

Book review

Virginia Berninger (2012). *Past, present and future contributions of cognitive writing research to cognitive psychology*. Psychology Press, New York - 652 p.
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Apparently, the act of writing fascinates many researchers. How else should we explain the field of writing research, that has grown in multiple directions of inquiry, including the socio-cultural, the developmental, the textual, educational, and the list goes on? In addition, a prominent direction of writing research is the cognitive psychological approach. This newly-published handbook highlights important work in the field of cognitive writing research. With some summaries of past research, several reports on present research, and conjectures about future research, the handbook also honors three 'founding fathers' of the field of writing research: John Hayes, Michel Fayol and Pietro Boscolo.

The editors of JoWR have kindly invited us, Thomas Quinlan and Amos van Gelderen, to review this handbook. According to our relative areas of expertise, we have divided the chapters between ourselves, into two equally sized parts. Thus, Thomas Quinlan reviewed Part 1, 2, 5, 6 and 7, while Amos van Gelderen reviewed Part 3 and 4. In reviewing these parts, each of us assumes responsibility for our own opinions.



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Part 1: John Hayes, Michel Fayol and Pietro Boscolo

From the 1980s, a number of researchers have helped develop the field of cognitive writing research. The most influential include: John Hayes, Michel Fayol, and Pietro Boscolo. In Part 1, these researchers reflect upon their contributions to the field:

In *Chapter 1*, Hayes reflects upon the life events that contributed to his becoming a cognitive psychologist, devoted to the investigation of writing. He emphasizes how serendipitous events helped shape the course of his research career. As a young student, he was deeply interested in physics, yet got drawn to psychology. One day he is observing pigeons' behavior, the next he is investigating human problem-solving. In an eloquent statement, the author affirms the value of investigating writing, as an important instance of everyday problem-solving.

In *Chapter 2*, Michel Fayol recounts 30 years of writing research. In early experiences teaching at a village grade school, he noticed that some children made little progress, particularly in written composing. Thus, teaching led him to research. The author reviews an interesting sequence of investigations, in which he and his colleagues systematically examine children's basic writing skills, as they contribute to various aspects of producing a text, including the lexical, grammatical, and syntactic; text-structure and text-cohesion; as well as spelling and punctuation.

In *Chapter 3*, Pietro Boscolo reviews his work investigating writing instruction, "to highlight the role of teacher-based writing research." The author explains how teacher-based research diverges from traditional cognitive approaches. Whereas the traditional cognitive perspective generally views writing in terms of domain-general skills, the author favors a social-constructivist view, in which the act of writing is 'situated' in a particular context. In reflecting upon his own writing research, the author details the important differences between process-oriented research (a common cognitive focus) and teacher-oriented research.

Apparently, these researchers came to their lives' work in somewhat different ways. Yet, all three became fascinated with the act of writing. By pursuing this fascination, they helped develop the field of writing research. As fellow writing researchers, we are direct beneficiaries of their work.

Part 2: The sociocultural plus cognitive traditions in writing research

The field of cognitive writing research primarily focuses on the mind of the individual writer. However, as a complex human behavior, writing can validly be investigated from a variety of other perspectives. For example, there are the writer's emotions (i.e., affective), social interactions (i.e., social), or even the text itself (i.e., genre).

In *Chapter 4*, Charles Bazerman builds conceptual links between the cognitive, historical, and sociocultural perspectives. Rather than a systematic integration, which may or may not even be possible, he presents some important points of commonality. For example, he emphasizes how writing cognition is tied to human beings' historical and cultural development. In particular, he highlights how changes in technology have altered the practices of writing. The author raises some of the important issues, upon which writing researchers from divergent perspectives often disagree. For example, one of those issues involves the basic conception of writing. Is the act of writing situation-specific or domain-general? Researchers from the sociocultural perspective tend to believe the former, while cognitive researchers assume the latter. Presumably, each side can cite evidence supporting their respective assumptions. Yet, these divergent assumptions may be largely due to differing epistemologies, those that tend to define distinct research communities. Notwithstanding these epistemological differences, the author proposes a rapprochement in writing research, across the sociocultural and cognitive perspectives. As such, I found this chapter intellectually honest, as well as interesting.

