Using keystroke logging in your research
... and in your classroom

Mariëlle Leijten & Luuk Van Waes
University of Antwerp | Belgium

Universiteit
Antwerpen

Overview

1. Introduction
   Which areas of research use keystroke logging?

2. Research
   How do you set up a keystroke logging research study with Inputlog?

3. Teaching
   How do you provide your students with process feedback in the classroom?

4. Inputlog 9-Beta
   How to log Chinese script?

Inputlog

- Windows (additional logging in MS Word)
- Writing modes
  - keyboard and mouse movements & clicks
  - speech: Dragon Naturally Speaking
  - focus: window monitoring (resources)
- Analyses
- Graphs
- Pre and post processing
- Play-back

Leijten, M., & Van Waes, L. (2013)

inputlog

Free download for researchers

Writing process research

Process observation provides data for research on:

- cognitive writing processes
- writing strategies
- writing development
- translation studies
- L1 versus L2 writing
- writing from sources
- live subtitling
- clinical diagnosis (e.g. dyslexia, dementia, aphasia)
- literary writers
- etc.

KSL with Inputlog: an introduction

General analysis

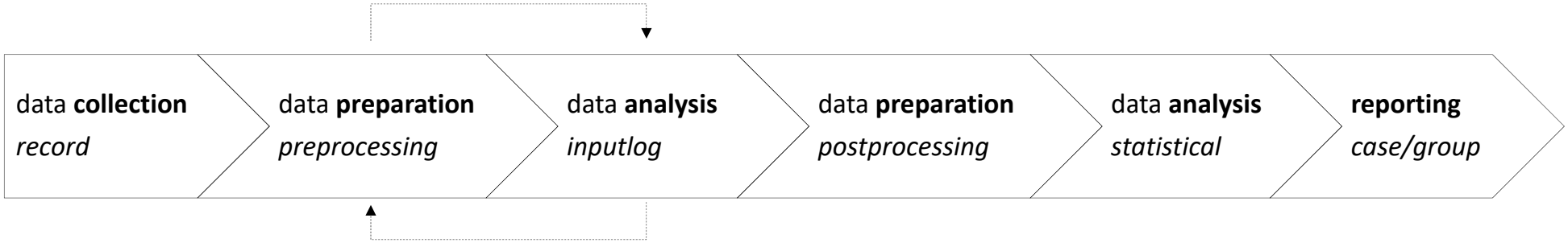
#Id	Event Type	Output	Position	DocLength	Character Production	StartTime	StartClock	EndTime	EndClock	PauseTime	
0	focus	Wordlog.docx - Microsoft Word								4259	
3	keyboard	D	0	1						7941	
4	keyboard	e	1	2	2					405	
11	keyboard	r	8	9	9	9859	00:00:09	10031	00:00:10	172	172
12	keyboard	t	9	10	10	9984	00:00:09	10140	00:00:10	156	93
13	keyboard	i	10	11	11	10078	00:00:10	10265	00:00:10	187	94
14	keyboard	o	11	12	12	10125	00:00:10	10296	00:00:10	171	47
15	keyboard	n	12	13	13	10234	00:00:10	10421	00:00:10	187	109
16	keyboard	SPACE	13	14	14	10421	00:00:10	10593	00:00:10	172	187

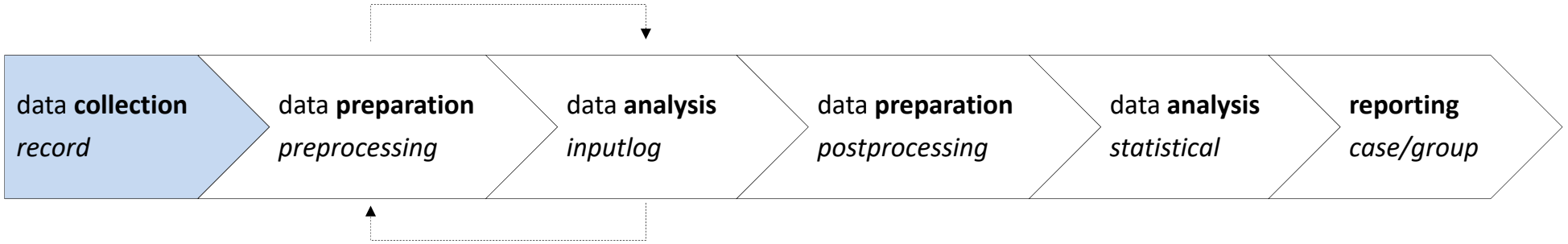
Research

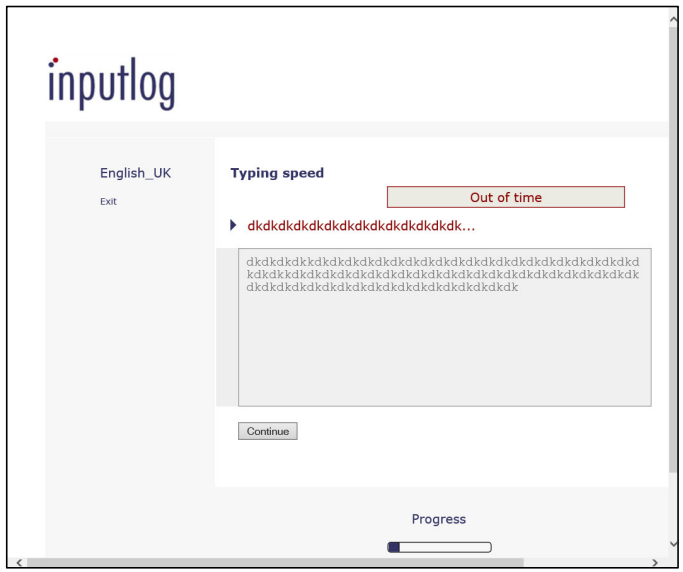
How do you set up a keystroke logging research study with Inputlog?

