CHAPTER

5

RATE LEVEL, R_L

A high rate level, R_L, is necessary for high reading achievement. However, a high R_L is not sufficient for high reading achievement. In the causal model presented in Chapter 1, R_L is one of two factors at Echelon 2 that are the proximal causes of reading achievement, or E_L. The other proximal cause of E_L is accuracy level, A_L, as explained in the previous chapter.

The R_L construct is very helpful for explaining why some people are better readers than others, even though their accuracy of comprehension is not different. As noted earlier, rauding rate, or rate level, has been ignored by many researchers and many educators, and this chapter presents the case that rate level should be ignored no longer. The case for R_L belonging with A_L at Echelon 2 was supported by Carroll (1993) who stated that:

> There is good factorial evidence for distinguishing reading speed from reading comprehension. That is, it seems to be confirmed that individuals can attain equal degrees of comprehension at different speeds. (p. 165)

Carroll goes on to summarize the evidence that he reviewed as follows: "the weight of evidence from these studies indicates that reading speed is a cardinal variable in reading performance, and that it is associated with speed of accessing the memory codes involved in word recognition" (p. 166).

The idea of rate level, R_L, or a constant reading rate, is somewhat foreign to many reading researchers, as well as many educators. The reading rate of a student has traditionally been regarded as being fluid or flexible, that is, changing with one's purpose (Hoffman, 1978). So, it is somewhat unconventional to think that each student has a normal, typical, or optimal rate that is relatively constant, which allows one student to be compared to another student. Likewise, it is a somewhat foreign idea that this normal rate, R_r, could be measured in GE units (see Appendix D), and thereby be scaled in a manner comparable to accuracy level, A_L.

In this chapter, the R_L construct will be defined and related to traditional concepts. Then, tests measuring the construct will be described. Also, empirical evidence relevant to the existence of R_L will be summarized.

Theoretical Construct

Rauding rate level, R_L, is based on rauding rate, R_r. Rauding rate is defined as the relatively constant rate at which individuals successfully operate their rauding process. This theoretical construct, R_r, is somewhat similar to the more traditional concept of normal reading rate. When R_r is measured in GE units, it is symbolized as R_L and called rauding rate level, or rate level. For example, if an individual has a rauding rate of 162 Wpm, then this can be transformed into a grade equivalent of 5.5, so that $R_L = 5.5$ (see Carver, 1994c, or Appendix D).

The rauding rate of an individual, R_r, is also likely to be the fastest rate at which the individual can read relatively easy material and still comprehend accurately. Relatively easy material has already been defined as text which has a difficulty level lower than the accuracy level of the individual, $D_L < A_L$. To comprehend accurately has already been operationally defined as 64% comprehension or higher ($A > .64$), and the successful operation of the rauding process would require accurate comprehension. Rauding rate is very similar to the following concept advanced by Holmes (1954): "Speed of reading is used in this study to denote the rate of comprehension of relatively easy material ..." (p. 8).

Rauding rate can be measured in several different units, besides the GE units of R_L (Carver, 1990a). It can also be measured in standard length words per minute. A standard length word is six character spaces in length—such as five letters and one blank space between words. Actual words per minute will be designated using lower case letters, that is "wpm," while standard words per minute will be capitalized, that is "Wpm." For example, students at the college level of reading have rates around 260 Wpm ($R_L = 13.3$) to 300 Wpm ($R_L = 16.3$). Traditionally, reading rate has been measured by counting actual words read per minute, but easier material contains shorter words than harder material. Therefore, rauding rate is *not* constant across different levels of text difficulty when rate is measured in wpm (Carver, 1990a); rauding rate is constant across different levels of text difficulty (varying D_L) when rauding rate is measured in Wpm and the differing levels of text difficulty are all relatively easy for the individual, $A_L > D_L$ (Carver, 1976).

Rauding rate, R_r, can also be measured in standard length sentences per minute (Spm); a standard length sentence is defined as 16.67 standard length words (Carver, 1990a). In the equations of rauding theory that are used to predict the accuracy of text comprehension (see Appendix C), the value of R_r must be in Spm.