At its core, *Chapter 5* by Céline Baudet, Roger Graves and Bertrand Labasse provides a comprehensive review of research into professional writing in Canada. As such, I found most interesting the sections summarizing the writing studies "in Anglo-Canadian Postsecondary Contexts" and "Quebec." In these two sections, the authors highlight some of the complications that arise from language difference, English and French (respectively), in which the two languages can serve quite different purposes. In Canada, 'professional writing' is often more English-oriented. If the chapter had remained focused upon this particular topic, i.e., research into professional writing in Canada, from a sociocultural perspective, all might have gone well. However, the authors also have another goal. In the introductory sentence, they state their intention to illustrate "trends toward global writing research." They envision an integration of cognitive and social perspectives of writing. In fact, many writing researchers recognize the validity of both perspectives. For the most part, the chapter seems more a comprehensive review of sociocultural writing research—along with various criticisms of cognitive writing research. Toward an integration of the social- and cognitive-perspectives, the authors apparently foresee the former assimilating the latter.

Chapter 6 by Perry Klein and Tracey Leacock describes the distributed cognition framework as a recent conception of cognition. Instead of a process mostly located in the mind of an individual, distributed cognition unfolds across a system. The system can include other people (i.e., both writers and readers), as well as technologies. Through a review of cognitive studies of academic writing, the authors argue that a distributed view is implicit in an influential cognitive model of writing (Hayes & Flower, 1980). In reading this chapter, two questions arose. First, why do the authors limit their analysis to a single interaction, between the writer and texts? Second, why did the authors choose to focus primarily upon the Hayes and Flower (1980) model? With these questions, I wondered whether the authors' argument was something of a 'straw-

man.' In the final section, the authors conclude that "a distributed approach helps us to see cognitive models of writing more clearly" (p. 148). 'More clearly' than what? The authors argue that cognitive views of writing are incomplete, because they fail to take into account for the sociocultural aspects of writing. However, for a variety of reasons, including certain conceptual weaknesses (described above), I was not convinced. They propose that distributed cognition framework could facilitate an integration between these two perspectives. Perhaps. However, if the authors wanted to make this argument, they should have started several pages earlier.

In the field of writing research, there is a relatively common pattern of results, which many find disturbing. On a variety of writing measures, in a variety of assessment contexts, girls often outperform boys. Even though many cognitive writing researchers are not interested in the topic of 'sex differences,' they should know about this pattern. *Chapter 7* contains a review of the research literature, in which Carmen Gelati addresses some of the implications of this apparent sex difference in writing, both in terms of research methodology and instruction. Any discussion of sex differences typically devolves into speculations about the source of those differences. From philosophy to cognitive psychology, the 'nature vs nurture' controversy has a long history. Both sides still have adherents. However, the field of cognitive psychology has come to view cognitive developments as an interaction between innate and environmental factors. By and large, the present chapter highlights the latter. As a result, the author largely ignores the possibility that sex differences in writing performance might have some innate bases. Seemingly, a more balanced treatment, more equally covering both sides of this controversy, might have resulted in a more comprehensive review of the research.

Part 3: Teaching, learning and assessing writing across the life span

According to its title, Part 3 covers teaching, learning and assessing writing across the life span. There are 5 chapters involved, one about teaching writing to young writers with learning difficulties, one about word-level skills supporting the (young) writers' processes, one about writing development of children with language and motor problems, one about metalinguistic development in secondary writers and one about writing in professional communication. So, regarding 'teaching', there is only one chapter covering this topic. Regarding 'learning', if we take that as equivalent of development, there are three chapters involved. 'Assessing' scores zero and the 'life span' is represented by four chapters covering (young) children in primary or secondary schools and one chapter about adults in their professional lives. In that respect, a chapter covering writing in higher education is sorely missing.