Designing keystroke logging research

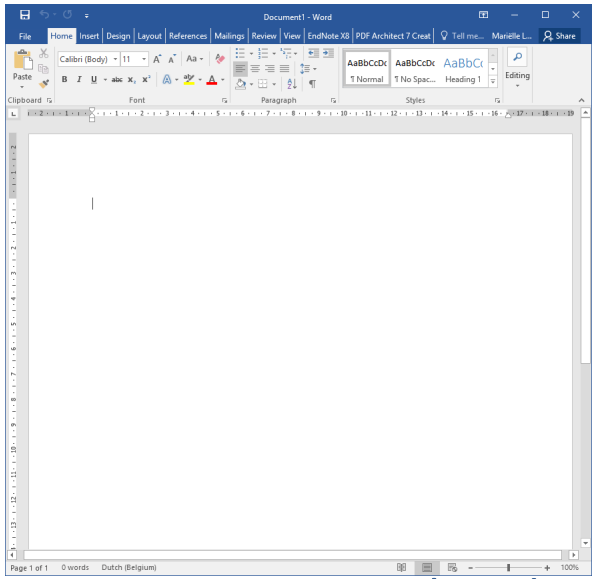
The Research Flow



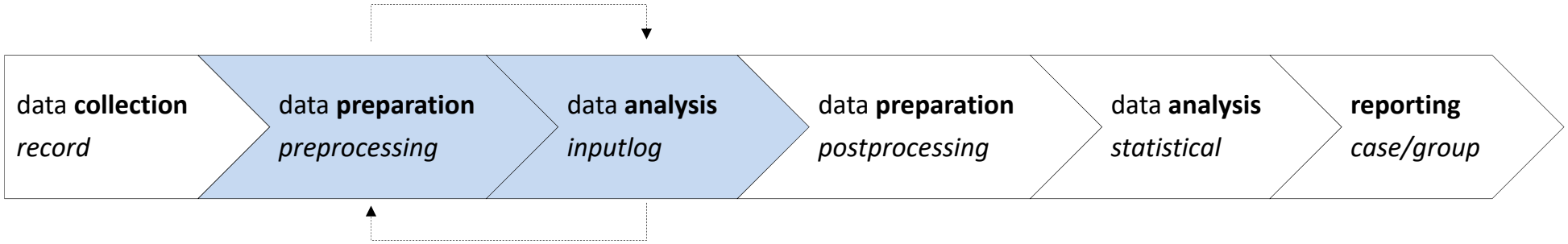




Copy task



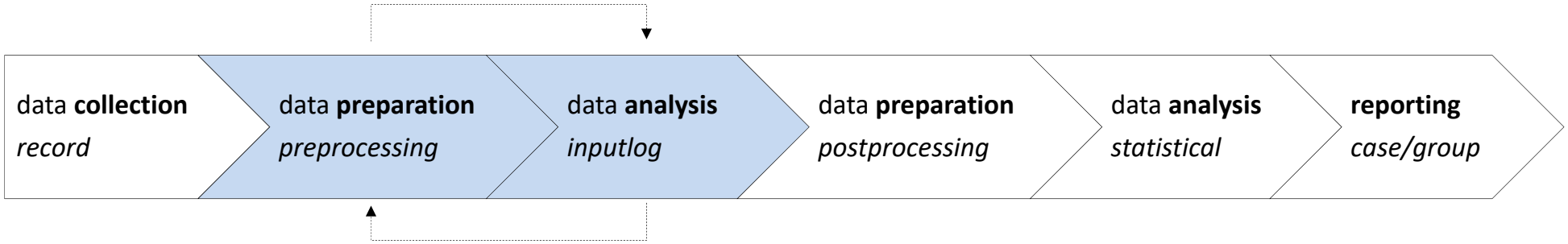
New, previous or other document



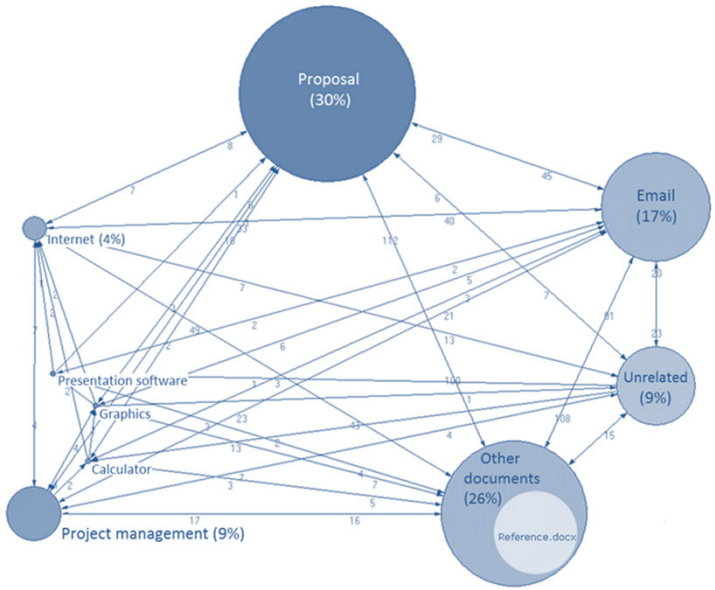
#Id	Event Type	Output
0	focus	Wordlog.docx - Microsoft Word
1	mouse	Movement
2	mouse	Scroll
3	mouse	Movement
4	mouse	Scroll
5	mouse	Movement
6	mouse	LEFT Click
7	focus	TASKBAR
8	mouse	Movement
9	mouse	LEFT Click
10	focus	WordLog_Nicky Petersen_20160308153728.docx - Microsoft Word
11	mouse	Movement
16	keyboard	l
17	keyboard	a
18	keyboard	s
19	keyboard	t
20	keyboard	SPACE

focus	main document
keyboard	l
keyboard	a
keyboard	s
keyboard	t
keyboard	SPACE
keyboard	s
keyboard	u
keyboard	m
keyboard	m
keyboard	e
keyboard	r
keyboard	SPACE

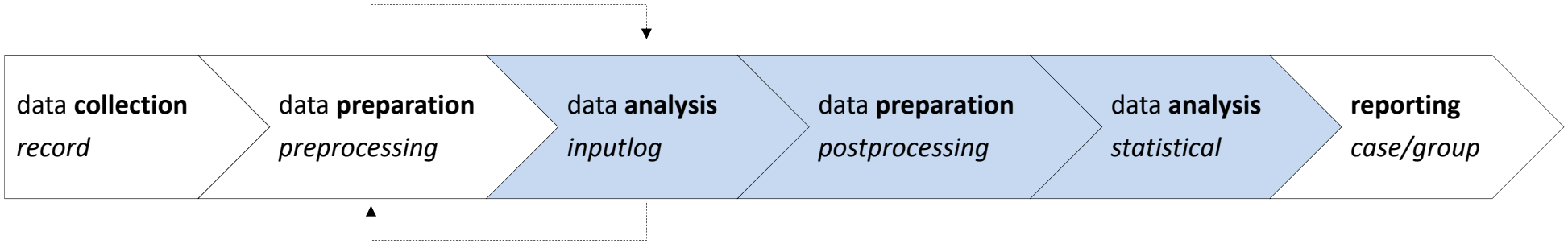
Data cleaning



#Id	Event Type	Output
0	focus	Wordlog.docx - Microsoft Word
1	mouse	Movement
2	mouse	Scroll
3	mouse	Movement
4	mouse	Scroll
5	mouse	Movement
6	mouse	LEFT Click
7	focus	TASKBAR
8	mouse	Movement
9	mouse	LEFT Click
10	focus	WordLog_Nicky Petersen_20160308153728.docx - Microsoft Word
558	focus	Google - Google Chrome
823	focus	Google - Google Chrome
824	focus	berlin museum modern art - Google Search - Google Chrome
831	focus	https://www.google.be/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwiOjae9qbHLAhXFDZoKHdKPA10QjhwIBQ&url=https%3A%2F%2Fnews.artnet.com%2Fart-world%2Fberlin-museum-of-modern-art-to-open-in-2021-220520&psig=AFQjCNGw6CA_E1fiSSyVzH3aJBLyWULn2Q&ust=1457534552896176 - Google Chrome



Data categorisation



Basic analyses

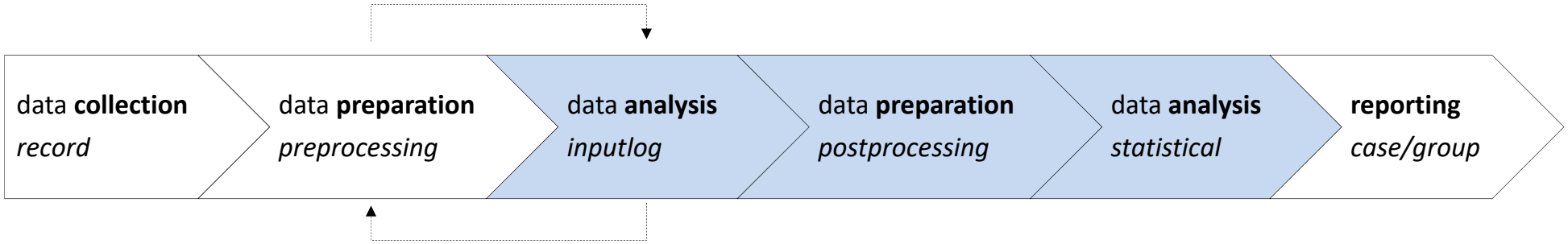
- general
- linear
- summary
- pause
- revision
- s-notatation