When word length is measured in a standard manner, such as standard words per minute, Wpm, then individuals normally read relatively easy material, $D_L < A_L$, at a relatively constant rate, as noted above. The first law of rauding, Law I (Carver, 1981), is that individuals attempt to comprehend thoughts in passages at a constant rate, called their rauding rate, R_r, unless they

are influenced by situation-specific factors to change that rate (see Appendix B). Ordinarily, the average rate of comprehending a passage, R, is the rauding rate of the individual, R_r, that is, ordinarily $R = R_r$. This means that when individuals are reading text as they normally read, their text rate or average rate, R, is ordinarily the same as their rauding rate, R_r, because there is no time limit that makes the average rate that the text was read different from R_r.

Individuals are not likely to shift out of their rauding rate under normal reading conditions because this rate is also their optimal rate. That is, at rates other than their rauding rate, their efficiency of text comprehension (E) is likely to be lower. This means that they are likely to comprehend less sentences each minute they read when they read at a rate different from their rauding rate; their maximum efficiency of sentence comprehension occurs at their rauding rate. So, R_r is the rate at which efficiency, E, is at a maximum. Most individuals have a constant rate of reading relatively easy text because this rate, called their rauding rate, is the rate that maximizes their efficiency of reading. If they varied their reading rate so it was higher or lower, then the number of sentences they comprehended in a minute of reading would be less (Carver, 1982). The preceding theory has been labeled as the Third Law of Rauding (see Appendix B).

In research situations, individuals may shift out of their rauding process, which they ordinarily operate at a relatively constant rate of R_r. They are likely to shift to a higher gear (skimming or scanning) or to a lower gear (learning or memorizing) whenever (a) the instructions request faster or slower reading, (b) the objective consequences of the experimental task, such as a test, requires more or less than simply comprehending the thoughts in the sentences, (c) the material is relatively hard, $D_L > A_L$, (d) the time limits are so short that the individual does not have time to finish at the rauding rate, or (e) the time limits are so long that the individual has time to finish at the rauding rate (see Chapter 2).

In summary, the rauding rate of individuals is the rate at which they operate their rauding process. This rate is often expressed in standard words per minute, Wpm. When this rate is expressed in GE units, it is called rauding rate level and symbolized as R_L. Individuals tend to read normally at a constant rate because this rate optimizes their efficiency, that is, the number of sentences comprehended each minute of reading is likely to be less at rates other than their rauding rate. So, rauding rate level, R_L, is an indicator of rauding ability and a proximal cause of reading achievement, or E_L.

Related Concepts

Introduction. In this section, rauding rate level will be related to the concepts of reading rate, raudamatized words, rapid single-word decoding speed, word recognition speed, and apping.

Reading rate. The main thing to remember about reading rate, as a traditional concept, is that it is completely empirical; it can be used to measure how fast a person covers words during reading but it does not necessarily reflect a stable attribute of the individual. Individuals can shift gears when reading (Carver, 1992e), so they read at different rates (see Chapter 2). Most college students, for example, will vary their reading rate from around 138 words per minute when they know they will have to recall words in a passage later (Gear 1, a memorizing process) to around 600 words per minute when they only have to locate target words in passages (Gear 5, a scanning process). Individuals operate their rauding process (Gear 3) at their rauding rate, but they can shift out of this gear into other reading processes that operate at different reading rates. An individual may want to be able to remember the ideas better, and therefore shift gears down to a learning process (Gear 2); it proceeds at a slower reading rate because it involves more than simply comprehending the thoughts in the sentences. Or, an individual may want to get an overview of the material, and therefore shift gears up to a skimming process (Gear 4); it proceeds at a faster reading rate because it does not involve the time consuming sentence integration component of the rauding process. Extensive empirical evidence supporting the existence of these five reading gears, or five basic reading processes, has been reviewed by Carver (1990a).

Reading rate is highly contextual and task dependent, varying from gear to gear for an individual. In contrast, rauding rate is relatively constant; it is relatively constant for an individual across different purposes, such as preparing for a test, identifying main ideas, or analyzing author motives (see review of Hill, 1964, by Carver, 1990a). Rauding rate is also relatively constant across different levels of text difficulty, as long as the text is relatively easy; for example, individuals at A_L = 12 and higher will read textual materials varying in difficulty level from D_L = 2 to D_L = 11 all at the same rate in Wpm (Carver, 1983). Rauding rate is a constant reading rate for an individual, but it does vary between individuals. Some individuals can comprehend relatively easy material faster than others; some individuals operate their rauding process faster than others. This relatively constant rate of reading is their rauding rate, and when it is expressed in GE units it is called their rauding rate level, R_L. So, reading rate varies within an individual who shifts from one to another of the five basic reading processes or reading gears, but the reading rate at which individuals operate their rauding process is relatively constant.

