

Donald A. McAndrew

HANDWRITING RATE AND SYNTACTIC FLUENCY¹

The scribal act, the physical act of writing, of moving the pen or pencil across the page so as to form decipherable words without great effort, is fundamental to the development of writing skills. Mina Shaughnessy, in her ground-breaking book on basic writing, echoes this when she characterizes basic writers as still struggling with the motor-mental coordinations that have long ago become unconscious for more practiced writers. As long as the mechanical processes involved in writing are themselves highly conscious, slow, or even labored, writers are not likely to have easy access to their thoughts.

Donald Graves, in a review of handwriting research significant for its brevity, states, "It is at the point of speed that we have underestimated the contribution of handwriting to composing" (398). Graves states that research with young writers shows that one reason they compose less effectively is because of the slowness of their handwriting, and he calls for research that attempts to uncover the connections between handwriting and writing. David Bartholomae, studying college-age writers, also finds that, even for writers of this age, "one constraint is the difficulty of moving the hand fast enough to translate meaning into print" (263), and he also calls for research into the nature of this handwriting constraint in composing.

Donald A. McAndrew, professor in the Rhetoric and Linguistics graduate program, teaches courses in teaching basic writing, the rhetorical tradition, reading theory, and research methodology. Formerly a director of developmental skills and of a writing center, he is coauthor with Thomas Reigstad of Training Tutors for Writing Conferences (NCTE, 1984). He is presently investigating the process of becoming a writing teacher and the utility of qualitative evaluation procedures.

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The body of research on handwriting, the scribal act, has been very carefully reviewed by Eunice Askov, Wayne Otto, and Warren Askov surveying the research of the 1960s, and Michaelleen Peck, Eunice Askov, and Steven Fairchild surveying the 1970s. Nowhere in the 141 studies reviewed is a direct connection between handwriting and writing examined. Judy Rice did find that handwriting rate was a significant predictor of general language achievement. And Lawrence Rarick and Theodore Harris did examine the relationship of handwriting speed and legibility, finding that, generally, increased speed led to decreased legibility except for the best handwriters who wrote legibly no matter what the speed. But neither of these studies looked directly at actual writing, rather they examined handwriting as a separate scribal process removed from the context of writing.

The body of research on writing also has examined the connection of handwriting and writing only slightly. Ellen Nold found that for children and inexperienced writers, the burden of the motor task of forming letters may overwhelm the limited capacity of short-term memory, interfering with the more global concerns of content and meaning. Sharon Pianko established the slower pace of basic writers. Her remedial and traditional groups produced approximately the same number of words per minute, but the traditional group paused twice as often as the remedial group. The remedial group, therefore, used a greater amount of time to physically write the same number of words. Pianko judged the remedial group's pieces as showing little concern for content, for getting the idea across to the reader. Brian Monahan found that effective writers did, indeed, concentrate on content, realizing that it was necessary to write fast to keep from losing thoughts. Less effective writers concentrated more on penmanship and were less able to transcribe quickly and effortlessly.

Linda Flower and John Hayes, relying on insights from cognitive psychology, explain this situation as one where the task of recording in visible language interferes with the more global processes of planning, generating, and organizing ideas according to goals established in the given writing situation. In an earlier article, Flower stresses that writing is an activity that places an enormous burden on short-term memory, constantly threatening to overload it. She states, "It is easy to see how the limits of short-term memory can affect a writer's stylistic control. For an inexperienced writer, the complex transformation of the periodic sentence—which would require remembering and relating a variety of elements and optional structures such as this sentence contains—can be a difficult juggling act" (281–282). The difficulty of this juggling act is greatly increased

when attention is additionally overloaded with concern for the motor skills of handwriting itself.

Colette Daiute agrees with Flower positing the "memory constraint hypothesis" that errors in sentence structure are most likely after sequences that could be expected to burden short-term memory. This hypothesis seems even more reasonable when the writer is not only experiencing all of the usual problems of writing but also is draining limited attention for the scribal act. The writer who must concentrate on handwriting simply has less attention for composing available from the outset. Daiute echoes psycholinguists (Miller; Sokolov) who emphasize the limited ceiling of short-term memory and its powerful influence as a real bottleneck in language activity. Marilyn Sternglass argues that the example of the most inhibited writer would be that of the writer whose attention is concentrated on the spelling of a single word. But, extending Sternglass, the most inhibited writer would be the one recording, letter by letter, the spelling of that single word, writing with great labor and attention, the writer absorbed in the motor activity of handwriting.

B. K. Britton, R. D. Westbrook, and T. S. Holdredge, investigating cognitive capacity and its engagement in language-processing activities, would describe the slow handwriter as a writer who has less capacity available for the primary task, in this case actual composing, because the secondary task, handwriting, requires more storage and more effort. These slow handwriters, cognitive psychologists (Neisser; Norman and Rumelhart) would argue, have not had the practice needed to develop the refined schemata necessary for reducing the attention given to handwriting. They suggest that this development of refined schemata is essential if handwriting is to reach the automatic level necessary for reduction of the cognitive capacity required during fluent composing. Until this happens, the portrait of the slow handwriter writing is one of a deliberate pace that absorbs attention, diverting it from the higher order concerns that produce pieces rich in content and varied in structure.

