e, do not conform to the ideal of ability to distinguish them across letters, particularly in lower case. Further, uppercase E and lowercase e have a number of features that indicate that they are different from one another.

Notice that arranging it so that there is an easy generalization between upper and lower case letters considerably reduces the task faced by the beginning reader. It does not reduce the task by half (only some letters can be designed to be easily generalized from one case to the other), but does reduce the tasks considerably. The letter G presents a difficult design problem. There are as many as five forms of G, which are common in material usually presented to beginning readers, and each form is very different from the other. Devising a system in which each letter is distinct, but similar across cases, typeface and writing will indeed simplify the task and make it less confusing.

There is well-developed knowledge concerning the processes of visual perception and pattern recognition. We recognize shapes, including letters, by using feature identification. Further, we know that this process is a manifestation of the anatomy and physiology of the neural apparatus from the eye to the brain (Ashcraft, 2002). An implication of such specialization is that we should not change basic features of letters. Letters that are rounded should remain rounded because that roundness is a salient, basic feature. Other basic features include lines oriented vertically, horizontally and at forty-five degree angles. To be concrete, O, C and Q should not emerge as straight and angled lines, but should retain roundness while at the same time emerging as distinct.

As we inspected various fonts as potential candidates for use by beginning readers, we noticed that the spacing between letters presented many problems. For example, with some fonts, when the r was placed next to an n (i.e., rn), the result looked very much like m. Given this circumstance and its potential for confusion, it seems reasonable for a font for beginners to have distinct letters and when juxtaposed do not appear to be another letter of the alphabet. There may also be a need for graphic standards that dictate the type size, kerning and tracking of text set in a reader friendly font.

Though there may be some advantage to experienced readers to have ligatures like *ffi* appear as a unit as it does in some fonts (also, in some fonts *ct* and *cl* looks very much like *d*), there is almost no advantage to novice readers.

We understand that there is an extant body of thought indicating that fluent readers perceive the shape of a word rather than each separate letter and from that premise there may be some advantage to spacing letters close together (Bringinghurst, 1992; Clair, 1999). There is considerable experimental evidence that can be brought to bear on this issue, which has been admirably reviewed by Adams (1990). Further, Adams conducted this review with the aid of a large panel of reading experts acting as advisors. A consensus emerged (also, see Snow, 1998). People read letters, but they get so good at it that among fluent readers it appears that they read words. Further, the goal remains for children to progress from nonreaders to fluent readers, which means they eventually have to process letters so efficiently that the percept is a word. The process, however, is processing letters. Further, since certain letters occur together more frequently than other combinations (i.e., there are spelling patterns), expert readers have the advantage of having learned this and that helps them to process letters more efficiently.

Knowing how people process letters to form words provides some guidelines for developing a font for beginners. We deduce that making the letters rather narrow will be an advantage. It will reduce some opportunities for confusion for beginning readers. It may even help experienced readers, but we found no strong evidence to bear on that issue. Expert readers have such a well-developed orthographic processing system, having so many associative nodules, that the slight differences in most commonly used fonts are probably not germane to efficient reading.

There is an alphabetic system, popular in Britain, which teaches reading by way of a “reformed,” phonemically regularized alphabet. The system, the *i/t/a* curriculum (initial teaching alphabet), also uses marks to denote differences in vowel sounds. There is evidence that it is helpful to a number of children (Adams, 1990). Developing fonts using guidelines we are advocating here, however, can make some of the same gains. Further, the child will not have to unlearn

features to generalize to the common fonts used in most of our print media. The limited success of the i/t/a curriculum does indicate, however, that developing a font specifically for beginning readers will achieve some measure of success.

English has been labeled the language of dyslexia. Presumably, that is because so many words are spelled irregularly. It would be nice if that were not the case, but getting agreement to spell words more in accordance with the phonemes of their usual pronunciation is something that is beyond any of us. It is probably worth noting that ninety-seven percent of English words are spelled the way they are pronounced and many of the problem-words are partly phonetic. Nevertheless, designing narrow letters for a font has the advantage of potentially controlling more precisely the space between letters. Consequently, space can be narrowed to indicate digraphs, particularly those that always signify a given phoneme, e.g., qu and ph. If certain digraphs can be noted graphically, some of the confusion associated with irregular spelling can be reduced.