Chapter 8 about strategies, knowledge, will and skills in a 30-year program of writing research does what the title promises and describes how Steve Graham and Karen Harris' successful intervention program (called SRSD: self-regulated strategy development) evolved from the 1980's until now. This multi-componential program is

based on a cognitive psychological approach and aims mainly on students with learning difficulties. Although the authors themselves do not stress this, their program deviates from the dominance in the early models (1980) of cognitive writing processes at the expense of motivation. In contrast, in their self-regulation concept Graham and Harris included an important role for the driving force of students' writing, a very effortful activity in comparison to other academic requirements especially for students with learning difficulties. Convincing students of the usefulness of newly learned strategies for planning, goal setting and revising is therefore very important, a call similar to the one frequently heard from the domain of reading strategies (e.g. Scott Paris). Remarkable in this respect is the observation made in this chapter (p. 188) that evidence about the role of motivation for writing is still 'very limited' and often inconclusive. What I especially liked about this chapter is its clear and succinct description of what is wrong with US writing education and what 'works' according to the research evidence. Finally, the number of intervention studies supporting the effectiveness of the SRSD approach is really impressive.

Chapter 9 about phonological, orthographic and morphological word-level skills, by Deborah McCutchen, makes a case for the importance of translating ideas into text and for the important role of linguistic skills in that process. These roles were more or less underspecified in the early models of writing, which were observed to leave the 'translation box' almost empty, while emphasizing the more 'cognitive' processes of planning and revision. Fluency in the use of language on the other hand, is nowadays regarded as an important component, especially for young writers' development, because it frees cognitive processes to attend to higher order issues, such as text coherence and adaptation to genre and readers. However, this chapter also reveals that there is still surprisingly little experimental evidence for this hypothesis. McCutchen devotes an interesting piece to her and other research on sentence combining training and its effects on global writing quality, but has to conclude that although there are some studies showing positive results, the underlying mechanism is still unclear. Is it really freeing cognitive resources by increasing automaticity, or is it merely the ability to produce more complex sentences and related morphology that underlies the effect (see also Van Gelderen & Oostdam, 2005)? Direct demonstrations of the influence of improved phonological or orthographic (spelling) skills on writing quality are mostly absent. Of special interest however, is McCutchen's description of an in-service training for teachers directed at improving their knowledge about phonological and orthographic issues in young (grade 1-5) students' spelling development. This training, which also included broader aspects of literacy teaching (e.g. text comprehension) resulted in positive effects especially for struggling readers on a range of literacy measures, not only lower order (such as spelling) but also of higher order (ratings of global writing quality).

Chapter 10 (Vincent Connelly, Julie Dockrell and Anna Barnett) aims at the writing of children with special language impairment (SLI), dyslexia and developmental coordination disorder (DCD). The first group is characterized as having problems with

oral language, the second with spelling and the third with motor processes involved in written language (handwriting). Nevertheless, the authors send out a warning that the distinctions between SLI and dyslexia are not as easy in practice, as the above definitions suggest. Their approach shares its main interest with the previous chapter in lower order aspects of writing influencing transcription and text generation on the sentence level. It also has in common with chapter 9 its interests in the possible effects of such lower order aspects on rhetorical aspects of writing. Are the deficiencies associated with SLI, dyslexia and DCD causally related with the students' observed lower writing quality and if so, how? Although it may seem evident that problems of dyslexic (and SLI) children with spelling cause their deteriorated sentence generation and therefore composing, in fact this is not so clear. Spelling skills are related to other linguistic skills, such as phonological, morphological, syntactic and also semantic (vocabulary) knowledge (e.g. Schoonen et al. 2003), which are at least as plausible candidates for the disruption of the writing of students with the above handicaps. Especially for students with SLI, a wide array of linguistic variables is at stake with possible complex interactions in the role they can play in writing. Although for DCD the case seems simpler, the authors point to a paucity on research in this area exploring the possible connections between the motor components of transcription and language development in a much broader sense, including orthographic coding, phonology and morphology. In the end, the authors go beyond these lower order issues and mention also the (largely unexplored) roles of cognitive factors such as conceptual abilities, meta-awareness, social-rhetorical skills and motivational factors. It is an interesting overview of research into writing development of these special populations. However, some more attention to the question how to teach writing to such students would be welcome.