Raudamatized Words. The concept of raudamatized words that was introduced in the last chapter on A_L, as an upgrade of the concept of automaticity, also has a direct connection to R_L. Remember that a raudamatized word is one which can be processed during rauding at the rauding rate of the individual. It was also theorized that raudamatized words are overlearned words such that further practice or experience with these words will not decrease the time needed to process them, t_r, because they have reached an asymptote that is common to all raudamatized words of standard length.

Notice that the rauding rate of an individual is also the rate at which standard-length words are read in context when these words are raudamatized words. Also, notice that there is a direct connection between raudamatized words and rate level, because R_L should be measured only when raudamatized words are purported to be involved, for example, using texts that are relatively easy, $D_L < A_L$, because they purportedly contain 100% (or 99% to 100%) raudamatized words (Carver, 1994b).

If raudamatized words are taken from relatively easy texts and presented in a randomized list, and then randomized again each time the list is presented, then individuals should not be able to improve the rate at which these words are read aloud; these words should be at asymptote with respect to the effect of practice upon rate of processing. Indeed, it is the naming of raudamatized words at a maximum rate that forces the constancy of R_r across difficulty levels as long as the text is relatively easy, $A_L > D_L$. An overlearned task cannot be improved with additional practice trials because it has reached maximum performance. Notice that it is not a lack of attention resources, *a' la* automaticity, that is being invoked as the mechanism that limits R_r, or R_L.

The effect of practice on the raudamatization of words was studied by Manis (1985). He gave students in grades 5 and 6, instruction and practice on 24 words they did not know. First, they learned the meaning of these words to an accuracy of 23 out of 24 correct in a trial. Then, they were asked to pronounce each word as fast as they could after it appeared on a computer screen, and latencies were measured. Results were reported in Sessions 1, 2, and 3. The results for Session 1 indicated that these "normal readers" pronounced these newly learned words slower than high-frequency control words. However, the results for Session 3 indicated that these students had overlearned (raudamatized) these 24 previously unknown words because they were pronounced just as fast as the control words. The results were somewhat different for a group of "disabled readers" who also were in grades 5 and 6. They were slower than the normals on all words in Session 1 and these disabled readers were not able to pronounce the 24 words as fast as the control words in Session 3. This means that the disabled readers had not raudamatized these 24 words by Session 3. However, they were clearly improving with practice and would very likely have been able to raudamatize these new words with additional practice sessions. That is, they would be able to recognize them as fast as the control words which they had already raudamatized. Keep in mind that the reading-disabled students had a slower rate of recognizing the control words, which means that they had a lower R_L. Also, remember that the normal-reading students were able to raudamatize the new words with the practice afforded by three sessions, whereas the reading-disabled students improved with the practice afforded but they were not able to raudamatize these words in only these few sessions.

Before continuing, it should be pointed out that in Chapter 2, a formula was given (Equation 2-1) for determining the number of milliseconds required for individuals to operate their rauding process on a standard length word in relatively easy text. The formula required that the rauding rate in Wpm be divided into 60,000; for example, if a college student had R_r = 300 Wpm, then this college student would require 60,000/300, or 200 msec per standard word. This 200 msec can now be interpreted as 200 msec per a standard length word that has been raudamatized, or 200 msec for each raudamatized word of standard length in the context of relatively easy text. Therefore, there is an inherent connection between raudamatized words and R_L. When the R_L construct is expressed in Wpm, then the amount of time needed to process a raudamatized word of standard length in context is the inverse of R_r. So, rauding rate expressed in GE units is rate level, R_L, and when rauding rate is expressed in msec per word, it is the time required to read a raudamatized word of standard length in context.

Rapid single-word decoding. The ability to read a list of isolated words quickly has long been considered an important ability in reading (Stanovich & West, 1979), and has been a cornerstone concept in verbal efficiency theory (Perfetti, 1985). This ability has been shown to correlate so highly with rauding rate that it is considered to be an indicant of rate level, R_L (Carver, 1991). Therefore, it would appear that much of the research involving speed of decoding isolated words can be alternately considered as research on rauding rate, or research on rate level, R_L. Lists of words that can be accurately pronounced without hesitation are likely to be raudamatized words so individual differences in their rate of decoding, or rate of pronunciation, are likely to correlate very highly with their rate of recognition during the rauding process. If the word lists used in the research contain all raudamatized words (well known to the readers with very high pronunciation accuracy and high speed of recognition), then this measure can be considered as an indicant of rauding rate, R_r, or as an indicant of rate level, R_L.

