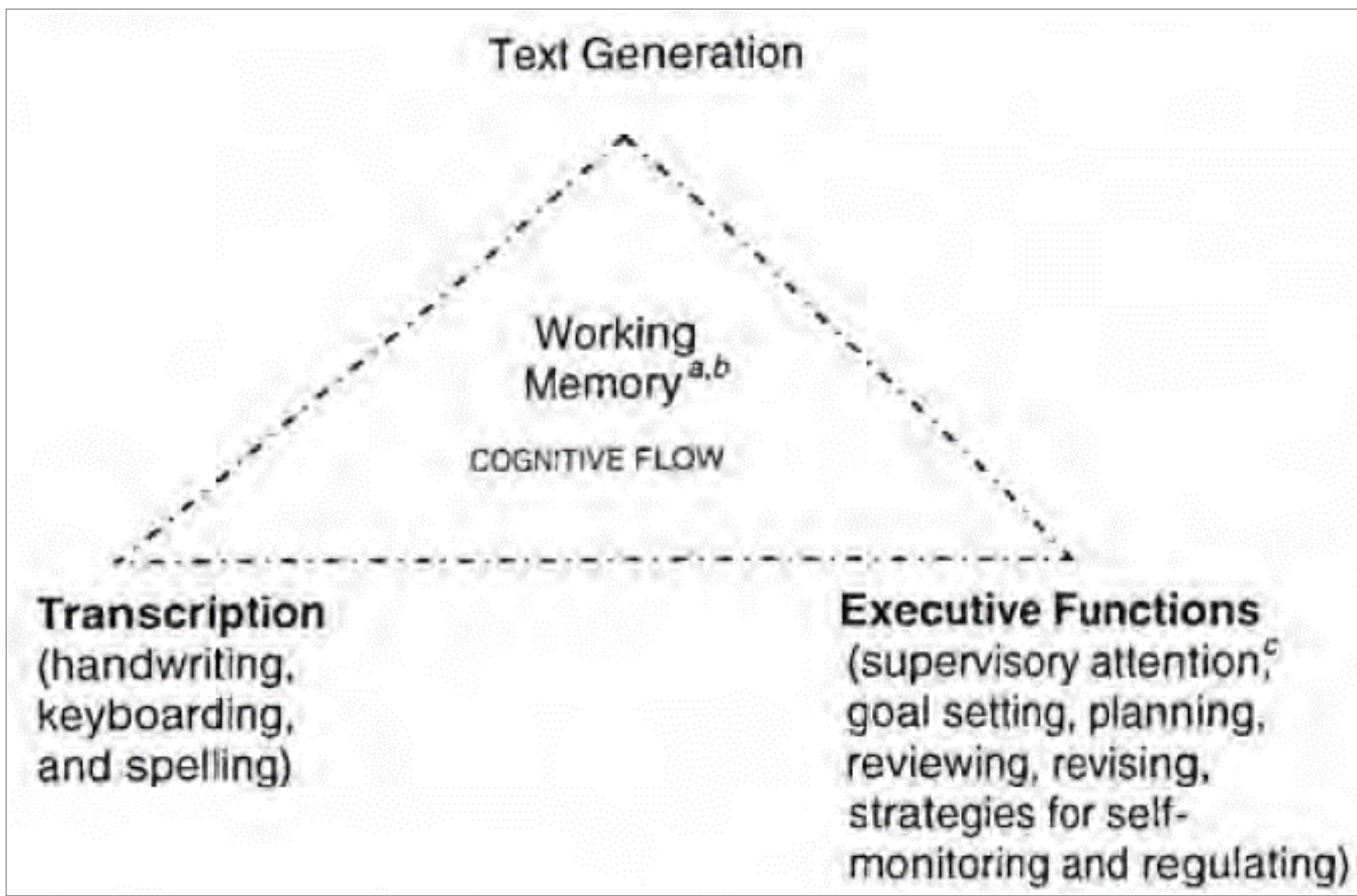


How Does Writing Medium Influence the Operation of Writing Processes and Writing Quality?

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What happens during composing?



Not-So-Simple View of Writing
(Berninger & Winn, 2006)

The way writing processes (**planning, text generation, transcription, & revising**) operate during composing can influence written language performance (e.g., text length, text quality, & fluency).

How do we identify writing processes?

Observing **on-line writing activities** provides clues to infer which writing processes operate.