Chapter 11 by Debra Myhill focuses on metalinguistic development of secondary writers, broadly defined as their awareness of language as an object, instead of an instrument for communication. Myhill, however, is not only interested in this awareness per se, but also in the way this awareness functions during the writing process, bringing not only text generation processes, but also sociocultural influences to the fore. A model by Gompert (1992) is used as a framework for studying metalinguistic development, consisting of 5 subdomains: metaphonological, metasyntactical, metalexical and –semantic, metapragmatic and metatextual. According to the model the first three subdomains develop first, followed by metapragmatic and finally metatextual knowledge. After making the observation that surprisingly little research is done on the relation between metalinguistic awareness and writing – an observation I wholeheartedly share – Myhill presents her own research in 31 UK grade 8 classrooms. Apart from an intervention study, which focused on contextual grammar teaching, reflecting on the effects of specific linguistic features on narrative, argumentative and poetry writing, the relevant data for this chapter are derived from interviews with individual students. By analyzing these interviews it becomes possible to corroborate or refute some assumptions of the Gompert model. For example, support is given to the

assumption that metasemantic knowledge develops before metatextual knowledge. On the other hand metasyntactical knowledge was yet not well accomplished by these students, refuting the assumption that this type of knowledge develops synchronously with metasemantic knowledge. Another result is that metapragmatic knowledge seemed to be more important and better articulated by these adolescents, than the model would predict. It is however the question whether this was not a side effect of the intervention focusing on the effects of vocabulary and expressions, possibly resulting in heightened metapragmatic awareness. This study is exemplary and hopefully will stimulate much more research into the question of how metalinguistic knowledge interacts with writing processes to create meaningful communication. This type of research is sorely missing now.

Chapter 12 by Karen Schriver is about professional communication. To appreciate the word 'communication' in this context (instead of writing) I have to emphasize that this chapter aims at more than just writing. In contrast with the previous chapters, professional communication entails not only text, but also visual design to make texts legible, attractive and rhetorically effective. Moreover, Schriver in this chapter seems to aim not just at writing because of professional requirements, but also at writing as a profession in itself. A large diversity of social purposes is involved, such as educating, persuading, clarifying, sharing or collaborating in an effort to make 'relationships between organizations, writers, designers and their constituent stakeholders'. It is hard to imagine the diversity of situations with which these professionals have to cope. They vary for example from writing clear instructions for car maintenance, to making a useful scheme of the London underground. Schriver sheds light not only on the diversity of these situations, but also on the challenges that have to be dealt with and the types of 'knowledge' these professional communicators need to get there. Instead of audiences, these people deal with stakeholders who may have a diversity of – even conflicting – desires and needs and normally do not want to take time to read texts thoroughly. The detailed account culminates in a 15 point list of characteristics of expert professional communicators. Strong emphasis is laid on the complexity of this expertise (e.g. "Can juggle multiple organizational constraints (...) and multiple representations of the content (what the boss wants, what the client needs, and what the author thinks is best) and still maintain a focus on the stakeholders needs") and on rhetorical issues. However, by this emphasis on a diversity of knowledge and skills (and what seem to be more attitudes than skills) it is hard to conceive of a research methodology that systematizes these insights a little bit and molds them into writing pedagogies for professional writers. This has to be a huge multidisciplinary enterprise indeed!

Part 4: Levels of language processing

This part of the book contains 6 chapters about different 'levels' of language processing in writing (words, sentences and texts). One chapter deals with lexical access and retrieval, the second is about the acquisition of spelling, the third about phonological,

lexical and grammatical skills for spelling, the fourth about the effects of fourth graders' handwriting skill, the fifth about the writing of single words and simple sentences and the sixth about differences between spoken and written sentence building. On the whole, from the different levels of language, words and sentences are well represented, with some emphasis on (the spelling and production of) words. The text level, however, is not represented. Given the increasing importance of writing research on the text level (e.g. conforming to the global requirements of different genres and text structures), this is a surprising omission.