Given the above interpretations, it is easy to agree that rapid single-word decoding is a very important factor that distinguishes good from poor readers because individual differences in this ability are almost indistinguishable from rate level, R_L, which is a proximal cause of reading achievement, or E_L. More specifically, individual differences in the rate at which a list of raudamatized words can be read aloud is likely to be an indicant of R_L and correlate very highly with another measure of R_L. Stated differently, the ability to rapidly decode isolated known words is empirically almost exactly the same ability represented by the theoretical construct, R_L.

Notice that the R_L construct incorporates rapid single-word decoding so that prior research on this variable can be interpreted as a proximal cause of reading achievement, or E_L. That is, if rapid single-word decoding is scaled into GE units, then it purportedly has lawful relationships to E_L, P_L, and C_s via Equations 1-1 and 1-3.

Speed of word recognition. According to Perfetti (1985), speed of word recognition is a very important factor in reading skill. The speed of recognizing the meaning of known words in context and the speed of rapidly pronouncing isolated known words could both be referred to as "speed of word recognition." Yet, individuals can recognize and pronounce known words in context about twice as fast as they can recognize and pronounce isolated known words. For example, Carver (1991) had students in grades 2 to 10 read a passage aloud as fast as possible and also read the words aloud in randomized order, and he found that the mean rate was 140.5 Wpm for words in the meaningful text and 81.6 Wpm for the same words when they were randomized. In this research, individual differences in both of these measures loaded highly on a rate level factor (.89 & .85), which was defined (a) by a measure of typical silent reading rate, and (b) by an objective test of reading rate. Therefore, speed of word recognition is likely to be highly related to the R_L construct as long as the words are overlearned, or raudamatized words. Stated differently, speed of word recognition is likely to be highly correlated with R_L as long as the words are likely to be raudamatized words for all the individuals involved. Speed of word recognition is an indicant of rate level, R_L. Thus, most previous research on speed of word recognition involving overlearned words can also be interpreted as research involving individual differences in rauding rate, or rate level, R_L, with lawful relationships to reading achievement, or E_L (Equation 1-1), and lawful relationships to pronunciation knowledge and cognitive speed level (Equation 1-3).

Apping. In rauding theory, it is contended that readers have learned to move their eyes down a line of printed words in a habitual manner that requires no conscious attention; this is an overlearned psychomotor habit that can be done while comprehending the meaning of the words and forming the complete thought in the sentence. These habitual eye movements have been called "apping," a word derived from the initial letters of Automatic Pilot for Prose (Carver, 1990a). During normal reading, or rauding, apping means that readers can think about the meaning of the words as they construct the thought in each sentence without thinking about where their eyes should move next. The eyes have been programmed by practice to automatically move down the line so that almost every word over 4 letters in length is fixated and each word can be perceived, lexically accessed, semantically encoded, and sententially integrated into the thought represented by the sentence. In this regard, Rayner (1997) has reviewed eye movement research and contends that "the optional strategy would be to fixate near the middle of each successive word" but "because short words can often be identified when they are to the right of the currently fixated word, they are often skipped" (p. 325).

Apping allows reading to be as efficient as auding, or as efficient as listening to an oral rendition of the same text when presented at the rauding rate of the individual. Apping also allows the reading of printed text to be as efficient as it would be if no eye movements were required, that is, as efficient as when each word is presented in the middle of a computer screen for a length of time in msec determined from the rauding rate of the individual and converted into msec per letter or msec per syllable. Indeed, research data exists which shows that eye movements are not needed to efficiently comprehend printed text (Masson, 1986). For example, Potter, Kroll, and Harris (1980) used the rapid serial visual presentation (RSVP) technique, developed by Forster (1970), to show that the number of idea units recalled were the same under the following three presentation conditions: (a) RSVP at 240 wpm, (b) reading printed text for a length of time equal to 240 wpm, and (c) listening to tape-recorded versions of the text at 240 wpm.

