Key transitions and typing errors

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We hypothesize that typing errors are often characterized by significant deviations from 'normal' temporal patterns in key transitions. The key objective in implementing a biometric measure based on keyboarding characteristics is to improve the automatic recognition of typing errors in process data.

AIM

The aim of this study is to investigate:

- the effect of different copy tasks, different keyboards and different typing expertise on typing errors (Grabowki 2008);
- differences in key transition time before and after typing errors (as opposed to median transition times for the same digraph).

On the basis of these results we want to optimize our algorithm to automatically filter out typing errors as a specific type of revisions when analyzing writing process data (Inputlog; Kim 1996)

Keystroke dynamics

Keystroke dynamics is a behavioral biometric. Mainly two measure have been used, so called dwell times and transition (or flight) times. These measures are based on the key-in press (P) and key-up release (R) clock times of each key (i) while typing.

Dwell time $D_i = R_i - P_i$

Transition time $T_i = P_i - P_{i-1}$

In this poster we focus on Transition times (ms) as a mean to identify typing errors as opposed to the median transition time of the same digraph that does not contain a typing error.

a^n	versus	a^n
typing error digraph		error free digraph

Writers have personal and quite stable typing rhytm patterns. Therefore keystroke dynamics are often used as a method of user authentication. (Mahar et al. 1995; Monrose & Rubin 1999; Guven & Sogukpinar 2003; Douhou & Magnus 2009).

Design
Participants

		10 + Blind
	20 Qwerty	
		10 − Blind
40 participants		
		10 + Blind
	20 Azerty	
		10 − Blind

Tasks

	2 visual copy tasks
4 writing tasks	
	2 audio copy tasks

Typing errors

Total	1925
mean per person	48
min - max	19 - 88

Type of errors
Transposition, Intrusion, Anticipation, Subsitution, Idle, Other

RESULTS

Qwerty vs. Azerty keyboard	no effect
+Blind vs. −Blind typists	no effect
Visual vs. Audio copy task	no effect

Before after
→ Ttime median < Ttime before TE < Ttime after TE

Adjacent
→ Ttime adjacent keys < Ttime Non-adjacent keys
→ Ttime for transposition and intrusions (30 to 40% of typing errors) sign. shorter, esp. adjacent keys.

Immediate delay
→ Ttime when typing error is corrected imemdiately (95% of typing errors)< Ttime when correction is delayed

Conclusion
Results show that transition times before and after typing errors significant deviate from the median transition time of similar digraphs. Therefore, they are a relevant (extra) indication to identify typing errors. The deviating key transitions in combination with a 'typing error correction algorithm' enabled us to identify 87% percent of the typing errors in a mirror corpus.

FUTURE RESEARCH
- Classification of digraphs (personal variation, technically, linguistically, frequency)
- Proprioceptive anticpation of typing errors further ahead
- Eye-tracking (graph)

ACKNOWLEDGMENTS
Tom en Kaat

Literature
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