Chapter 13 by Patrick Bonin, Sébastien Roux and Christopher Barry goes into the application of a paradigm for spoken word production into the field of writing, namely (rapid) naming. It focuses on written production and asks 'how orthographic codes corresponding to individual words are accessed and produced from semantic information'. The authors indicate that almost all knowledge about these processes is acquired via cognitive neuro-psychological study of brain-damaged patients with acquired dysgraphia, but that this is not sufficient for sound theory building. They emphasize that data from healthy adults should be more included into this research. It is interesting to learn how phonological processes interact with orthographic processes on the micro-level of words, even in unexpected ways. However, this type of research is still in its initial phase and lots of questions are unanswered. In addition, how insight in the micro-level of written production may add to our knowledge about how sentences and texts are being produced (both spoken and written) remains uncovered in this chapter.

Chapter 14 by Sébastien Pacton et al. continues the micro-level perspective of the previous chapter, by focusing on the role of 'graphotactics' (see later) and morphology in how children learn to spell. This is an interesting link, because it provides a good example for how phonology is quite insufficient to generally explain written word production. The main attention of these authors is directed at morphophonemic writing systems, such as English and French, in which letter-sound relations are not transparent. In these systems, children seem to be doomed to learn the spelling of each unique word separately. However, this chapter reviews evidence that this is not completely true. Evidence is reviewed of the role of graphotactic knowledge, defined as regularities in the orthography (admissible letter combinations) of the language itself and of children's sensitivity to this type of knowledge. It is concluded that 'knowledge about certain graphotactics already develops as early as the first school year and increases during the following years'. Even in cases where children and adults may use simple morphological knowledge (meaningful units within words) they seem to resort to graphotactic strategies for spelling. Underlying this research is the overwhelming and ever surprising importance of implicit learning in language. Contrary to what many people believe, a lot of learning takes place just by frequent exposure to the same exemplars without conscious awareness of the underlying rules and without teachers explaining any rules (which are probably just as unknown to themselves as to their pupils). By giving many detailed examples of the way specific spellings are being

handled by children, this chapter is a valuable resource for anyone interested in the multiple problems posed by French and English orthographies.

Chapter 15 by Barbara Arfé et al. brings us even further into the study of underlying processes for spelling. In contrast to the previous chapter however, now a shallow orthography (Italian) is being discussed. The authors begin by emphasizing, in contrast to the previous chapters, the importance of broader linguistic knowledge than just phonology and orthography in spelling processes. Therefore, they characterize spelling as a higher order process, in contrast to many conceptualizations of writing processes. Interestingly, these authors bring to the fore that spelling makes children aware that sounds can be quite ambiguous both for grammatical reasons (such as the silent plural -s in French in words like chiens) or for semantic reasons (such as the inaudible difference in English between two and too). For that reason, spelling is of more importance than just transcription of sounds and has relevance for higher levels of word production than the word alone. However, most evidence for this position comes from nontransparent writing systems. This chapter reports a study into Italian children learning to spell in their shallow orthography. Focusing on 1st, 2nd and 3rd graders, in what is called a first exploratory study, and using mainly regression analytical techniques, the authors show that even for these little Italians other skills seem to be involved in learning to spell, namely grammatical and semantic skills. This is explained by assuming that these children make use of more integrated knowledge about the writing of Italian words, than just the phonological part, despite the fact that it would theoretically be possible to transcribe sounds only. Nevertheless, the amounts of explained variance in the regression models are quite low (and quite variable from grade to grade), leaving much room for other explanatory variables than the ones studied. Therefore, the theoretical case to be made needs much more empirical support than this study can provide. In addition to the authors' explanation, I wonder whether the idea of a perfectly transparent orthography is tenable. I don't know the Italian situation well enough, but in Dutch (also regarded as a transparent orthography) there are several factors precluding such an ideal (such as regional accents, dialects and 'lazy' pronunciation, let alone the issue of immigrant accents). For that reason, even in relatively 'transparent' orthographies, many children cannot just rely on the sounds they hear for correct spellings.