It should not go unnoted that the typical eye movement length of 6 character spaces, found by McConkie and Zola in 1984, is exactly equal to the length of a standard word in rauding theory, as defined earlier by Carver in 1976. This equivalency is not likely to be an accident. Carver (1976) reported that the average number of character spaces in college level words ($D_L = 13$) is 6. Because words read by college students tend to average around 6 character spaces in length (some longer and some shorter), and because college students normally fixate upon almost every word in the text during normal reading (see review of evidence by Carver, 1990a), it would be consistent for McConkie and Zola (1984) to find that college students most often have eye movements 6 character spaces in length.

In summary, apping is a psychomotor skill involving eye movements, which allows the rauding process to operate at the rauding rate of the individual, whether the text is being read or auded.

Relevant Tests

Introduction. Different tests that can be used to measure R_L will be described in some detail—the Rate Level Test, the Typical Silent Rate test, the Maximum Oral Rate test, the Nelson-Denny Reading Test-Rate, and other tests.

Rate Level Test (RLT). The RLT is a standardized test which uses a modified cloze task as an indicant of R_r and R_L. It is a 2-minute timed test that requires individuals to read short passages at the second grade level of difficulty

($D_L = 2$). These passages have been modified so that every fourth word offers a choice between two words—the word that belongs in the passage (right choice) or an alternative word that obviously does not belong in the passage (wrong choice); the wrong choice is obvious to those individuals who are at the second-grade reading level ($A_L = 2$) and higher. That is, the words on the test should be raudamatized words for students who are reading at a level above the first-grade. Accuracy on this test is typically 100% or very close to 100% so that the primary variable in the situation is how fast the correct answers (right choices) can be marked. The number of right choices marked in 2 minutes (corrected for guessing) is the Raw Score. The test manual (Carver, 1994c) explains how this raw score can be converted into Wpm for R_r or GE units for R_L (see also Appendix D).

The test manual, noted above, also contains extensive information regarding reliability and validity. Scores on Form A and Form B were compared for students in grades 3 through 12, college, and graduate school; the standard error of measurement was consistently around 1.2 GE units, and the average alternate form reliability coefficient across grades was .84. With respect to validity, the RLT was administered to students in grades 2 to 10, along with three other indicants of R_L (Carver, 1991). From a factor analysis of the correlations involved, controlled for grade level using partial correlations, (a) the RLT loaded .84 on an R_L factor, (b) typical silent rate loaded .80, on the R_L factor, (c) maximum oral reading rate loaded .89 on the R_L factor, and (d) speed of reading isolated words loaded .85 on the R_L factor. Notice that the RLT loaded higher than silent reading rate, about the same as the rate of reading isolated words, and a little lower than maximum oral reading rate.

Typical Silent Rate (TSR). On this test, which is part of the CARD battery (Carver, 1996), individuals are given a passage at the second-grade level of difficulty ($D_L = 2$) to read silently. Remember that rauding rate, R_r, can be directly measured whenever the rauding process is operating. This process is likely to be operating when individuals (a) are given relatively easy passages to read, $A_L > D_L$, (b) are asked to read these passages as they would read normally, and (c) are timed for how long it takes them to read the passages. Then, a measure of rauding rate can be obtained by counting the number of standard-length words in the passages, and then dividing by the elapsed time, in minutes, to get Wpm, as is the case for TSR.

Formulas have been given elsewhere (Carver, 1990a) for converting from various units into Wpm, such as from syllables per minute or from the printer's "em" unit. The obtained value in Wpm can also be divided by 16.67 to get rauding rate, R_r, in Sentences per minute, Spm, as was noted earlier in this chapter. However, R_r is more often expressed in GE units, as R_L, and Carver (1989, 1990a) has provided tables for translating Wpm into R_L. The Carver (1990a) transformation has subsequently been improved by Carver (1994c), that is, upgraded slightly by more recent research (see Appendix D).

The procedure just described for obtaining a direct measure of rauding rate, R_r (or R_L), works very well when averaging individual scores for groups (see Carver, 1983). However, it can produce unreliable data for a single individual because it is not entirely objective. For example, an individual may shift out of the rauding process into a higher gear (faster rate) or lower gear (slower rate) under the guise of being in Gear 3. The best direct measures of rauding rate would involve some evidence that the relatively easy text being read was also being comprehended accurately ($A_r > .64$).