Specific analyses

- source
- fluency
- bigram
- word pause
- linguistic
- token
- copy task

Visual analyses

- process graph
- source network
- fluency graph



Basic analyses

- general
- linear
- summary
- pause
- revision
- s-notatation

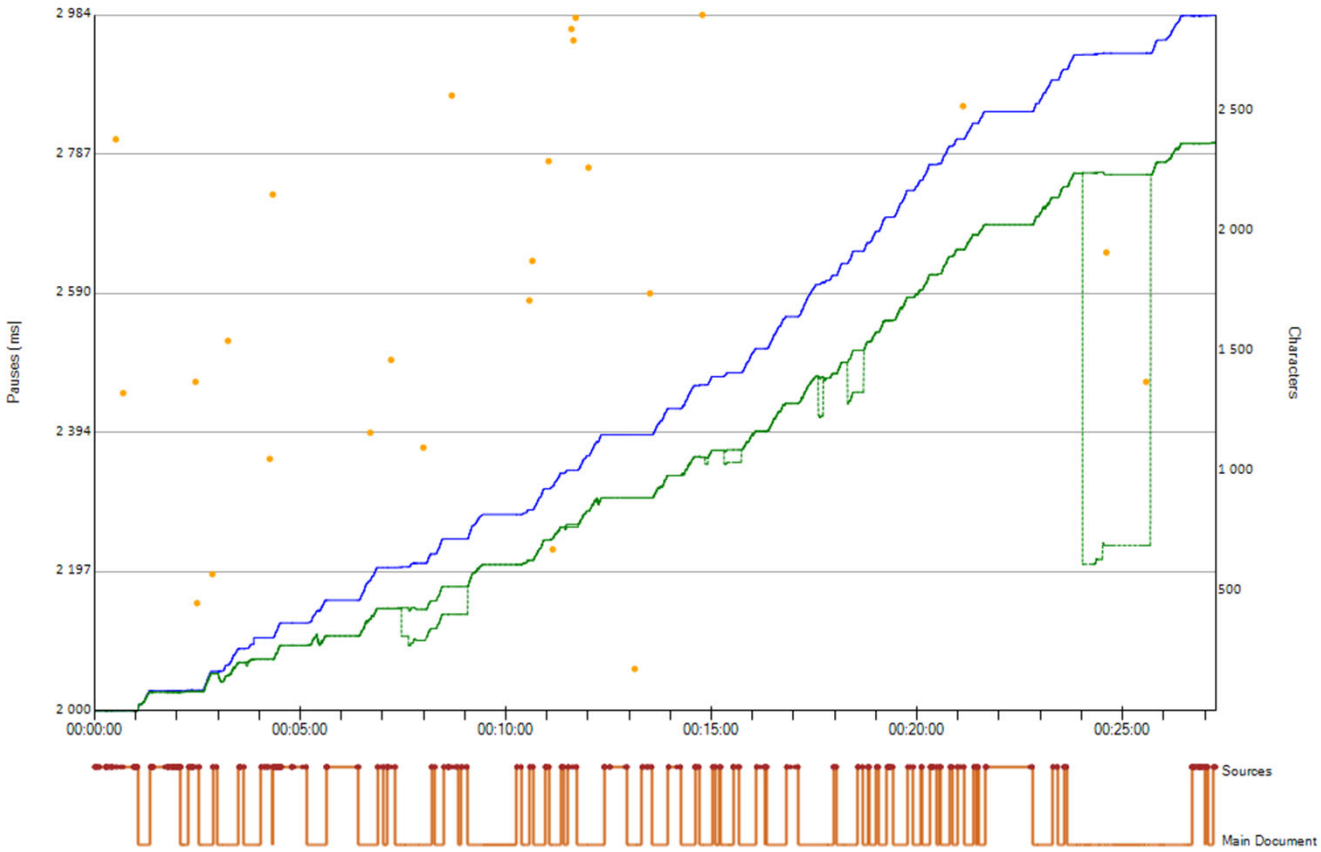
Specific analyses

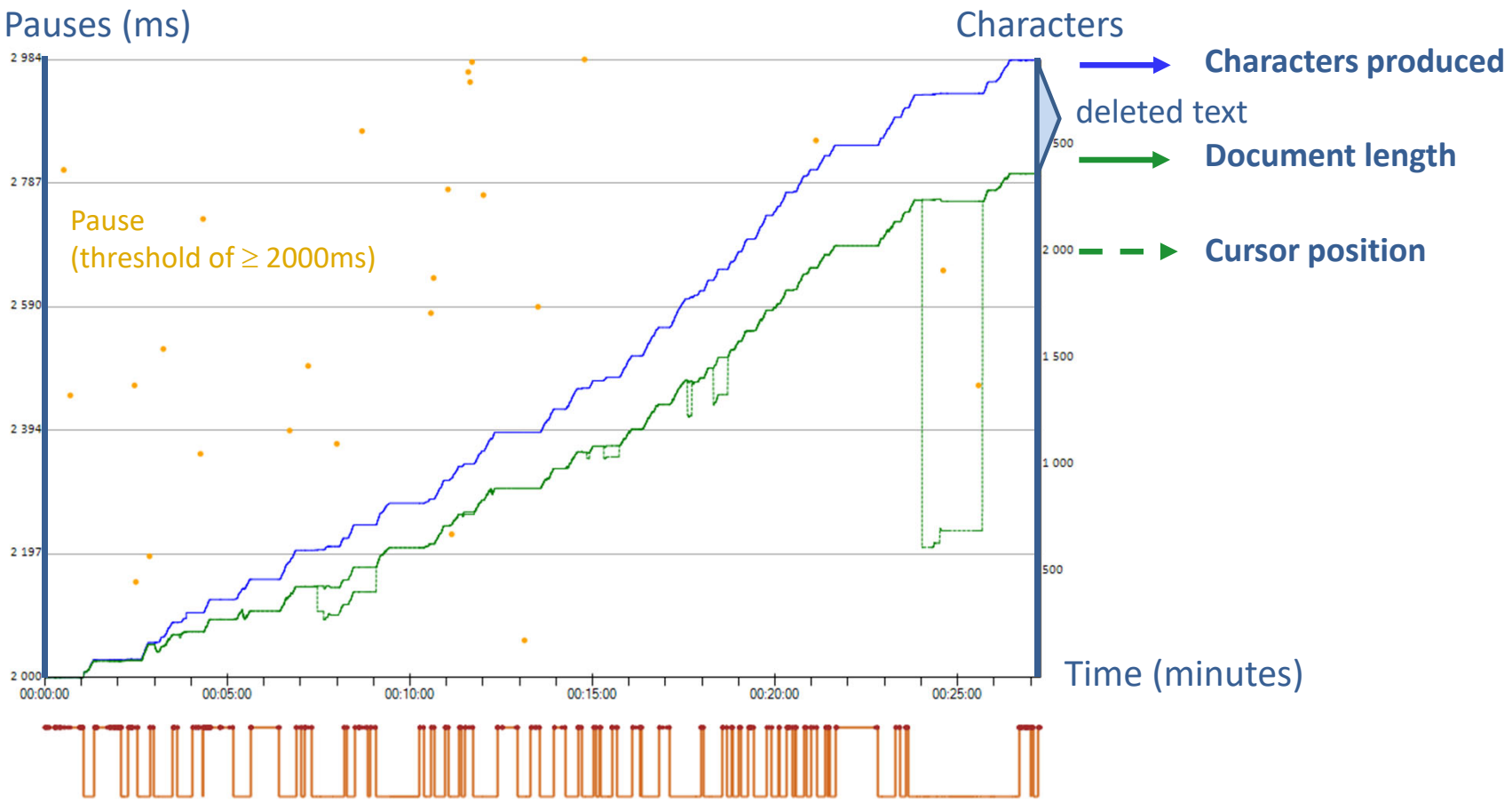
- source
- fluency
- bigram
- word pause
- linguistic
- token
- copy task