	Pause	Language Burst	
	1	Will first meet	
RP	2	e (meet → met)	SR
FP	3	Kate when she walk on a runway	
RP	4	ed (walk → walked)	SR
FP	5	He was immediately drawn attracted to her.	MR

Pause patterns

Formulation Pause (FP): planning & text generation
Revision Pause (RP): revising

Characteristics of Language Bursts

Surface Revision (SR): revising at surface level
Meaning Revision (MR): revising at meaning level

Research Questions:

- Do revision pause rate, meaning revision rate, and quality rating vary between writing mediums in fifth and seventh grades?
- Does the relation between meaning revision rate and the quality of writing vary with writing mediums in fifth and seventh grades?

Do writing mediums differ in influencing the operation of writing processes?

Adult writing:

Typing is more conducive to **revising** than handwriting in adult writing (Gould, 1981)

Regardless of writing medium, higher occurrence of revisions that involve **meaning modification** (i.e., meaning revision) tends to lead to better **writing quality** (Hawisher, 1987).

Child writing:

Few studies have directly examined the role of writing medium on the operation of writing processes and the relation between revising process and writing quality.

Participants

Participants were typically developing children:

- 35 fifth graders (mean age = 10;7, SD = 0;6) and 31 seventh graders (mean age = 12;7, SD = 0;5)
- All children were main stream English-speaking.
- All children: parent report, performance above the 10th percentile on GFTA-3 and CELF-5
- All children passed screenings for cognition, hearing, articulation, and oral mechanism.

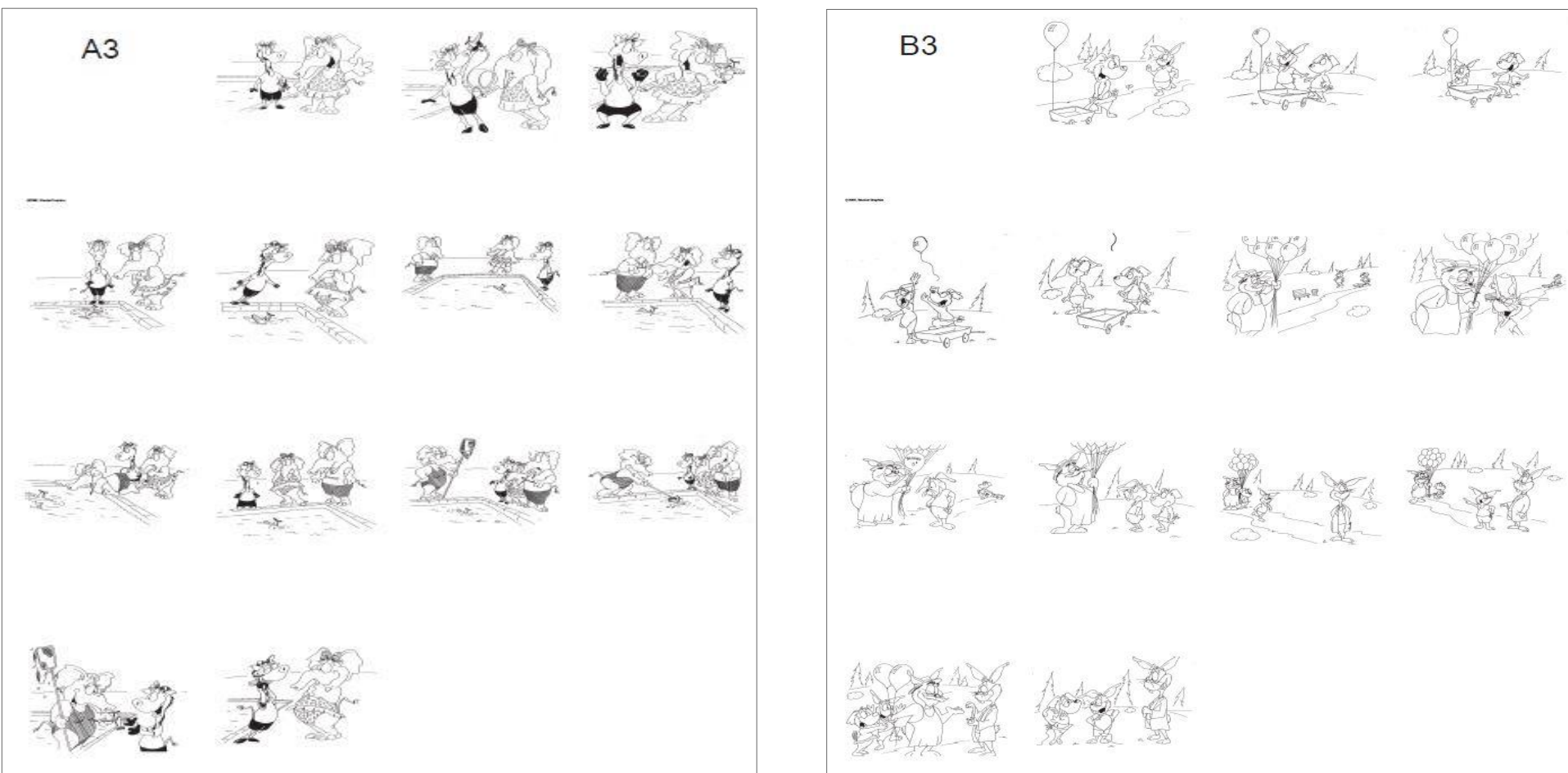
Why fifth & seventh graders?