Chapter 16, by Alves et al. moves the focus from spelling to 'translation' processes in writing. To avoid confusion, this term does not refer to translation from one language to another, but to the fundamental process of transposing ideas into language. The authors, choose the concept of language 'bursts' to start with. A burst is a stretch of continuously transcribed text, supposedly resulting from the writer's previously planned linguistic phrases (in working memory). The longer such bursts, the authors assume, the more automated (or fluent) the writer's translation processes are. They report a study into the influence of handwriting skills of 4th graders on burst length. Previous studies have already shown that handwriting can be an obstacle for fluent translation processes, and thus for longer bursts, when it is not fully automated, especially in the

case of beginning writers. There are indications that they are not able to plan and transcribe concurrently, because of the severe load of handwriting on their working memory. Fourth graders are quite divergent in their handwriting fluency. For that reason, three groups were distinguished: low medium and high, and its effects on pausing, language bursts, transcription fluency and text quality were established. As expected, differences in language bursts, transcription fluency and text quality were related to handwriting skills. The students with the highest handwriting skills produced longer bursts, longer texts, more words per minute and better quality texts. According to the authors, the contribution of this study is the effect of handwriting skills on length of language bursts, since all the other effects were already known from previous studies. However, from the review several other studies also demonstrated this effect on language bursts, so what remains is a new demonstration with 4th graders, which is theoretically a somewhat meager outcome.

Chapter 17, by Mark Torrance and Guido Nottbusch takes as a starting point the linguistic components of writing words and sentences by literate adults. In contrast to Arfé et al. in chapter 15, who considered spelling in children, in this group of adults, linguistic processes for 'translation' are regarded as 'low level' because they seem to be quite effortless and automated and therefore do not take much conscious attention. The authors signal that surprisingly little research into this type of written language production is carried out. Almost all studies hitherto concern spoken production. On the other hand, there might be important differences in how speakers formulate words and sentences and how writers do that. The authors point at three important differences: 1) the pressure for online fluency in speaking (which is absent in writing), 2) the issue of mental representations of written and spoken words (which might be different according to some; there might be different orthographic and phonological lexicons) and 3) different processes for monitoring accuracy of output (simultaneous in speech, but not in writing). The authors plead for a research program exploring the psycholinguistic consequences of these differences in 'postconceptual' written production. Additionally, they review studies into typing speed of simple words and present their own studies into the writing (typing) of simple sentences. Using so-called IKI (inter key intervals), the possible planning units of typists within words and sentences are being explored and the degree in which psycholinguistic processes are involved (syllables, morphemes, syntactic units). Advance planning of single clause sentences is a case in point. Do typists need to preplan such sentences before they start typing or not? Give or take some inconsistencies in the results discussed, the preliminary answer in this chapter is: no, typists do not need such preplanning and the suggestion is that this has to do with the above difference between writing and speaking, the (absent) pressure for fluency in writing. What this line of study may reveal about 'normal' writing of natural texts is not exactly clear, but the authors make a case for the fact that hitherto in key stroke logging, the main attention was on thinking pauses of minimally 2000 ms, while their approach has shown that planning may occur in pauses of much less duration, or even concurrently with typing. This seems an

important addition to key stroke methodology and its use for analyzing writing in a more general sense.

In *Chapter 18*, Audrey Mazur-Pallandre, Michel Fayol and Harriet Jisa report an empirical study into the effects of modality (speaking vs writing) on argument structure of sentences. This study, based upon a theory of Du Bois (1987) ('preferred argument structure') shares theoretical commonalities with previous chapters in comparing the cognitive constraints of speech with those of writing. More specifically, the authors take as their vantage point that speech is produced under much more time pressure (and pressure to produce continuous language) than writing and this difference has important consequences for syntactic complexity of spoken and written utterances (compare chapter 17). In their study, the authors do not only compare the effect of modality (speech/writing) but also text type (narrative/expository) on the structure of sentences (particularly lexical noun phrases in subject position). Subjects were selected from different French speaking age groups (10, 12, 15 and 24 year olds). Results of the study show effects of age groups, modality and text type on different aspects of noun phrases (number of nouns per clause, noun phrases in subject position, words in subject and in non-subject lexical noun phrases). Especially the effects of text type (narrative vs expository) seem quite large. In particular in regard to proportions of lexical noun phrases in subject position, written expository texts seem more complex than all the other type/modality interactions across all age groups, suggesting that even the youngest participants are sensitive to genre differences. Though these results are interesting, the theoretical predictions of the study, for example what to expect from the difference in text type or what kind of developmental pattern in the use of lexical noun phrases is expected for French, are not revealed in advance and only very briefly discussed at the end. In addition, the authors do not report or discuss interactions between their main variables, although the figures sometimes suggest that such interactions (e.g. between age and modality or between modality and type) exist.