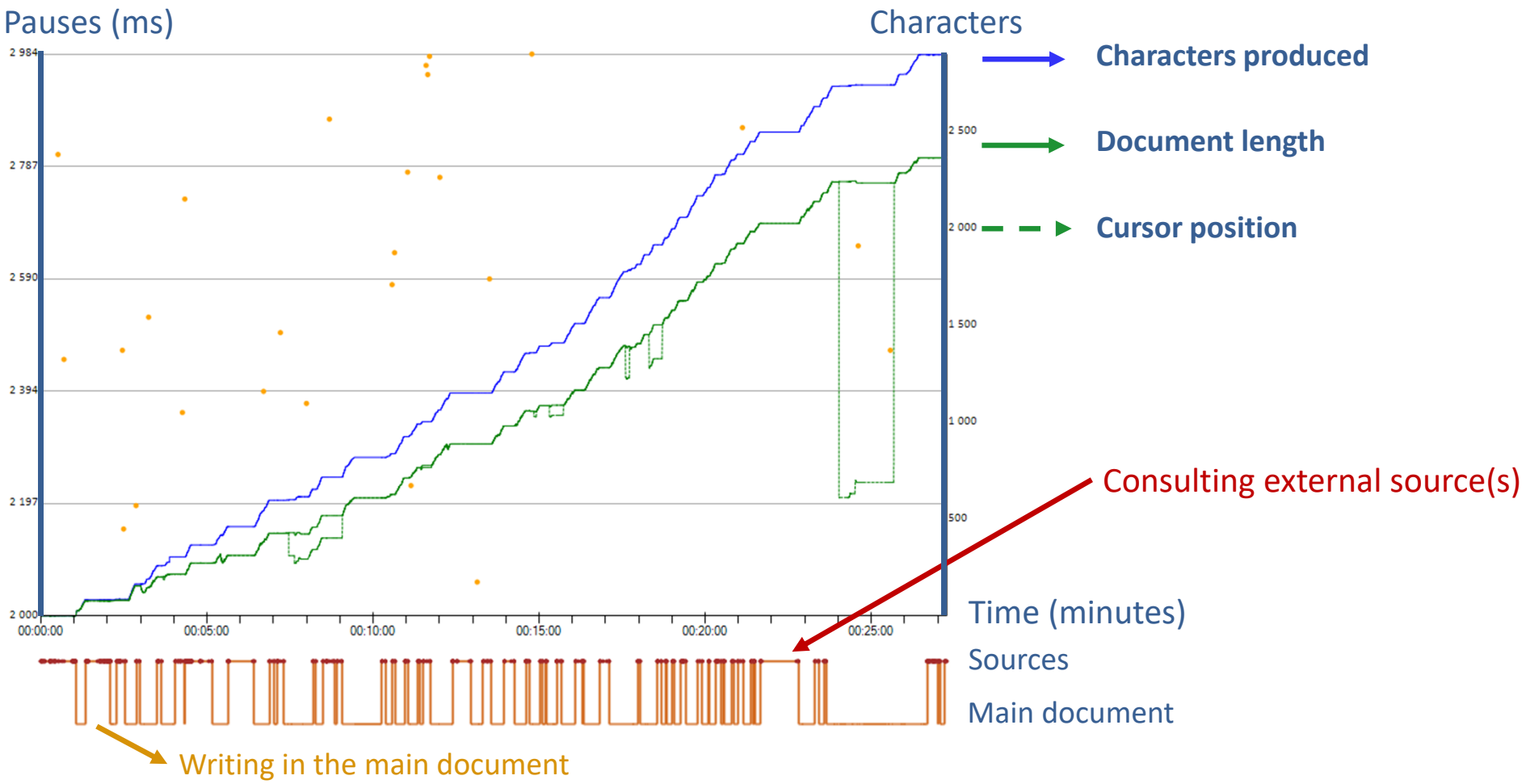
Visual analyses

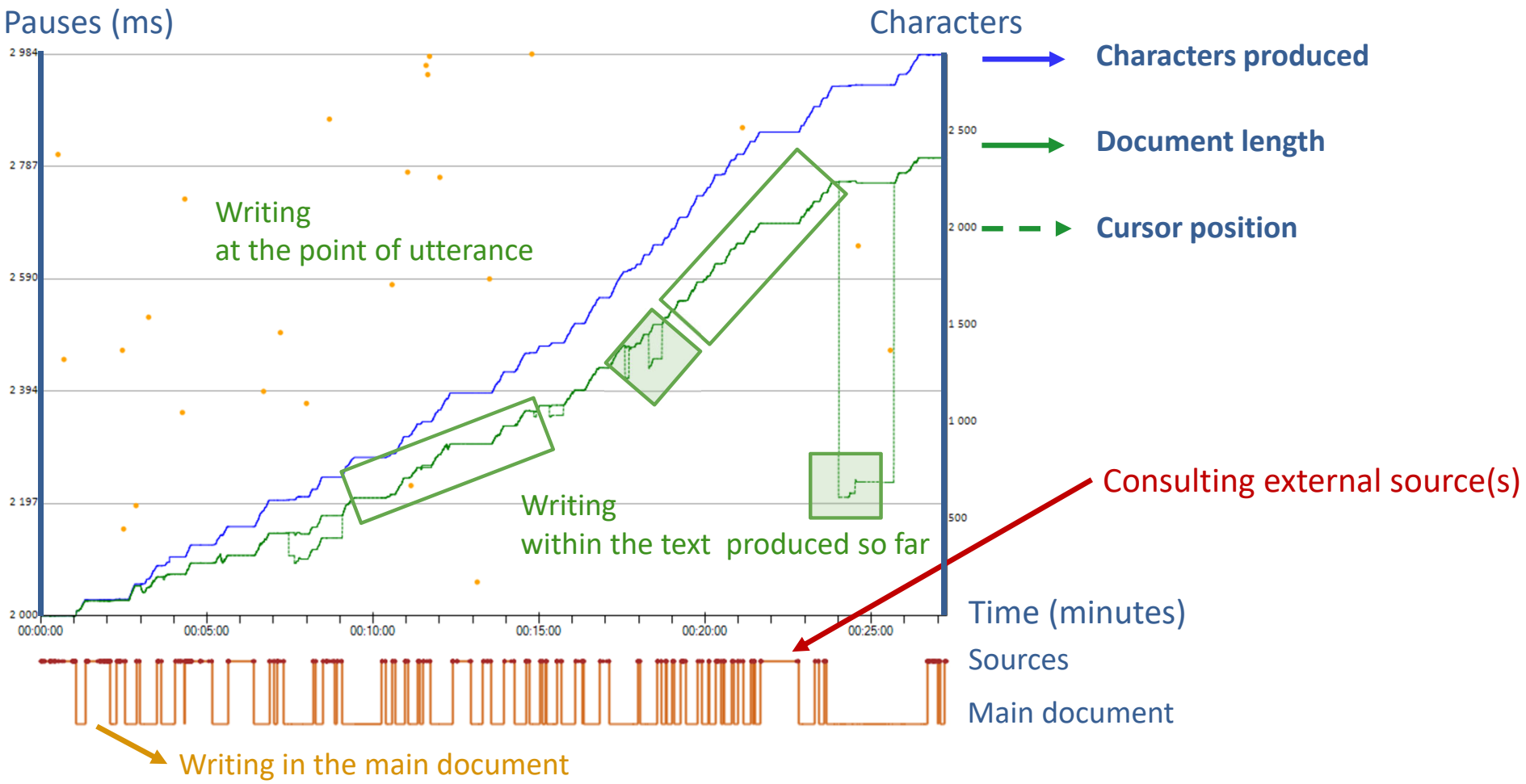
- **process graph**
- source network
- fluency graph