There are likely to be substantial variabilities in handwriting and typing proficiency in children within and between these grades (Alstad et al., 2015).

Procedure & Analysis

Narrative sample collection and processing

- Two narrative samples were collected from each child by using two sets of 13 pictures (Schneiderman et al., 2005).

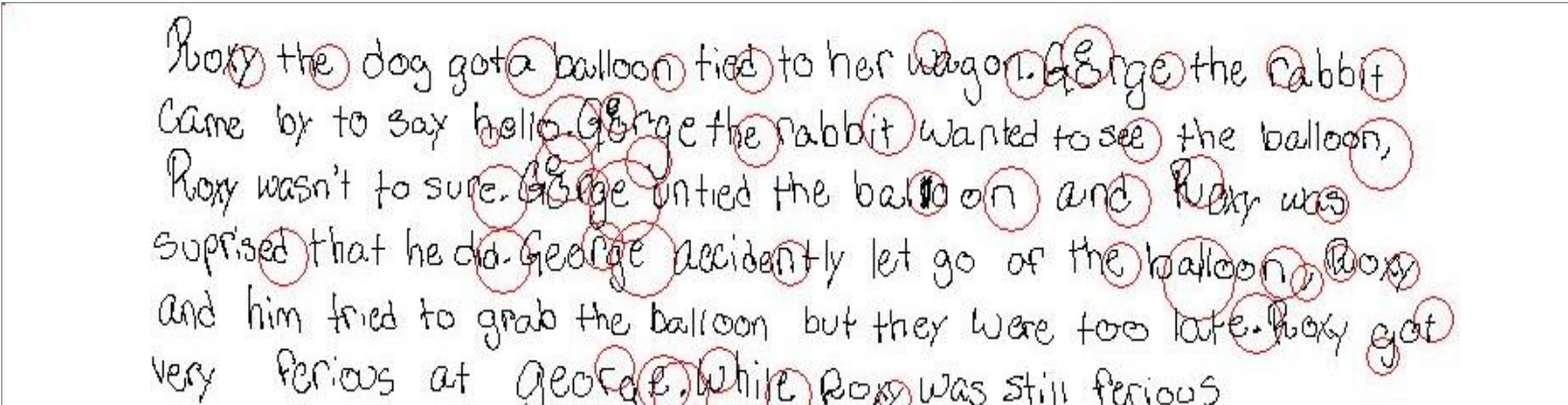


<http://www.rehabmed.ualberta.ca/spa/enni/pictures>

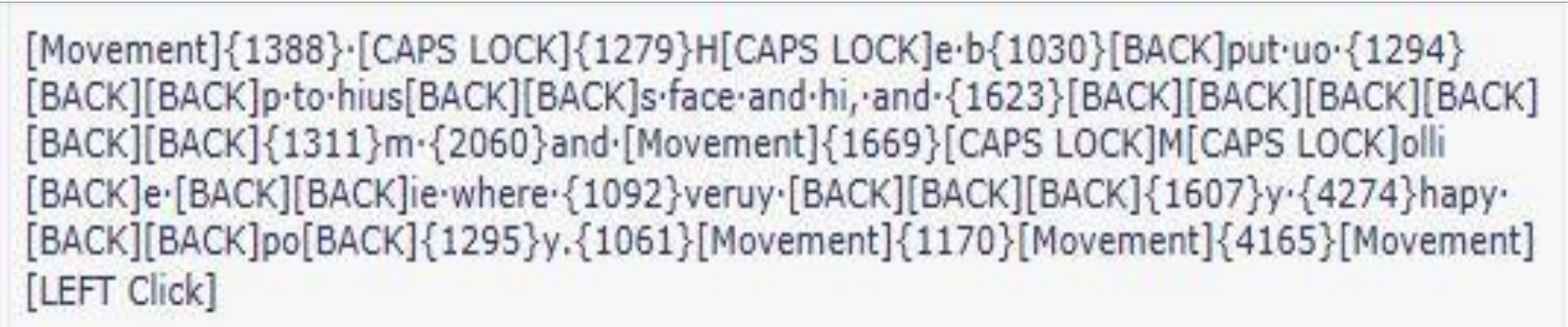
Procedure & Analysis

Narrative sample collection and processing

- Handwriting task: on a digitizing tablet (Wacom Intuos 5) with a Wacom Inking Pen and Eye & Pen 2 (University of Poitiers, 2012) for recording writing activities
- Typing task: on a QWERTY keyboard with Microsoft Word and Inputlog 7 (Leijten & Van Waes, 2012) for recording writing activities
- On-line narrative production was segmented into language bursts between pauses with a pause threshold of 1 second.



Handwritten narrative sample recorded with Eye and Pen 2



Typed narrative sample recorded with Inputlog 7

Quality ratings on three domains

- Development of ideas (1 to 6)
- Organization of ideas (1 to 6)
- Language facility & conventions (1 to 6)

Results

Mean (SD) of on-line text production measures by grade

	5th Grade		7th Grade	
	Handwriting	Typing	Handwriting	Typing
Background Narrative Measures:				
Total Writing Time (min.)	11.38 (6.14)	14.93 (9.57)	9.29 (4.72)	10.90 (6.14)
Total Pause Time (min.)	5.01 (3.66)	8.99 (6.95)	3.56 (2.62)	5.01 (3.32)
Number of Words	137.80 (54.21)	140.77 (72.18)	151.42 (62.94)	182.68 (80.49)
Words Per Minute	13.48 (4.38)	10.79 (4.73)	17.13 (3.65)	18.15 (4.77)
Number of Pauses	75.23 (42.15)	180.11 (116.94)	56.19 (30.16)	104.90 (59.15)
