

Book review

Observing writing: Insights from keystroke logging and handwriting

Lindgren, E., & Sullivan, K. (Eds.). (2019). *Observing writing: Insights from keystroke logging and handwriting*. Leiden, The Netherlands: Brill. doi: <https://doi.org/10.1163/9789004392526> | 378 pages - ISBN 978-90-04-39251-9

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The present book addresses theoretical and applied aspects of keystroke and handwriting logging research from different perspectives: psychology, computer science, education, linguistics, multilingualism studies, and neuroscience. In the beginning of the book, Lindgren, Knospe, and Sullivan present an overview of the writing research conducted from 2006 until 2018 that used digital tools. This overview is organized into different themes: tool development, processes in writing, writing development and education, writing difficulties, writing in first, second, and foreign languages, writing in the work place, and translation. This introduction aims to provide the reader with the questions that researchers seek to answer with the help of digital keystroke logging and handwriting tools. Notably, authors concluded that since the publication of the edited volume “Computer keystroke logging methods and applications” (Sullivan & Lindgren, 2006), there has been an exponential growth of research using keystroke logging not only to describe writing but also to understand the cognitive and sociocultural aspects of this activity. It is this growth that lead to the edition of this new volume.

After this introductory chapter, the book presents 15 chapters, and a final conclusion (Coda). The chapters are grouped into five themes: tool development (Chapters 1, 2, 3, 4, and 5); analysis of data collected with logging tools (Chapters 6 and 7), foreign language research (Chapters 8, 9, 10, and 11), and cognitive processes in writing (Chapters 12, 13, 14, and 15). The final chapter summarizes all the contributions in this book and points out future directions for writing research using observational logging tools.



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1. Book Contents

1.1 Theme 1: Tool development

In the first chapter, Wengelin, Frid, Johansson, and Johansson review and discuss studies that combined keystroke logging with other methods (e.g., eye-tracking). Despite highlighting the advantages of using multimethod approaches in order to increase our understanding of the writing process, the authors conclude that few studies have adopted such an approach. Additionally, the authors present a new-version of the keystroke-logging program ScriptLog, which combines eye-tracking and the triple task paradigm. The authors discuss the New ScriptLog as a tool that offers advanced integration with eye-tracking equipment, making it possible to record and analyse eye movements during text writing.

In the second chapter, Alves, Leal, and Limpo present some handwriting logging tools and introduce HandSpy. This is a handwriting logging tool suitable for both children and adults, which allows writers to use apparently normal pens and paper. The authors present HandSpy technical components, functions, and procedures of data collection. Afterwards, they present a study that examined the validity and reliability of the tool by comparing transcription and online measures of low- and high-quality texts in a sample of 80 second graders. Overall, HandSpy provided accurate measurements of bursts and pauses during the production of a text.

In the third chapter, Leitjen, Van Horenbeeck, and Van Waes analyse keystroke data from a linguistic perspective. The authors present Inputlog, a keystroke-logging program, combining the linguistic perspective with cognitive process research. After briefly contextualizing the importance of linguistic proficiency in text production, the authors present exploratory results from a study with 48 university students comparing text production in L1 (Dutch) and L2 (English). Specifically, the dynamics of text production was analysed by focusing on writers' pausing behaviour. The authors conclude with a discussion on how automatized linguistic analysis can contribute to writing research.

In the fourth chapter, Bécotte-Boutin, Caporossi, Hertz, and Leblay address writing analysis through visualisation and emphasize the importance of using coloured numerical visualizations of writing data. The authors underline the need to graphically depict text in time and space, as the visualization of both the written product and the written process will increase the understanding of the complexity of writing. Furthermore, the authors explain the concept of data representation and the importance of visualisations of the writing process, where they distinguish between linear and non-linear representations. Several useful examples with different writing logging tools are presented.

In the fifth chapter, Chukharev-Hudilainen discusses how writing research methods based on keystroke logging tools can bring added value to educational

contexts. Specifically, the author presented a study about how keystroke logging technology could be integrated into automated writing evaluation (AWE) tools to enrich the teaching of writing. The author formulates design principles for an AWE system with keystroke logging support, and discusses the accuracy and usability of CyWrite, a prototype tool currently under development.

1.2 Theme 2: How to analyse data provided by logging tools

In Chapter 6, Perrin portrays progression analysis, a multi-level approach that combines ethnographic observation and interviews with computer recording and cue-based retrospective protocols. The author shows how large corpora of writing research data can be controlled using this method. Through a newswriting research with journalists, the author explains the principles of ecological data management in real-life writing research, and explores the development of layers and exploitation of real-writing data from progression analysis.

In Chapter 7, Wallot and Grabowski present Recurrence Quantification Analysis (RQA). This is a time-series analysis method aimed to help researchers to use the information in the dynamics of keystroke logging data. Based on a data set of a copy-typing experiment with 30 undergraduate students in their L1 (German) and in an unknown language (Finnish), the authors illustrate the practical application of RQA. In their discussion of the findings, they show the usefulness of RQA for the analysis of keystroke-logged typing data and its ability to generate new views on the writing process.

1.3 Theme 3: Foreign language research

Chapter 8, written by Breuer, focuses on the fluency in L1 and foreign language writing through an analysis of planning, essay writing, and final revision. The author presents a study where keystroke logging analysis was used to test the effect that language and planning methods have on text production. For that, they tested 10 undergraduate students writing academic essays in their native (German) and foreign (English) languages. The effects of two planning strategies (i.e., note-taking and freewriting) on L1 and foreign languages were examined. Besides writing, it was tested whether there were differences on planning, formulating, and revising between native and foreign languages.