Maximum Oral Rate (MOR). The MOR test is used in the CARD, Computer Assisted Reading Diagnosis (Carver, 1996). Students are given a short passage (about 100 words) that is very easy ($D_L = 2$), and asked to read it once silently to themselves (see TSR above). When finished, they are then asked to read aloud exactly the same passage again, as fast as they can; this procedure provides a measure of maximum oral rate, MORR, which is the number of standard words in the passage divided by the time required to read it aloud, in minutes. Carver (1990a) has hypothesized that R_r = MORR + 25 Wpm. However, a linear equating technique has subsequently been used to convert MORR into GE units, or R_L, for the CARD (Carver, 1996). This test also has an equivalent form, i.e., Form A and Form B.

The case for the MORR task being a good indicant of R_L is supported by Carroll (1993) who stated that "reading speed would seem to involve comprehension only minimally; the measure is simply the time to read a passage aloud as fast as possible, i.e., to recognize the words (in sentences) and utter them" (p. 165).

Carver (1991) has presented data, noted earlier in connection with the RLT, which indicates that the MOR test measures the rate level factor better than the RLT, better than typical silent rate, and better than the speed of reading isolated words; the MOR loaded the highest, .89, on the R_L factor. However, the RLT is a group test and MOR must be administered individually.

It should be noted that the rate of reading text orally is generally not a good indicant of R_L. Carver (1990a) has discussed how individuals who are asked to read text aloud (a) may choose to accent a good oral rendition for others, and not try to comprehend what is being read, or (b) may focus on comprehending, while disregarding how the rendition may sound to others. The rates that accompany these traditional oral reading situations cannot be relied upon to provide a good indicant of R_L. For example, on some reading tests a child is asked to read aloud and at the same time comprehend what is being read so that questions can be answered accurately later. The score on the comprehension test *may* provide an indicant of A_L and the rate of oral reading *may* provide an indicant of R_L. In these situations, the score on the test questions on the text *may* provide a better indicant of E_L than A_L. It should also be recognized that there will always be a certain amount of tradeoff between accuracy and rate during typical oral reading situations, because slowing down will lower rate and increase accuracy while speeding up will increase rate and decrease accuracy. Thus, variation in strategy during typical oral reading will likely change the correlation of oral reading rate with A_L and R_L.

In summary, maximum oral reading rate is an exceptional type of oral reading because (a) it requires that the text to be read be relatively easy and already have been read once silently for comprehension, (b) it requires that the text be read as fast as possible, and (c) it is relatively objective, reliable, and valid as a measure of R_L.

The Nelson-Denny Reading Test (NDRT). The NDRT provides a measure of reading rate, so it will be instructive to analyze this measure. Students are asked to read a passage that is about 600 words in length for 1 minute. At the end of this time period the examiner asks the individual to circle the word, or the line, they are reading. Then, reading rate is the number of words covered during this 1 minute of reading. For example, if the individual circled word number 279 (counting from the first word in the passage), then reading rate would be 279 wpm.

As early as 1968, Farr concluded that the rate measure on the NDRT "should probably not be used at all" (p. 190). Later, Carver (1992a) showed that this rate measure provides a poor indicant of the rate level factor. Theoretically, this NDRT rate measure would not provide a good measure of rauding rate, R_r, because it is likely to involve a passage that is relatively hard, $D_L > A_L$, for some college students. Also, because these individuals are expecting to be tested on what they have read, many are likely to shift into a learning process, or Gear 2, instead of using their rauding process (see Chapter 2). Finally, the words covered on the test would need to be converted into standard length words in order to provide a measure of rauding rate, or rate level, R_L.

Other Tests. A great deal of research has been conducted on the latency of word recognition and the speed of word recognition (see Perfetti, 1985). This research has unintentionally involved an indicant of rate level, R_L, because it involves the rate at which isolated raudamatized words are named (recognized or identified). As noted earlier, researchers have often acknowledged the importance of word recognition speed, even though it has not been generally acknowledged to be an indicant of R_L. For example, consider the following quotation from Stanovich (1980):

> Since the speed of recognition is now widely acknowledged as being crucial to reading (even among investigators of vastly different theoretical persuasions—see Biemiller, 1977; Doehring, 1976; LaBerge & Samuels, 1974; Smith, 1971; Smith & Holmes, 1971), it would seem necessary to focus on how readers of different abilities use orthographic structure to speed word recognition. (p. 38)

So, any measure of the speed at which overlearned words—raudamatized words—can be recognized is likely to provide an indicant of R_L. Again, prior research on individual differences in the speed of word recognition may be reinterpreted as investigations of reading rate, or rauding rate level, as long as the text was relatively easy, or raudamatized words were used.