Pauses Per Minute	6.63 (1.22)	12.01 (2.17)	5.97 (1.09)	9.48 (1.75)
Number of Revisions	24.09 (20.88)	45.89 (45.60)	13.58 (10.65)	42.10 (26.92)
Number of Meaning Revisions	2.43 (3.91)	10.31 (16.02)	1.48 (1.86)	9.71 (9.38)
Target Measures:				
Revision Pauses Per Minute	.86 (.54)	2.99 (1.07)	.60 (.47)	2.85 (.64)
Meaning Revision Rate	.02 (0.02)	.04 (0.05)	.01 (0.01)	.05 (0.04)
Writing Quality	9.21 (2.83)	9.73 (3.58)	9.21 (2.84)	11.11 (2.19)

Results

2 (Grade) x 2 (Medium) Mixed Analysis of Variance

Revision pause rates

- Typing > Handwriting ($p < .001$, $d = 4.58$)
- Fifth = Seventh

Meaning revision rate by writing medium

- Typing > Handwriting ($p < .001$, $d = 1.60$)
- Fifth = Seventh

Quality rating by writing medium

- Typing > Handwriting ($p = .04$, $d = .55$)
- Fifth \leq Seventh ($p = .06$, $d = .46$)

Simple correlation analysis

Meaning revision rate and writing quality

- Positive association in typing for fifth graders ($r = .38$, $p = .01$)
- No significant association in handwriting for fifth graders, nor for seventh graders in either medium

Concluding Thoughts

- Handwriting and typing influenced the operation of writing processes differently in both grades.
- Typing was more conducive to revising than handwriting in child writing.
- Typing may be a better tool to make meaning revisions than handwriting, making a positive contribution in improving writing quality, especially in the fifth grade.

Acknowledgement

This project is supported in part by Mark Diamond Research Fund from the Graduate Student Association (GSA) at University at Buffalo awarded to the first author. We thank Mary Coble, Chelsea Finn, Morgan Lester, Emily Pukos, Christy Tolevski and Anne Wilson for data collection and processing.

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