Chapter 9 was written by Tiryakioglu, Peters, and Verschaffel, and presents a study that relates language competence with composing processes in writing an argumentative text. Specifically, the authors compared composing processes in L1 (Turkish) and L2 (English) in a sample of L2 learners (eight high-school students), and the effect of L2 proficiency level on composing processes in L2. Data was collected from keystroke loggings, think aloud protocols, and post-writing questionnaires. The authors discuss the results based in the comparison of L1 and L2 composing

processes, and in the composing processes of high and low L2 proficiency students. In the end, they discuss the pedagogical implications for writing instruction.

In Chapter 10, Hoang focuses on the issue of metaphorical language in L2 learners and considers the temporal load of metaphor production as part of the L2 writing process. The author presents a study with 15 undergraduate students to understand the motivations of the use of metaphorical language in writing texts, and whether the use of metaphorical language adds cognitive load to the writing process, as measured by pauses. Keystroke logging and stimulated-recall interviews were the two sources of data. The author centred her discussion on the logged pauses as cognitive indices of metaphoricity in L2 writing and on the temporal cost of metaphorical language use in L2 writing.

In Chapter 11, Knospe, Sullivan, Malmqvist, and Valfridsson present a study that examined how seven high-school students learning German as a third language (L3) use online resources when solving writing tasks. The analysis was made through keystroke logging combined with screen-recording, which allows to observe the interplays between text and writing, search queries, search results and students' strategies. Additionally, stimulated recall interview allowed students to reflect about their writing process and to receive feedback on their writing. The authors present the individual results of each participant and discuss them with a focus on the impact that digital resources can have on writing processes in the context of foreign language learning.

1.4 Theme 4: Cognitive processes during writing

In chapter 12, Aldridge and Fontaine present an overview of research about the impact of increased cognitive demand on digital writing processes, pauses in language production, and performance in keyboard language production. Afterwards, they present a study with undergraduate students divided into groups based on their keyboard efficiency. The goal was to determine if keystroke logging can capture the impact of increased cognitive load on typing and if the written process is influenced by typing fluency. The results are presented according to the nature of the writing task (i.e., copy and writing), and its level of difficulty. Pausing behaviour and error occurrence in both tasks are also discussed. Finally, the differences between participants with high and low keyboard efficiency across tasks are compared.

In Chapter 13, Galbraith and Baaijen discuss the association between keystroke logging measures and cognitive models of writing. The authors discuss the problem of alignment between keystroke logging measures and cognitive models of writing through a model of text production. This model distinguishes between the conceptual processes involved in the creation of content and the linguistic processes involved in content formation in language. They present procedures for increasing the alignment between keystrokes and cognitive processes, focusing on the characteristics of text production in isolation from other components of the writing process (e.g., the

relationship between pauses and bursts). Finally, they present a reflection of how text production is combined with planning and revision.

In Chapter 14, Linnemann addresses the cognitive representation that is formed by the writer about the cognitive, affective, and motivational dispositions of a potential reader of their written production. This audience anticipation is discussed from the perspective of cognitive models of writing and phases of the writing process (i.e., planning, formulating, revision). The Adaptive Control of Thought model is presented as a basis for a study intended to explore when and why the potential reader is anticipated by the writer during written production, and the importance of addressing the audience during writing is emphasized.

In Chapter 15, Lindgren, Westum, Outakoski, and Sullivan explore the revisions that writers undertake at the leading edge. The leading edge for keystroke logging is defined as the position immediately after the last written character in the text produced, and it is considered to carry important information about how inner speech becomes externalised in writing. The authors present a study aimed to define the linguistic characteristics of revisions at the leading edge. The study analyses the pre-contextual revisions of six texts from a multilingual 15-year-old writer, in three languages (Swedish, English, North Sámi). The results are presented and discussed in reference to different levels of revision (i.e., sub graphemic, graphemic, morphemic, word levels). Implications for the development of keystroke logging tools software close this chapter.

1.5 Final chapter: Coda

In the last chapter of the book, Strömquist highlights the crucial role of keystroke logging in pulling writing research to a scientific level. Based on the contributions of the research discussed in previous chapters, he also presents several reasons that contributed to that development. First, the increase and advance of content-driven technology, such as the combination of keystroke logging with other tools (e.g., eye-tracking), and the use of equipment that increases the ecological validity of writing research (e.g., HandSpy or Inputlog). Second, the interdisciplinary cooperation, with conjoined efforts from experts from different fields such as psychology, linguistics, educational science, and neuroscience. Third, the societal needs and challenges, where literacy is a central one. The author finishes with a reflection about the comparative study of speaking and writing, and about the way a writer interacts with the external representation of her/his ideas.

2. Conclusion

This book presents a comprehensive description of research that used digital tools to explore cognitive and sociocultural aspects of writing, clearly showing the evolution in writing research since 2006. Since then, keystroke logging tools became more stable, included more data analysis functions, have been combined with other data

collection methods (e.g., eye-tracking), and included functions to create detailed visualisations of the writing process. In general, the authors view keystroke logging as an important and unobtrusive method of data collection, showing how writers behave when producing a text. This information is particularly useful to help researchers in understanding how writing processes work and interact with each other. Also, it can contribute to scientific advances regarding diverse aspects of writing research (e.g., foreign language research) and to know more about the cognitive activities during writing and how they are represented in logfiles. Importantly, in handwriting, logging tools have been developed recently, as well as the combination of handwriting logging programs with other tools (e.g., eye-tracking), and the development of analysis tools.

This book is undoubtedly a useful tool for researchers in different fields to advance research in writing. Moreover, it can foster new insights relevant for education, because it has the potential to bridge the gap between research on writing processes and pedagogical applications. As Chukharev-Hudilainen noted in Chapter 5, nobody stands behind students' shoulders and watches how they write their texts, but digital writing tools such as keystroke and handwriting logging tools can deliver crucial information about how writing processes work.

References

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