In the present investigation, a first attempt was made to study handwriting speed and its relation to one feature of written products. Specifically, this study examined the relationship of handwriting speed to the syntactic complexity of the finished product. The central research question of the study was: will the pieces produced by writers who have a slow handwriting speed be syntactically less complex, showing less embedding and branching, than those of writers who write more quickly? To write complex sentences with a variety of clausal and nonclausal modifiers

requires that a writer manipulate a number of separate linguistic bits, translating them from ideas generated, storing one or more in full or reduced form in short-term memory as others are recorded by hand. If this very act of recording by hand requires attention, not to mention a *large* amount of attention, then the attention available for storage of ideas and linguistic bits becomes less. The resultant syntax should be less complex because the writer is unable to store those things that create complexity.

Method: Subjects, Materials, and Procedures. To examine the relationship between handwriting speed and syntactic complexity, the syntax of writers identified as having a fast handwriting speed and of writers identified as having a slow handwriting speed was examined. Since the work of Shaughnessy, Pianko, and Monahan, discussed above, would suggest that basic writers could be expected to have a slower handwriting speed, and, by implication, traditional college writers could be expected to have a faster handwriting speed, subjects for the study were college students chosen from four sections of English 100, Basic Writing (SAT Verbal \leq 350), and four sections of English 101, College Composition. From the 152 students in these eight sections, the thirty fastest and the thirty slowest handwriters were identified using the highest score on any one of the four tests described below.

The materials for the present investigation consisted of four tests of handwriting rate and a persuasive writing task, all completed by all subjects.

In the 141 handwriting studies reviewed by Askov, Otto, and Askov and by Peck, Askov, and Fairchild, only seven directly dealt with handwriting speed. The handwriting speed was usually estimated by having students copy a passage that was presented on the overhead or chalkboard. These researchers, in reality, measured copying speed not handwriting speed, because writers were forced to look back and forth from the original to their copied version and because the original was not necessarily written in a syntax and lexicon appropriate to the writers.

Since these studies did not have an agreed-upon method for measuring handwriting rate, except for this copying rate which was judged to be invalid, four tests were constructed according to the following guideline—the maximum handwriting speed should be estimated in a situation that comes close to real writing but that does not call for actual composing and its additional complexities.

The first test was based on Kellogg Hunt's "Aluminum" passage, a paragraph of very short sentences about the making of aluminum. Students were directed to first combine the short sentences into longer ones. When all were finished, they were asked to copy the

new paragraph. Here the students were copying a passage that was cast in syntax that was individually representative of the writer, much like actual writing, because the writer had just created the new syntax.

The second test asked students to write out from memory the Pledge of Allegiance. Writers were familiar with the material and would be transferring something from the mind to paper, again much like actual composing.

The third test asked students to copy the *Star Spangled Banner* which was printed at the top of a sheet. The fourth test asked them to recopy it as fast as they could. In both of these tests, students were familiar with the material, and in the fourth test, since they had copied it once already, they were also familiar with the scribal requirements of the passage. Both of these again seemed closer to the situation of actual composing.

All students also were asked to write a piece of writing in response to a persuasive task because research (Crowhurst and Piche; Perron) has shown persuasive discourse calls forth the most complex syntax.

The four speed tests were given during a 30–40-minute segment of class during the second week of the semester. For all four speed tests students were asked to write legibly enough so that they could read it, believing this was the standard of legibility for actual composing. For each speed test, students were timed until the first person finished, and, then, all writing stopped. The total letters produced in each situation were counted and divided by the elapsed time to produce a rate score in letters per minute. A student's highest score on any of the four tests was the score used to identify the thirty fastest and thirty slowest handwriters.

During the third week of the semester, students had two class periods (2 hours) to write in response to the persuasive writing task. William Smith has reported that students use their fastest handwriting rate when they are prepared to write about a topic. For this reason during the beginning of the first class of the two classes used for writing, students discussed the task in small groups and then did a 10-minute "freewrite" about the task to help them prepare for actual writing.

The pieces of writing of the thirty fastest and thirty slowest handwriters were then analyzed for eighteen direct or derived syntactic variables: (1) total words, (2) total clauses, (3) total T-units (independent clauses with all modification), (4) words per T-unit, (5) words per clause, (6) clauses per T-unit, (7) number of left-branched (pre-subject) structures, (8) total words in left-branched structures, (9) number of right-branched (post-predicate)

structures, (10) total words in right-branched structures, (11) number of medial embeddings (between subject and predicate), (12) total words medially embedded, (13) total free (movable in T-unit) modifiers, (14) words in free modifiers, (15) percent of words in free modifiers, (16) percent of words left-branched, (17) percent of words right-branched, (18) percent of words medially embedded.