In general, any measure of the time, rate, or latency at which readily identifiable words are correctly named (or pronounced) should be a good indicant of R_L. It is not necessary that the words be in meaningful order, or in context. It is only necessary that the words involved be raudamatized so they can be named accurately and relatively quickly. On the other hand, reading rates measured under conditions likely to induce memorizing, learning, skimming, or scanning processes are not likely to provide good indicants of R_L. Also, it should also be mentioned that the speed of pronouncing pseudowords has a special relationship to R_L, as will be explained in detail later in Chapter 11.

Summary of Theory

The rate at which individuals operate their rauding process is their rauding rate. Individuals normally read relatively easy materials at a relatively constant rate, which is their rauding rate; when this rate is measured in standard-length words and expressed in GE units, it is called rauding rate level, R_L. Whereas the reading rate of an individual may vary when other reading processes are operating, such as scanning, skimming, learning, and memorizing, rauding rate is relatively constant at a certain level, called R_L. Rauding rate is also the optimal rate, that is, the most efficient rate of comprehending sentences in text, whether the text is read or auded.

The words in relatively easy material that can be accurately and rapidly processed at the rauding rate during the operation of the rauding process are called raudamatized words. Raudamatized words are overlearned words that require a fixed or constant amount of time to process when they are standard in length, and this amount of time is the inverse of the rauding rate, or $1/R_r$. When reading these raudamatized words in relatively easy text, the eye movements involved are habitual and require little or no attention. These rhythmic eye movements are called apping—a term derived from automatic pilot for prose. Apping involves a fixation on almost every word; these fixations during apping involve lexically assessing, semantically encoding, and sententially integrating every word in a sentence of text. Apping allows printed raudamatized words to be successfully processed during the rauding process at the same rate as these words would be successfully processed (a) when no eye movements are involved during auding, or (b) when no eye movements are involved during the presentation of one word at a time in the middle of a computer screen. Rauding rate is relatively constant across varying levels of text difficulty, as long as $D_L < A_L$, because all of these words are raudamatized and therefore processed at the same rate even across varying purposes.

Indicants of R_L include (a) typical silent reading rate for relatively easy text, (b) the fastest rate at which raudamatized words in context can be pronounced aloud, called maximum oral reading rate, and (c) the fastest speed at which lists of raudamatized words can be pronounced aloud. The Rate Level Test, RLT, can be used as an indirect measure of R_L for students above the first-grade level because it is likely to contain raudamatized words for those individuals. The Rate score on the Nelson-Denny Reading Test would not provide a very good indicant of R_L because (a) some individuals are likely to shift into a learning process (Gear 2) in order to answer the test questions more accurately, (b) some of the words may not be raudamatized for some of the readers, and (c) the rate is not measured in standard length words per minute, Wpm.

Summary of Evidence

There is a great deal of data from many different research studies which provide strong support for the constancy of reading rate in standard words per minute when individuals are reading relatively easy material in a normal or typical manner (see Carver, 1990a, for a review of Ballantine, 1951; Carver, 1971a, 1971b, 1976, 1981, 1983; Coke, 1974; G. R. Miller & Coleman, 1971; Morse, 1951; Rothkopf & Coatney, 1974; Zuber & Wetzel, 1981); this evidence supports the existence of the R_r construct, and the R_L construct. The concept of apping, which accompanies normal reading of text and occurs at the rauding rate, has been supported by research which has found that random spaces inserted between the words of text has the effect of slowing reading rate (Lloyd & McKelvie, 1992).

The earlier idea that readers continually change their rate to match continually changing purposes and continually changing material difficulty (e.g., Hoffman, 1978), has no empirical support when normal or typical reading of relatively easy text is involved (see Carver, 1990a for a review of Hill, 1964).

The earlier idea that readers vary their rate with the number of propositions in a text (Kintsch & Keenan, 1973; Keenan & Brown, 1984), is relevant to a learning process or a memorizing process but is not relevant to the rauding process or normal reading. Therefore, this research should not be interpreted as evidence against rate level, R_L.