Part 5: Cognitive processes in writing

In the grammar of many languages, the morphological form of a verb is sometimes determined by the relative plurality of the subject. How do writers determine the correct form of verb, in order to establish subject-verb agreement? In *Chapter 19*, Denis Alamargot et al. present strong evidence suggesting that reading may support this grammatical problem-solving. Why use eye-tracking to investigate this type of grammatical problem-solving? The authors suggest that their investigation represents a 'next' methodological step. They suggest that the recent emergence of eye-tracking somehow reflects a maturing of the field of cognitive writing research. Indeed, this investigation is innovative, by considering the role of visual behavior. Alternatively, there is a more compelling reason to use eye-tracking: It provides a way of observing reading-during-writing. Some recent cognitive models of writing (i.e., Hayes, 1996) posit that reading is a fundamental process in writing. Thus, writers may be rereading

their text, in order to evaluate the subject-verb agreement. Thus, I believe the authors' experiment could be more profitably viewed as an investigation into the role of reading-during-writing. Otherwise, it seems fair to ask, what do these eye movements signify? Reading or something else?

In cognitive writing research, the act of revising has long been recognized as important. However, the field's understanding of revising has developed over time. In *Chapter 20* Charles MacArthur reviews this body of research, highlighting the important developments in our understanding of revising. The author not only addresses top-down approaches to revising (e.g., Hayes et al., 1987), but also bottom-up approaches (e.g., Galbraith & Torrance, 2004). As the chapter-title indicates, the author rightly emphasizes the importance of evaluating. Indeed, this emphasis is appropriate, given that revising surely depends upon evaluating. If a particular revision serves to improve the overall quality of text, then the writer has presumably already made some evaluation. Further, to evaluate the developing text, a writer must presumably read it. On this view, reading and evaluating are prerequisites to revising. The author clearly articulates the development of a cognitive understanding of revising, through a comprehensive review of the relevant research studies and models.

In the early 1980s, cognitive scientists became fascinated in the act of writing, as an example of complex, everyday problem-solving. They also recognized the potential value of Baddeley and Hitch's theory of working memory, as a conceptual grounding for investigating writing. Accordingly, in cognitive writing research, many studies have considered the role of working memory. In *Chapter 21*, Thierry Olive provides a comprehensive and insightful review of this research. In cognitive writing research, working memory theory has served a few vital functions: It provided a conceptual linkage to the field of cognitive psychology, while also providing a viable conceptual framework for understanding writing cognition. The author knowingly traces two conceptual histories, i) the significant developments in working memory theory, as well as ii) the applications of working memory theory to writing research. The author clearly delineates these two strands, particularly at their various points of convergence and divergence. In cognitive writing research, the conceptual linkage to working memory theory has provided multiple benefits, from the conceptual to the methodological. What about future research? The author indicates that certain components of working memory require further explication. Also he wonders about possible mediatory influences of social and emotional factors, as well as developmental changes in working memory function.

Part 6: Applications of technology to studying and teaching writing

Cognitive psychologists face the 'black box' problem. That is, they seek to gather evidence about a covert phenomenon, human cognition. In cognitive writing research, one potential source of evidence is keystroke logging. When composing a text at the keyboard of a personal computer, the individual keystrokes, as well as the latencies

between them, may reflect underlying cognitive processing. Keystroke logging data may have a particular validity, since it directly records the writer's behavior in real-time. In *Chapter 22*, Luuk van Waes et al. discuss how keystroke logging methodology may support investigations of writing. The authors highlight three important applications of keystroke logging systems. First, keystroke logging data can record pauses in text input, which may reflect the cognitive demands of problem-solving. Second, keystroke data can enable a fine-grained analysis of revising. For example, the Cut&Paste activity may indicate revising, while use of the Backspace key may indicate editing. Third, beyond research applications, keystroke logging might also have pedagogical applications. Theoretically, keystroke logging could be used to instruct writers, by providing them with feedback on their own writing performance. In this introduction to keystroke-logging methodology, some mention of data analysis seems warranted. Overall, this chapter presents an interesting introduction to prominent keystroke and handwriting logging tools, comparing and contrasting the capabilities of each system.

