



# Typing-Differences in Simultaneous Typed Chat

Michael Glass<sup>1</sup> Yesukhei Jagvaral<sup>1</sup> Chinedu Emeka<sup>2</sup> Jung Hee Kim<sup>3</sup>  
<sup>1</sup> Valparaiso University <sup>2</sup> University of Illinois <sup>3</sup> North Carolina A&T State University



## Introduction

A feature of the COMPS (Computer-Mediated Problem Solving) chat environment is it permits everybody to type and see and respond to each others' dialogue all at the same time.

In this regime there is no such thing as forcibly interrupting. A second person starting to type contributes to the conversation immediately, but does not affect the first person's ability to type.

The hypothesis considered in this study is that since the communication medium does not impede simultaneous chatting in the same way that person-to-person talking does, chat behaviors during simultaneous typing will differ compared to when a single person has the floor.

This study investigates the typed-chat behaviors in 56 approximately hour-long chat sessions, with 3 or 4 people in each session. The participants were students and teaching assistants in a Java class, working on problem-solving lab exercises.

We tested for differences in four behaviors

1. Does the frequency of editing keystrokes change?
2. Does typing speed change?
3. Does turn-taking change?
4. Does conversational exchange structure change?

As this is a relatively new inquiry, the main conclusion is:

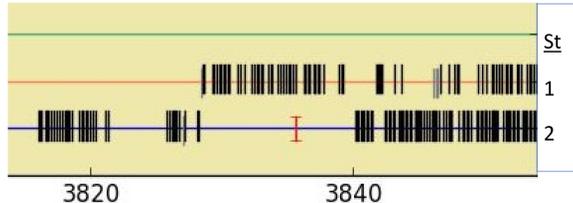
"More research is needed."

(You knew that.)

## What Ends a Dialogue Turn?

This time-record of keystrokes shows two people typing sometimes alone and sometimes simultaneously.

- Black tick marks are normal keystrokes
- Red mark is <enter>, ending a turn.
- Grey slightly lower marks are deletions



There is sometimes no reason to type <enter> to formally end a turn. In the above conversation Student 2 delayed <enter> about 7 seconds.

As in spoken dialogue, pausing can be interpreted as a transition relevance point, a place where normal conversational turn-taking is licensed. For this study we have determined turn-ending by <enter> or after 2 seconds pause, whichever comes first. If after the pause nobody else types and the first student continued, the turn is not determined to have ended.

In the example, the first few Student 1 keystrokes at about 3827 were considered to be simultaneous with Student 2, but after the 2 second window passed Student 2 was deemed to have relinquished the turn and Student 1 was typing alone.

## Conclusions and Future Directions

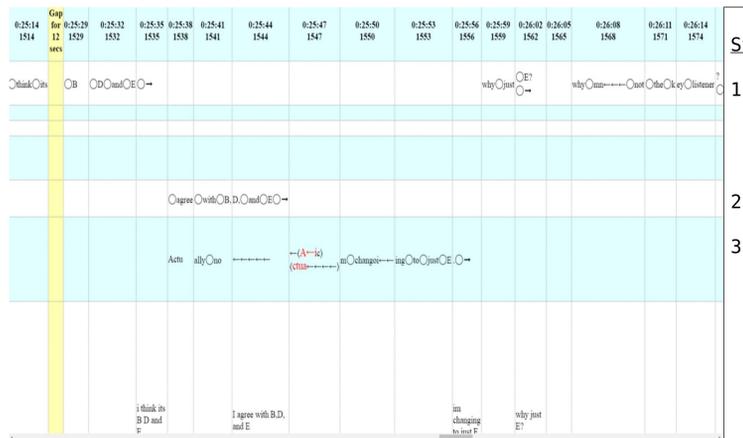
Conclusions to the original four questions:

1. Yes, when two people are typing simultaneously they do significantly more editing of their text.
2. When two people are typing simultaneously many (maybe a quarter) of people speed up their typing speed significantly.
3. In the absence of a need to push <enter> (because everybody can see and respond without it), a pause of about 2 seconds seems to indicate a turn-taking opportunity. We haven't shown definitively that the behavior change at 2 seconds pause is solely due to this.
4. Qualitative examination of exchange structure of simultaneous dialogue shows recognizable patterns, none of them new to simultaneous typing. A more reliable and quantitative analysis would be useful.