The earlier idea that the amount of context influences reading rate is not relevant to the rauding process, or normal reading (Gough, 1984). That is, Stanovich (1980) reviewed data which seems to have effectively demolished the idea that individuals use hypothesis testing and predictions to speed up word recognition (an idea espoused by Smith, 1971; Goodman, 1967; Levin & Kaplan, 1970; Williams, 1977). For example, Mitchell and Green (1978) found that the more predictable parts of text were *not* read faster.

Finally, speed of word recognition, which is an indicant of R_L, has long been considered to be an important determiner of reading ability (Carroll, 1993; Perfetti, 1985; Stanovich, 1980).

Given the amount of data supporting the existence of the R_L construct, and the lack of any conflicting data collected during the past 25 years, it is very surprising to find as late as 1995 that Rayner, Raney, and Pollatsek disregarded this prior theory and supporting research when they interpreted the data they collected involving reading rate and text difficulty data. They had 10 college students read six different passages that varied in difficulty from "light fiction" to "biology." The six mean rates they reported decreased from a high of 365 wpm for the light fiction passage to 233 wpm for the biology passage. They suggested that there was a dramatic influence of text difficulty, and that "familiarity with the material allows people to read text faster" (p. 14). In this interpretation of theirs, notice that (a) they did not mention the measured difficulty level of the text, (b) they made no distinction between the rates for relatively easy text and relatively hard text, and (c) they did not control for word length, by using standard-length words per minute, Wpm. Their data have been reanalyzed on the basis of some reasonable assumptions about the relative difficulty level, D_L - A_L, of their passages, and their lengths in standard words; it also seemed reasonable to assume that their college students were at the middle of college, A_L = 14.5. Therefore, the light fiction, history, and psychology passages were assumed to be relatively easy, $A_L > D_L$; these rates varied only from 313 Wpm to 334 Wpm. This is hardly a dramatic difference (31 Wpm) considering that the light fiction passage was read only 4% faster than the history passage and only 6% faster than the psychology passage. Furthermore, with regard to the economics passage, the physics passage, and the biology passage, they were assumed to be relatively hard, $D_L > A_L$, so it is not surprising that these students would shift down to a learning process; these passages were read considerably slower than the light fiction—18% slower for economics, 26% slower for physics, and 28% slower for biology. These data therefore may be alternately interpreted as supporting the theory that reading rate is relatively constant at R_L for relatively easy material.

Implications

We need to consider the strong probability that one theoretical construct, R_L, explains individual differences in many different rate measures, such as the following: (a) typical rate of reading relatively easy material silently, (b) fastest rate of reading aloud raudamatized words in context, and (c) fastest rate of pronouncing isolated lists of raudamatized words. When one of these measures is

used in research it should be considered as an indicant of R_L, and therefore a measure of one of two proximal causes of reading achievement, or E_L.

Although rauding rate level, R_L, is an extremely important attribute of all readers including lower graders and middle graders, it is often ignored by educators. For example, school districts often administer standardized reading comprehension tests (indicant of E_L) and standardized reading vocabulary tests (indicant of A_L) but they do not ordinarily administer standardized tests that attempt to measure normal reading rate (indicant of R_L). Because R_L is a proximal cause of reading achievement, or E_L, it does not make sense to ignore it while measuring A_L, which is the other secondary cause of E_L. Furthermore, by administering a measure of rate level, it seems likely that many school districts would find that the whole-language approach and the phonics approach to instruction were causing their students to be slower readers, that is, lowering their R_L (see Chapters 22 and 23).

Rauding rate, rate level, raudamatized words, and apping, are theoretical constructs that have considerable empirical support. Furthermore, the R_L construct integrates and clarifies several previous concepts in reading, such as typical silent reading rate, fastest rate of reading text aloud, rapid single-word decoding, and automaticity. Acceptance of the R_L construct, which includes acceptance of a constant rauding rate for relatively easy materials, necessarily means that the traditional concepts of automaticity and rapid single-word recognition have been superseded, or upgraded.

Forget Me Nots

Rauding rate level, R_L, is a theoretical construct that tries to incorporate all of the good ideas that have traditionally been associated with normal reading rate and the rate at which lists of known words can be decoded. These earlier concepts have been upgraded by the R_L construct, which is more precisely defined both from a theoretical and operational standpoint. Rate level, R_L, is the rate at which an individual typically reads relatively easy text when that rate is measured in grade equivalent units; for example, an individual may have a fourth-grade rate level R_L = 4.

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To Mary Lou, Melanie, Heather,

Bill, Jay, and last but not least, Joey.