Part 7: Emerging cognitive neuroscience of writing

In previous chapters of this volume, some authors propose that cognitive writing research is undergoing a conceptual shift, one toward the sociocultural perspective. In *Chapter 23*, Virginia Berninger and Todd Richards also predict a conceptual shift, but one toward the neuroscience perspective. Howsoever the field of cognitive writing research may develop, the neuroscience perspective seemingly represents one viable direction. The authors provide a very readable summary of their research, with its particular focus upon the needs of children with learning difficulties, particularly those related to reading and writing. Initially, I was confused by the authors' frequent use of the term 'writing brain.' Ultimately, I decided that this was a term of convenience, rather than an operational term. As such, it seems the authors are referring to a simpler conception of writing, which might be described as 'text production.' If so, the authors' conclusions about the 'writing brain' may or may not generalize to more complex conceptions of writing, which include processes such as planning and reviewing. Certainly, the brain is responsible for cognition, which seemingly makes it the obvious target for cognitive research. At the same time, we might ask the question: Is the neuroscience approach inevitable? There is an important practical constraint. Neuroscience cognitive research requires the acquisition, maintenance, and operation of a brain imaging system. Thus, the adoption of this methodology requires access to expensive, sophisticated equipment, which may serve to limit the use of this methodology. The authors claim that entire psychology departments have embraced this new methodology. At the same time, I know of other cognitive scientists who remain skeptical of this approach to research.

Conclusion

The final section of this volume is entitled, 'Visions of the Future of Writing Research.' We chose to not review the chapters in this section. In this section, some authors described their own research plans. This approach seems apt, since many of these research plans will presumably come to fruition. Thus, by providing a glimpse of their own research plans, these authors are providing their own vision of the future of writing research.

In this final section, some authors do offer predictions about the future of cognitive writing research. In fact, in this volume, such prophesies are a recurring theme. Several authors propose that the field is currently undergoing a conceptual shift. However, about the nature of this supposed shift, opinions differ. Some authors foresee a shift toward the socio-cultural perspective; while others see movement toward the neuroscience perspective. Traditionally, cognitive research has focused primarily on the mind of the individual. Will cognitive writing research shift away from this traditional focus, from the mind to the brain, from the individual to the social? Presumably time will tell.

In this volume, some topics received considerable attention, while others received seemingly little. Among the former, we could mention the (psycholinguistic) studies that take as their starting point comparisons with speech. Although most of these chapters (e.g. 9, 13, 17 and 18) stress that studies comparing oral and written production are quite rare, they seem to make a convincing point that such comparisons represent a promising research direction. Among the latter, we could mention the role of motivational factors in writing. Only chapter 3 directly addresses the role of motivation seriously, in Pietro Boscolo's reflections upon his own work. Since writing is often such an effortful activity, one might expect greater researcher interest in the role of motivation (and emotion). In addition, the topic of writing technologies seemingly received little attention. Writing has changed, dramatically. Applications running on networked digital devices account for many new uses of written language. Yet, there was little mention of electronic mail, messaging, or online forums. Given the proliferation of these digital applications, does the word 'writing' still mean what we think it means?

In the title of this volume, the word 'cognitive' appears not once, but twice. Accordingly, a reader might expect a homogenous collection of chapters, all from a single 'thought-collective.' However, this is not the case. Admirably, the editor has brought together writing researchers from a range of perspectives. This is a great accomplishment. This volume illuminates the breadth of the field of cognitive writing research, while pointing out possible fault-lines. In so doing, it provides a window onto an active field of inquiry, the future of which remains 'unwritten.'

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