## Acknowledgments

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## Example of Simultaneous Typing



This diagram segments the timeline into 3-second chunks.

Student 1 suggested:

I think it's B D and E

Simultaneously:

-- Student 2 agreed with student 1.

-- Student 3 typed:

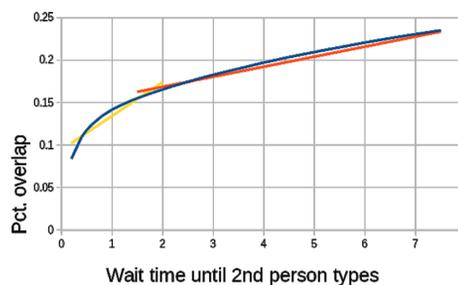
Actually no

then edited that to:

im changing to just E

There are more deletion and editing behaviors when several people are typing simultaneously.

## How Long a Pause Licenses Turn-Taking?



Measuring  $t$  seconds after person A's keystroke (except a turn-ending <enter>), what is the probability that another person B has started? We believe there are two processes at work, one before about 2 seconds and one after 2 seconds.

- B uses normal turn-taking. B waits 2 seconds before deciding that person A has relinquished the floor. Then B optionally spends think time before typing.
- B is "interrupting," jumping in early before A's turn has finished. If A and B were entirely independent, inter-keystroke times would be exponentially distributed. They are not. Future work: see if they are exponentially distributed in the < 2 second region.

## People Edit More Often When Somebody Else Is Also Typing

N=56 Dialogues	Alone	Simultaneous
Keystrokes total	246274	47890
Average per dialogue	4398	855
Deletion fraction	0.089	0.139
Std. Dev (N=56)	0.034	0.077

Keystrokes that were deletions for the two conditions were counted. Deletions increased from 8.9% to 13.9%.

- Two-tailed Student's t-test on the total difference showed the difference was significant, with  $p < 0.001$ .

Within one conversation nothing changed between the two conditions: it was the same students discussing the same problem in the same conversation, so one student in one conversation constituted a separate pairwise comparison.

- Paired t-test: each of the 163 separate participants who had at least 80 keystrokes in each condition: also significant,  $p < 0.001$ .

## People Change Speed When Somebody Else Is Also Typing

163 experiments: each is one student participating in one dialogue who had at least 80 inter-keystroke times while typing simultaneously and 80 while typing alone.

Some students sped up if somebody else was typing, some slowed down. For 30% of students the change was significant at  $p < 0.05$ .

- 4 students showing significant slowing could be chance.
- 45 students with sig. speeding up is more suspicious.

Fisher's combined probability test and Stouffer z-score test applied to the 163 individual experiments both reject the hypothesis that alone and simultaneous typing speeds are the same at the  $p < 0.01$  level.

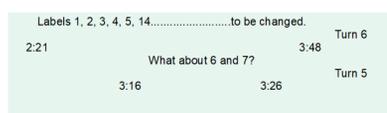
Combining all inter-keystroke times from all participants (eliminating pauses of  $\geq 2.0$  sec.) shows mean times of 244ms in the alone condition and 238ms in the simultaneous condition. Student's t-test shows this 6 ms speedup is significant at  $p < 0.05$ .

## Dialogue Exchange Structures When Somebody Else Is Also Typing

Exchange structure (from Conversation Analysis): a dialogue is segmented into *exchanges*, where a segment contains a turn which *initiates* the exchange, followed by *responses*, and possible *followups*.

Does the ability to "talk" over each other produce novel dialogue structures? We see three patterns of overlapped dialogue between students A and B.

1. B responds to part of A's current turn, without waiting for A to finish. The illustration to the left is an example.
2. A and B respond simultaneously to student C. The illustration at the top of this column is an example.
3. Persons A and B both contribute turns but are not part of the same conversational exchange. Each of the simultaneous turns either responds to or follows up an earlier turn or initiates a new exchange in the conversation. Both happen to be uttered at the same time.



Student B responds to A (noticing that A skipped two labels), while A continued uninterrupted.

Manual annotation of 50 cases with the three category labels plus "other" by three annotators showed high levels of disagreement. But no case was labeled "other" by any annotator.