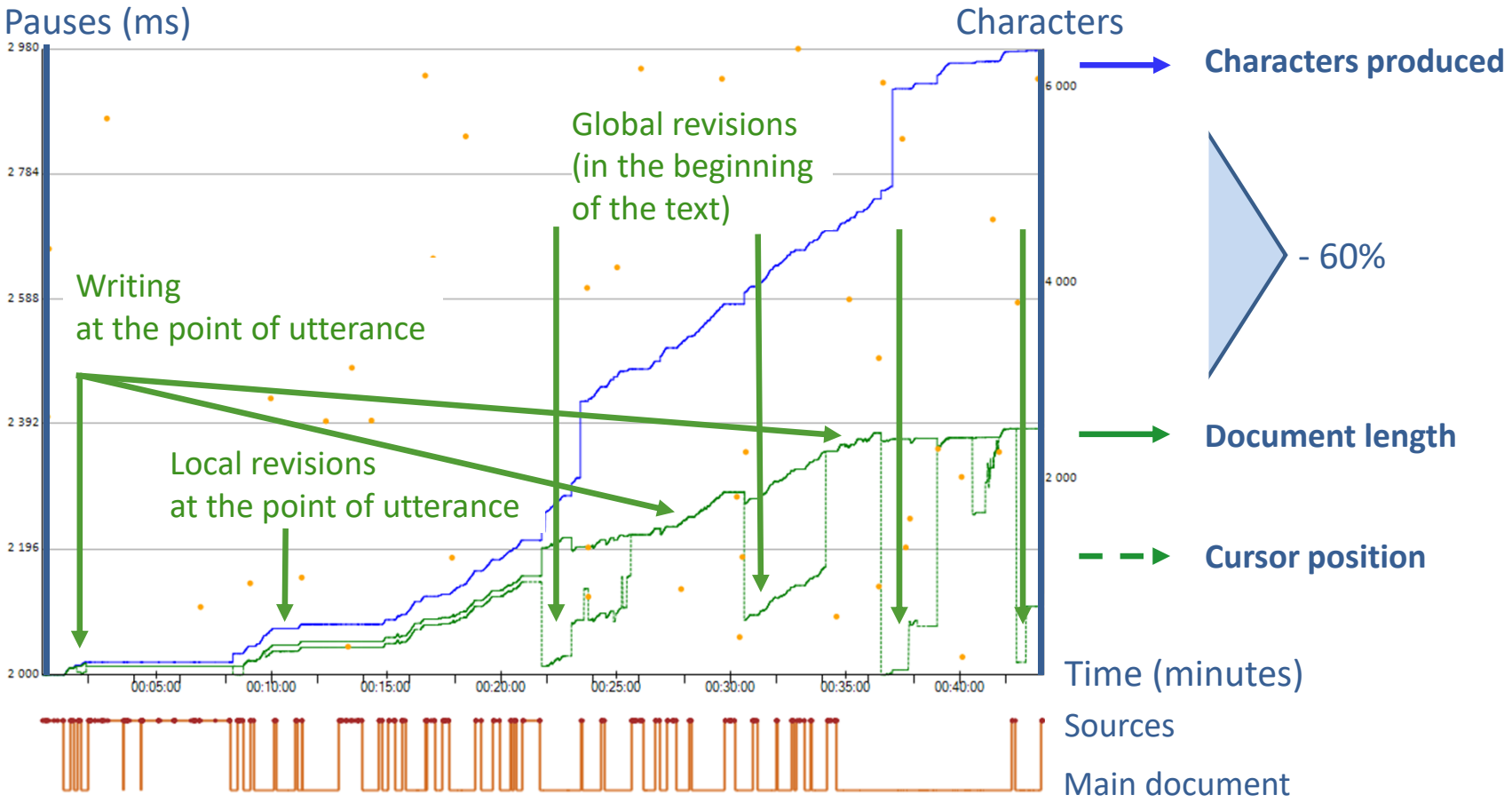
Process graph



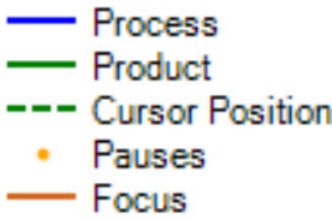

Pauses (ms)
Characters
Characters produced
deleted text
Document length
Cursor position
Pause
(threshold of ≥ 2000ms)
2 984
2 787
2 590
2 394
2 197
2 000
2 500
2 000
1 500
1 000
500
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
Time (minutes)

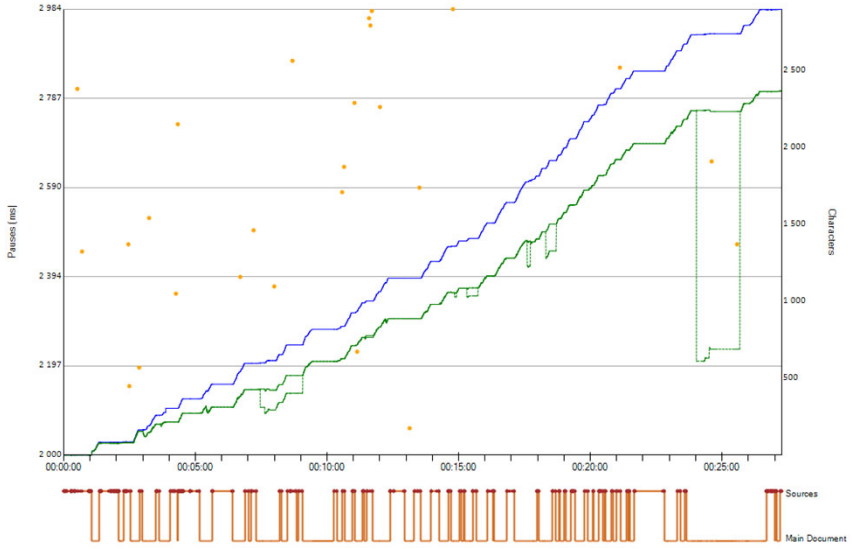

Pauses (ms)
Characters
2 984
2 787
2 590
2 394
2 197
2 000
2 500
2 000
1 500
1 000
500
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
Characters produced
Document length
Cursor position
Consulting external source(s)
Time (minutes)
Sources
Main document
Writing in the main document


Pauses (ms)
Characters
2 984
2 787
2 590
2 394
2 197
2 000
2 500
2 000
1 500
1 000
500
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
Characters produced
Document length
Cursor position
Writing
at the point of utterance
Writing
within the text produced so far
Consulting external source(s)
Time (minutes)
Sources
Main document
Writing in the main document

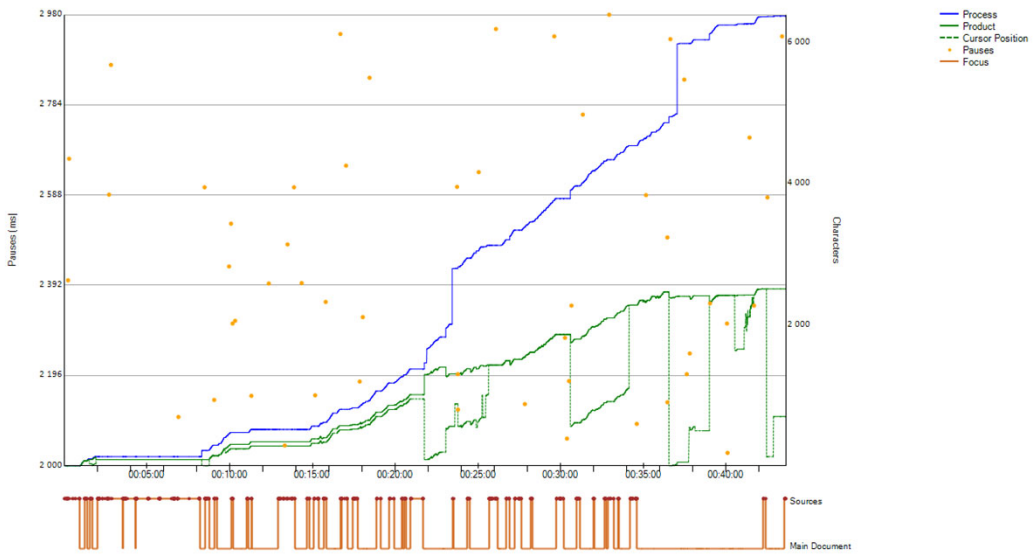

Pauses (ms)
Characters
2 980
2 784
2 588
2 392
2 196
2 000
6 000
4 000
2 000
Global revisions
(in the beginning
of the text)
Writing
at the point of utterance
Local revisions
at the point of utterance
Characters produced
- 60%
Document length
Cursor position
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
00:30:00
00:35:00
00:40:00
Time (minutes)
Sources
Main document

Process graphs





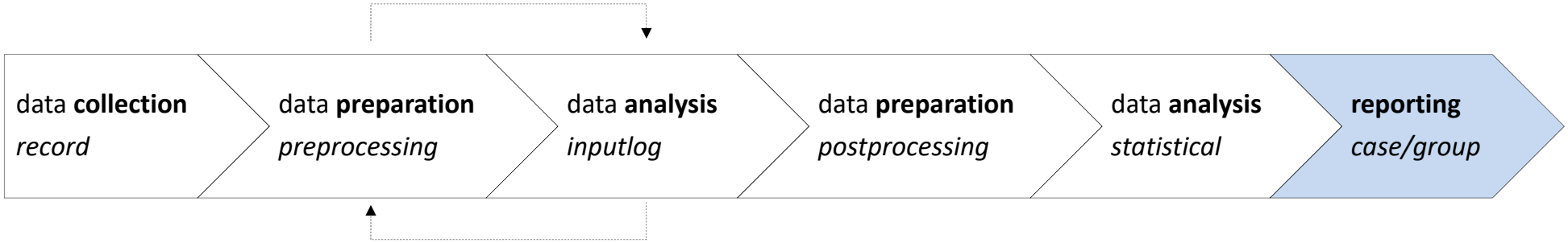
Linear writing process
Singular global revision episode