There is a consensus that lateral mirror images are a source of perceptual confusion. Recently, it was found that neurons of the inferotemporal cortex of the macaque-monkey brain responded equally well to b and d, indicating that there may be underdeveloped neuronal apparatus for making the visual distinction between mirror images (Rollenhagen & Olson, 2000). There are a couple of related ideas concerning the difficulty of perceiving the difference between mirror images. One is related to the fact that there has not been either phylogenetic or ontogenetic pressure to perceive mirror images. To use the words of Rollenhagen and Olson (2000, 1506): “a tiger is equally threatening when seen in right or left profile.” Their data, derived from recording relevant neurons, indicate a lack of specialization of neuronal machinery for making such a distinction. The other idea is related to the general bilateral symmetry of the central nervous system’s visual apparatus. Left hemisphere neurons activated by a b must be linked to right hemisphere neurons activated by a d. Given the possibility for confusion, particularly among those whose neural apparatus are just developing and who have limited experience at detecting mirror images, it seems that we should just avoid making letters that are mirror images of one another.

There are clearly things we can do to make learning to read easier. We can make, for example, periods (full stops) more compelling than commas (half stops). Yet, in font after font, used in children's readers, the comma is commanding and the period is rather diminutive.

Eventually a child must respond correctly to the invariants of the thousands of slightly different ways each letter is presented. There has to be generalization from the letters used initially to those used eventually. The relevant rules of learning, however, are uncontroversial. Learning is slowed, retarded, when different stimuli call for the same response and the same response is to be elicited by different stimuli. It is most efficient to learn the response to some consistent stimulus and then generalization will almost automatically occur to similar stimuli. A child that learns to identify letters using one writing system, and learns that very well, is not apt to have much difficulty generalizing that learning to different fonts. The converse is not the case, however. Presenting many variants of a letter, with the hope of achieving generalization across fonts, is apt to be merely confusing and retard substantial learning.

We call for the development of a font that has distinctive letters, that is clearly legible, that has few or no mirror images, that eases generalization across upper and lower case and eases generalization from what is asked to be printed by the beginning reader and what is asked to be read. There should also be some consistency, when possible, from cursive script and the emergent font and some consistency from what is apt to appear on a computer screen and what is being presented to a beginning reader. This asks a lot. Yet, there is more. There is another criterion. The emergent font has to be clearly recognizable by expert readers. Further, the emergent font for beginning readers cannot appear peculiar, i.e., it has to generalize eventually to the other fonts of the print world. It should be different, but not too different. Of course, it should be as beautiful as its functionality will allow.

We have recommended a number of design characteristics that we deduce will be friendly to beginning readers and dyslexics. We have deliberately not provided any specific examples about how a particular letter ought to look. Our recommendations are derived from the expanding literature of cognitive science, typography and type design;

and, consequently, are subject to the same changes as the changing content of the science itself. We believe, however, that there is a sufficiently well-developed body of extant knowledge (Adams, 1990) to confidently conclude that by attending to the font presented to beginning readers that considerable progress can be made in helping our children. The talents of a number of designers all trying to devise a friendly font is apt to be the best way to get designs to meet the goal of having a friendly font for beginning readers.

Those interested in the art of lettering have often focused, recently, in making letters unique and attention attracting thereby achieving a goal of advertising. Those neuropsychologists interested in learning disorders, particularly dyslexia, have focused, recently, on classification and diagnosis of the disorders (Kolb, 1996). Until recently, the reading specialists have been focused on what has been called “the reading wars” (Snow, 1998) (incidentally, the polemic war is over and the decision has been made to let experimental science determine the value of various ways of teaching reading). With very few exceptions, e.g. (Sassoon, 2002), there seems to be a lack of focus on lettering for beginning readers by either developers of fonts, neuropsychologists or reading specialists. Obviously, by now, one of the goals of this essay has been to advertise the possibility of a font that is friendly for beginning readers and dyslexics. A number of neuropsychologists and other specialists might argue that, although such an enterprise is O.K., it will have only a marginal impact on the incidence of disorders of learning to read. Recall, however, the possibility that the differences in brain they might observe may be a result of failure to become literate rather than the cause of dyslexia. Also, meta analysis of the literature (van Ijzendoorn et al, 1994) on non word reading deficits (an index of phonological deficit which, in turn, indicates a poor central nervous system processing unit) in relationship to developmental dyslexia came to the conclusion that nonword reading deficits were common among those with developmental dyslexia, but only accounted for fifteen percent of the variance of the presenting problems. As the authors acknowledged, the occurrence of this deficit is statistically significant but leaves plenty of room for alternative explanations and approaches to the problem. They noted that some of the unexplained variance

in children's reading ability could easily be related to poor initial comprehension of basics such as letter identification. Because fonts have not been deliberately designed to be friendly for beginners, those who would complain that such an endeavor will have little impact have little basis for their conclusion.

Developing a font that is friendly to beginning readers, particularly those who might have dyslexia, takes design skills and knowledge of the chores of learning to read. If a child learns to read, the child will be exposed to completely new worlds, one of which will be the artistry of lettering. The artistry of lettering, however, for someone who has had trouble learning the letters is apt to be a source of grief rather than a source of pleasure. Let us move toward the time when everyone appreciates the art of lettering. Recall, no prevention is too early when dealing with our children.

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