Results: Handwriting Speed and Syntax. The assumption that basic writers would be characterized by a slower handwriting speed was shown to be true for only some basic writers. Half of the thirty fastest handwriters were basic writers and almost half, thirteen of thirty, of the slowest handwriters were traditional writers.

Results of a multivariate analysis of variance of the syntactic data indicated that basic writers wrote significantly different sentences ($p < .002$). Basic writers produced significantly fewer words ($p < .0001$), T-units ($p < .0001$), and clauses ($p < .0001$) than traditional college writers. However, the length of their T-units and clauses, as calculated by words per T-unit and words per clause, were not significantly different. Neither was the number of clauses per T-unit, the subordination ratio. It would seem then that basic writers simply write fewer T-units, but these T-units are just as long and contain subordinate clauses of the same length and at the same frequency as traditional college writers. Basic writers in this study, as has been observed frequently, showed a striking lack of overall written fluency; they simply wrote less. However, further analysis of the structure of their T-units indicated that this was only part of the truth.

Significant differences in the structure of their T-units were noted when left-branched and right-branched structures were examined. Traditional college writers produced approximately twice as many left-branched structures ($p < .001$), and these structures were almost twice as long as those of basic writers ($p < .001$). Traditional college writers also produced almost three times as many right-branched structures ($p < .02$), these structures were three and one-half times as long as those of basic writers ($p < .02$), and they made up a significantly higher percentage of the total words in the piece ($p < .05$). These striking differences demonstrate that basic writers and traditional writers wrote decidedly different types of T-units, especially in the right-branched position, a position established as characteristic of mature syntax. Traditional college writers wrote more than basic writers and wrote it in the more complex syntactic patterns associated with mature writers.

The differences in the syntactic patterns of traditional and basic writers were frequent and striking, but what of handwriting speed?

The multivariate analysis of variance for handwriting speed indicated that it did not have a significant effect on any of the eighteen syntactic variables. However, handwriting speed did approach significance as a main effect for total words ($p < .07$), total T-units ($p < .09$) and number of right-branched structures ($p < .09$). This fact coupled with what looked like some interesting patterns among the cell means led to the use of post hoc Helmert mean contrasts to see if these mean patterns were statistically significant.

The cell means for total words, total T-units and total clauses showed a statistically significant pattern, namely traditional college writers who were also fast handwriters produced more words ($p < .0001$), more T-units ($p < .001$), and more clauses ($p < .001$) than any of the other subjects whether they were also traditional college writers or fast handwriters. These traditional/fast writers also produced significantly more left-branched structures ($p < .009$), and significantly more right-branched structures ($p < .02$) and words in right-branched structures ($p < .03$). In fact, traditional college writers who were also fast handwriters finished higher on fourteen of eighteen measures when compared to traditional college writers who were slow handwriters, although the differences were statistically significant only for the six measures just mentioned. This same pattern, an advantage to the fast handwriter, was also present in the basic writers for fourteen of the eighteen variables, although none of the differences reached statistical significance.

Discussion. Slow handwriters reach the limit of full attention or engagement and remain at that level, dutifully recording a sentence that shows few of the characteristics of mature syntax. During the same amount of time, the fast handwriter has quickly recorded a syntactic chunk and, in so doing, has temporarily "emptied" attention or engagement, making it available again to focus on another unit, either a new T-unit or a part of a developing T-unit.

The fast handwriter is able, therefore, to bring attention and engagement to bear more frequently while writing. These moments when attention is temporarily emptied give the fast handwriter more opportunities to write more T-units and/or more richly modified T-units. The slow handwriters' slower scribal rate simply allows fewer of these opportunities to occur. Fewer opportunities mean less complex syntax because these opportunities are the moments when the exact words of the syntactic unit just recorded fade to, as Daiute suggests, long-term storage, a deeper, semantic level storage, freeing short-term storage, or attention to work, with a new or continuing unit. The more frequent temporary emptying of short-term memory that characterizes fast handwriters may be a

factor that gives composing a rhythm—available capacity frequently develops, attention then frequently refocuses.

In summary, this study supports the body of research that describes the differences in syntax of basic and traditional college writers, confirming previous research that indicated differences in overall fluency and differences in the use of left- and right-branching structures. This research also makes a first attempt at clarifying the speculations about how handwriting speed is related to composing, supplying at least some evidence that there is an advantage to having a fast handwriting speed, for traditional college writers for sure and quite possibly for basic writers. Finally, instructionally, this study would imply that teachers of writing should encourage traditional college writers to write rapidly when they draft their pieces. Encouraging this scribal fluency has been advised for basic writers, but this study concludes with empirical support for also recommending this to traditional college writers. Scribal fluency seems to allow for a maximizing of syntactic fluency, and it is, therefore, something that should be encouraged in all students.

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