Recursive writing process
Multiple global revision episodes

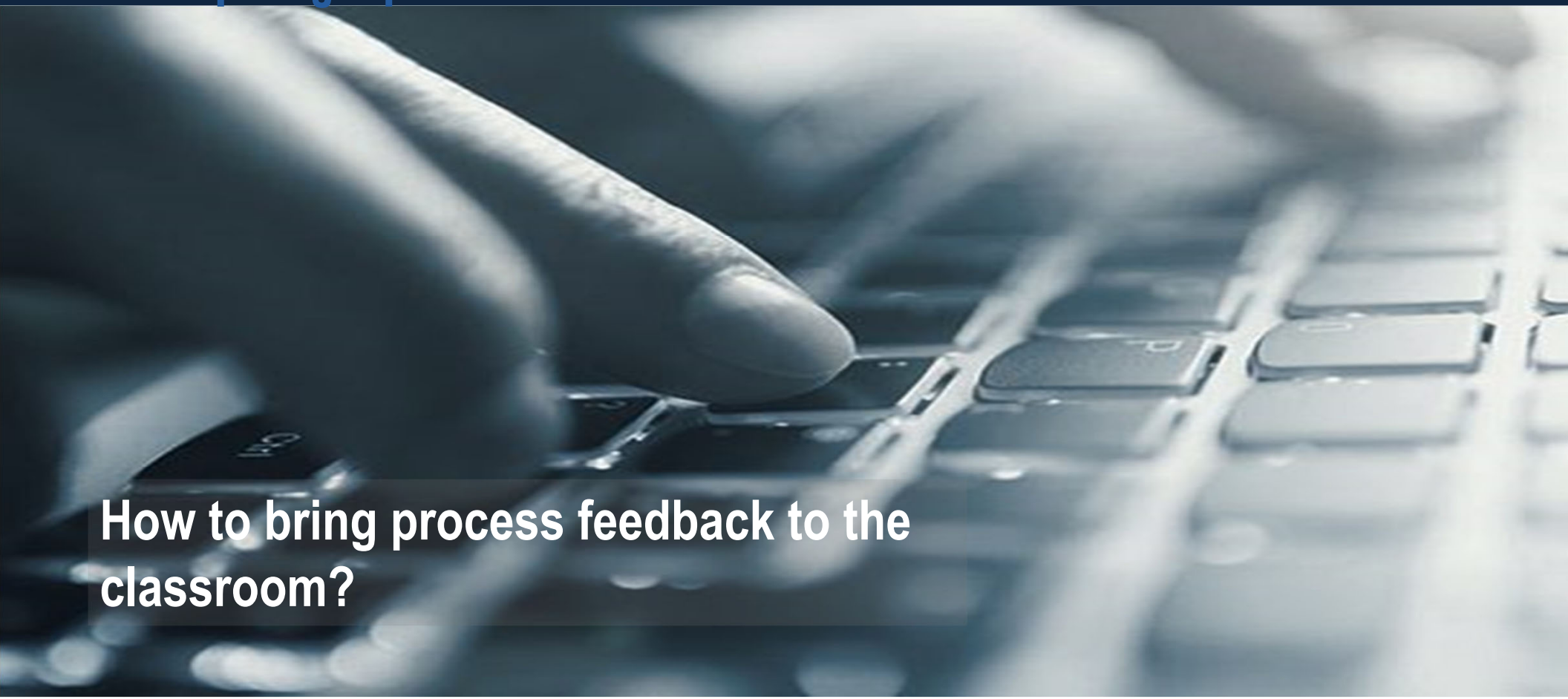
Designing keystroke logging research

The Research Flow



Teaching

The Inputlog report function



How to bring process feedback to the classroom?

Bring process data to the classroom

inputlog

General Analysis

Meta Information

Logfile	Nicky_Peterson.idfx
Log Creation	07/06/16 10:09:05.758
Log GUID	593a25ee-d1e1-46f4-9ce8-cf52c1b265d0
Logging Program Version Number	7.0.0.3
Analysis Creation	22/05/18 16:52:59
Analysis GUID	ad5776de-3b1d-4c76-a3c6-c4f79ab123c6
Analysis Program Version Number	7.1.0.53

Session Identification

Participant	Nicky Peterson
Text Language	NL
Age	16
Gender	vraag
Session	taak 1
Group	D5

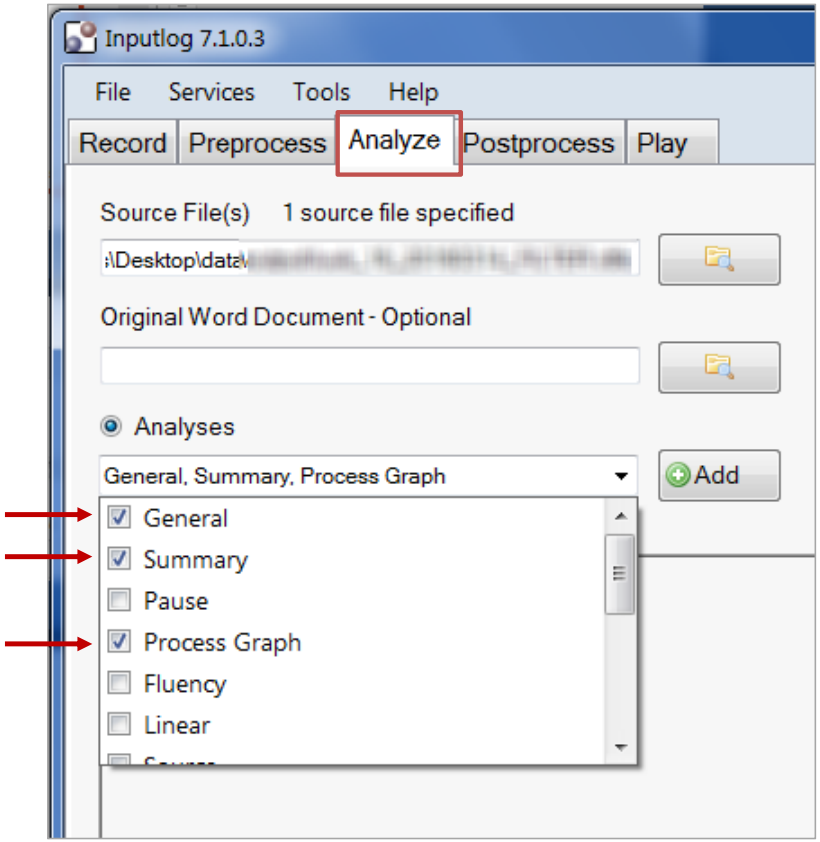
Challenges:

- technical
- pedagogical
- statistical

#Id	Event Type	Output	Position	DocLength	Character Production	StartTime	StartClock	EndTime	EndClock	ActionTime	PauseTime	PauseLocation
0	mouse	Movement			0	0	00:00:00	187	00:00:00	187	0	INITIAL
1	focus	Start			0	1684	00:00:01	1684	00:00:01	0	0	CHANGE
2	mouse	Movement			0	1684	00:00:01	2636	00:00:02	952	0	INITIAL
3	mouse	LEFT Click			0	2979	00:00:02	3151	00:00:03	172	343	MOUSE
4	focus	TASKBAR			0	3385	00:00:03	3385	00:00:03	0	0	CHANGE
5	mouse	Movement			0	3385	00:00:03	4196	00:00:04	811	0	MOUSE
6	mouse	LEFT Click			0	6240	00:00:06	6442	00:00:06	202	2044	MOUSE
7	focus	Adobe Reader - [Opdrachtomschrijving_argumentatief.pdf]			0	7378	00:00:07	7378	00:00:07	0	0	CHANGE

How to bring the process to class?

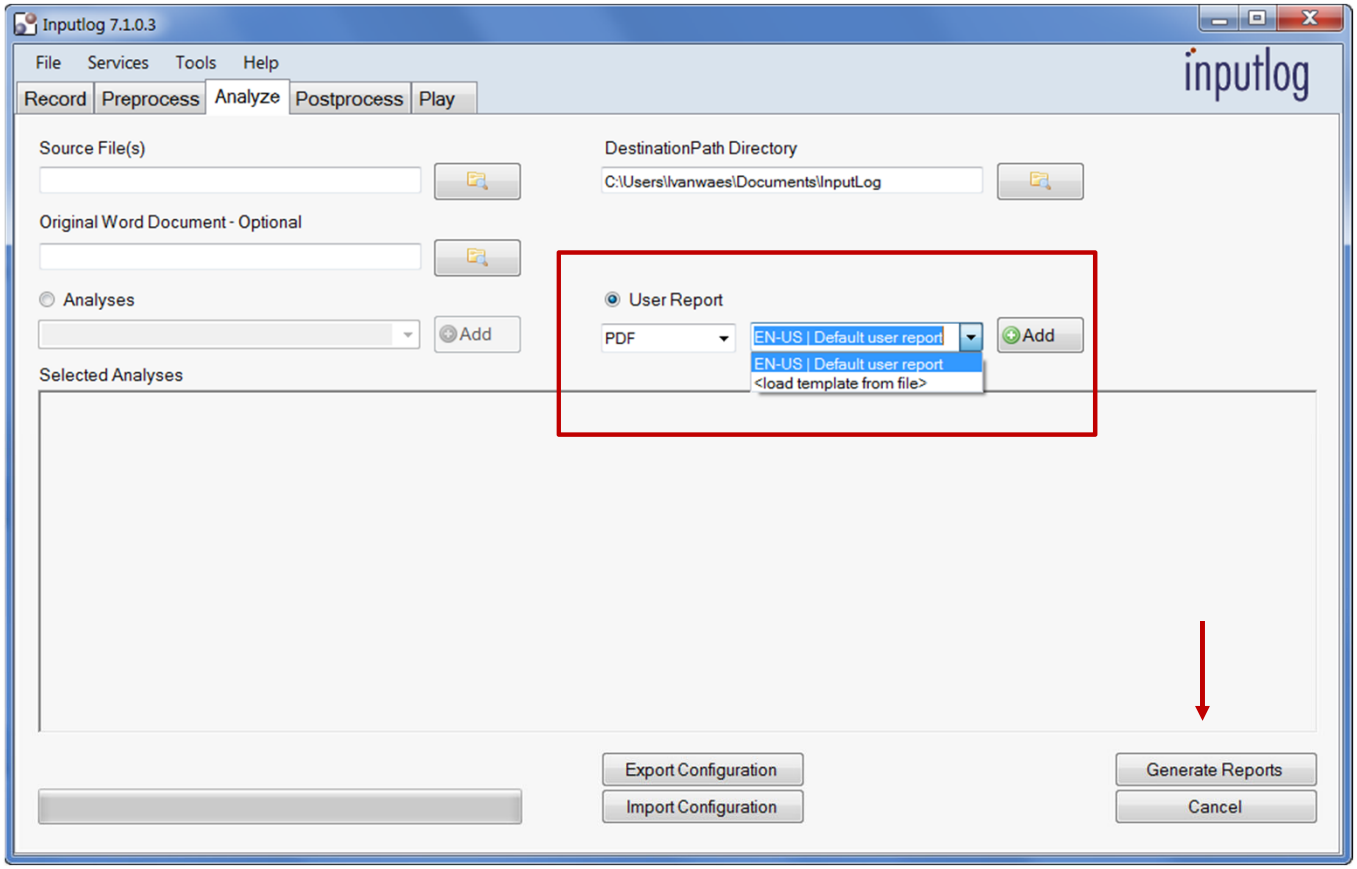
Analyze



3000+ variables

15 variables

Process reports: user friendly



Process report: Example

inputlog

Process report: Nicky Petersen

Intro

Dear Nicky Petersen

This feedback report provides you with some process and product writing characteristics. Together they describe and typify your writing process of the composition task at hand.
This report will help you to reflect upon the way you completed this task. It is also useful to compare your writing process for different writing tasks, or as a basis to compare your writing strategies with those of your fellow students.

Mariëlle Leijten and Luuk Van Waes
Research group Professional Communication

Overview

This report contains the following sections:

- Time characteristics
- Process description
- Pausing behavior
- Revision behavior
- Typing characteristics
- Process and Fluency graphs

Overview

This report contains the following sections:

- Time characteristics
- Process description
- Pausing behavior
- Revision behavior
- Typing characteristics
- Process and Fluency graphs

Time

In general when composing this writing task you divided your time as follows:

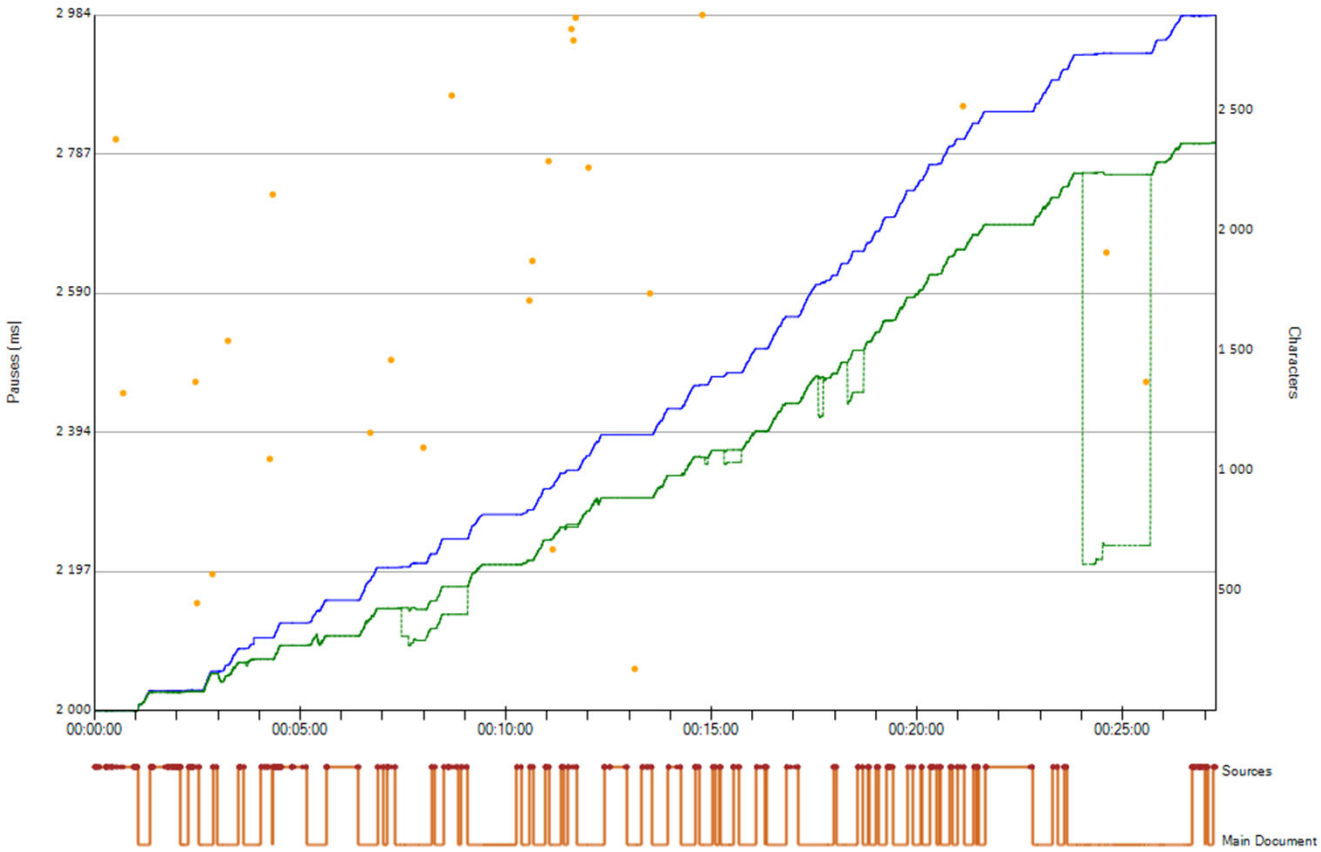
- Total process time (hh:mm:ss): 00:32:20
- Total pausing time (taking into account a pause threshold of 2000 ms): 00:08:15
- Total active writing time (taking into account a pause threshold of 2000 ms): 00:24:04
- The ratio of the time you spent 'thinking' versus the time you spent 'typing' (threshold 2000 ms): 25.54 %

Process

The following process indicators characterize the way in which you produced your text:

- To compose your text of 344 words (or 2166 characters), you produced 466 words (or 3046 characters) during this writing process (excl. copied text).
- Characters per minute (product): 66.98
- Characters per minute (process): 94.19
- Proportion product/process: 63.65% [Note: the lower the percentage, the more revisions you made.]

Process graph



Instructional movie

Pedagogy: Process feedback flow

Inputlog 9 - Beta

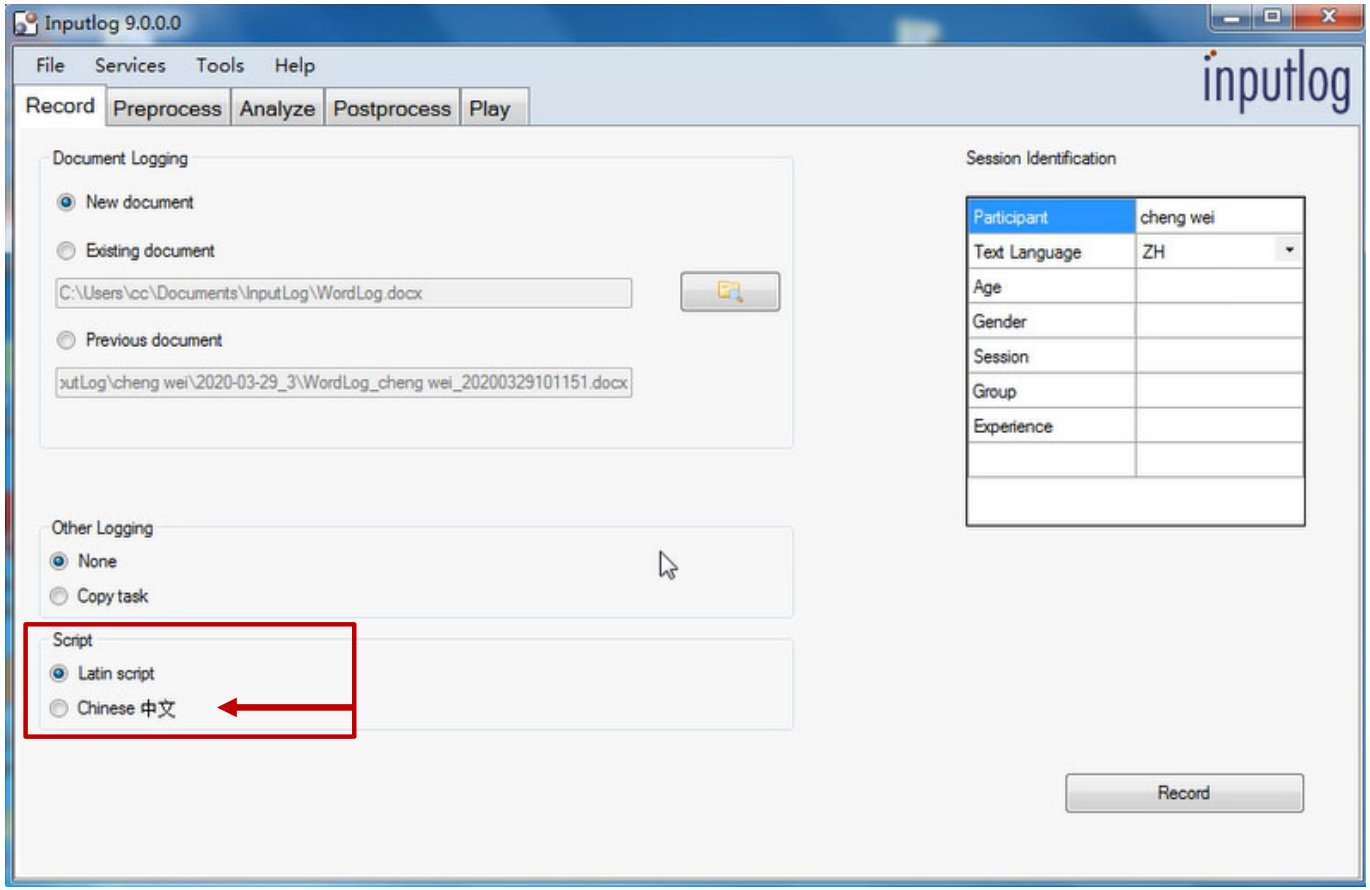
Logging Chinese script

How to log Chinese script?

Logging Chinese script

Thanks to:
prof. WANG Junju
CHENG Wei
XU Cuiqin

Screenshot Inputlog 9 beta



Example

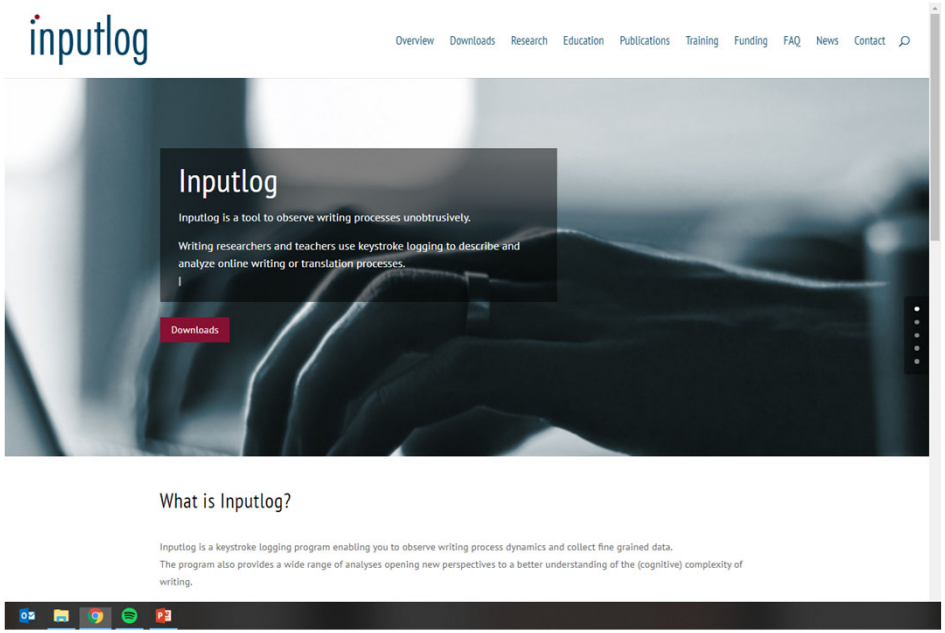
这是我第一次使用

event_ Id	event_ output	IME Buffer	IME Text	IME Generated	Location Recoded Pinyin	Location Recoded Sign	event_char Production	event_ action Time	event_ start ClocK	event_ end Clock
10	e	e		FALSE	BEFORE SENTENCES	BEFORE SENTENCES	1	110	00:23.1	00:23.3
11	s	es		FALSE	WITHIN PINYIN		1	102	00:23.4	00:23.5
12	SPACE	es	这是	TRUE	BEFORE SELECTION	BEFORE CHARACTER(S)	3	191	00:24.4	00:24.6
13	w	w		FALSE	AFTER SELECTION	AFTER CHARACTER(S)	3	143	00:25.2	00:25.3
14	SPACE	w	我	TRUE	BEFORE SELECTION		4	143	00:25.6	00:25.7
15	d	d		FALSE	AFTER SELECTION		4	118	00:25.8	00:25.9
16	i	di		FALSE	WITHIN PINYIN		4	102	00:25.9	00:26.0
17	y	diy		FALSE	WITHIN PINYIN		4	96	00:26.1	00:26.2
18	SPACE	diy	第一	TRUE	BEFORE SELECTION	BEFORE CHARACTER(S)	6	117	00:26.6	00:26.7
19	c	c		FALSE	AFTER SELECTION	AFTER CHARACTER(S)	6	142	00:26.8	00:26.9
20	i	ci		FALSE	WITHIN PINYIN		6	86	00:26.9	00:27.0
21	SPACE	ci	次	TRUE	BEFORE SELECTION	BEFORE CHARACTER(S)	7	111	00:27.4	00:27.6
22	s	s		FALSE	AFTER SELECTION	AFTER CHARACTER(S)	7	160	00:27.6	00:27.8
23	h	sh		FALSE	WITHIN PINYIN		7	71	00:27.8	00:27.9
24	i	shi		FALSE	WITHIN PINYIN		7	88	00:27.9	00:28.0
25	y	shiy		FALSE	WITHIN PINYIN		7	95	00:28.1	00:28.2
26	SPACE	shiy	使用	TRUE	BEFORE SELECTION	BEFORE CHARACTER(S)	9	167	00:28.8	00:29.0
27	z	z		FALSE	AFTER SELECTION	AFTER CHARACTER(S)	9	175	00:30.8	00:31.0
28	e	ze		FALSE	WITHIN PINYIN		9	152	00:31.1	00:31.3
29	BACK	z		FALSE	REVISION		9	95	00:32.2	00:32.3
30	BACK			FALSE	REVISION		9	96	00:32.4	00:32.5
31	x	x		FALSE	WITHIN PINYIN		10	135	00:33.0	00:33.1
32	i	xi		FALSE	WITHIN PINYIN		10	103	00:33.2	00:33.3

Next steps

- Develop analyses for Chinese logging
- Bring more ‘intelligence’
  - big data studies
  - pattern analysis
  - machine learning

www.inputlog.net



Installation procedure

Follow this procedure if you want to download Inputlog:

1 | Register

1.1 | Complete the registration form You will receive a personal installation code to unlock the installation procedure.

Register

1.2 | Confirm your registration Confirm your registration by activating the link in the registration mail that is automatically sent to your mailbox.

1.3 | Wait for your personal installation code As we personally handle and evaluate every request, it might take a few days before you receive your code.

2 | Download

2.1 | Select the Inputlog version of your choice Decide whether you need the latest version (preferred choice for most users) or a former version (to complete research projects in which former versions have been used).

2.2 | Download the program

Go to the latest version of Inputlog

3 | Install

3.1 | Open the installation file Inputlog_xx.exe The installation wizard will be started.

3.2 | Enter the registration code See also: hardware and software requirements in the installation section.

3.3 | Finalize the installation procedure Inputlog will start automatically.

Good luck on using keystroke logging in your research… and in your classroom