Toward Interactive Dictation

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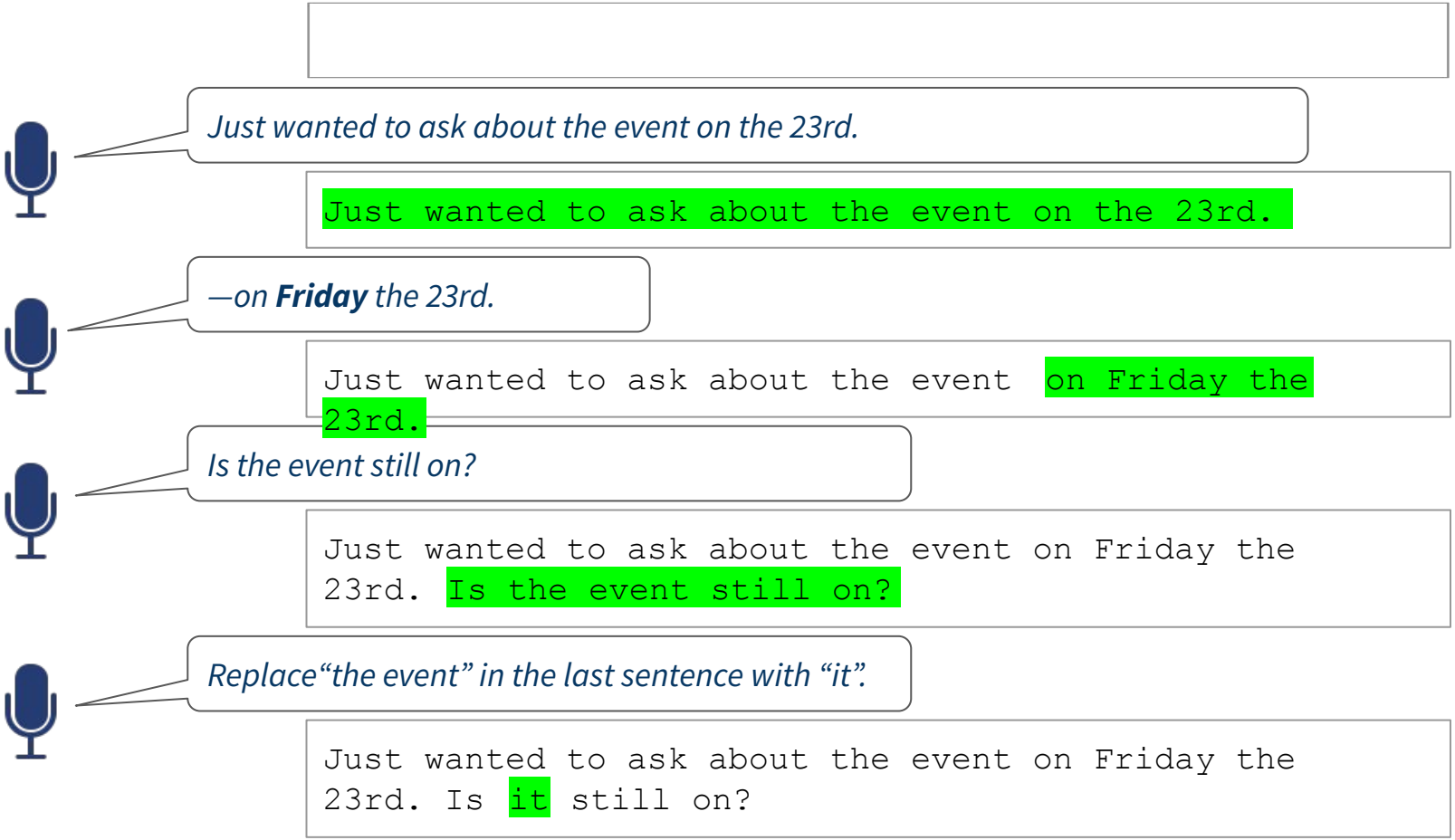
ACL 2023

Microsoft Semantic Machines

Problem Overview



Existing Speech-to-Text Systems

Most current systems do not support editing through voice.

Ones that do:

Nuance Dragon NaturallySpeaking

Microsoft Word, Dictate

Limitation: Inflexible natural language for commanding

- Relies on wake words to activate command mode
- Users must memorize a list of commands

Control the microphone
Go to sleep | Stop listening
Wake up | Listen to me
Microphone off

Get help
Give me help
"Search the help for …"
What can I say
– Show navigation commands
– Show correction commands
– Show formatting commands
– Show punctuation commands
– Open help

Basic dictation and editing

Add lines and spaces
New line | Press enter
New paragraph
Press Tab key | Tab key | Tab
Tab <n> times

Format
Underline <xyz>, Capitalize <xyz>
All caps on | off
Quote that
Bracket that

Copy and paste
Cut | Copy that
Cut |Copy <text>
Cut |Copy from <text> to <text>
Paste that

Spell out
Spell that
Spell <cap b a hyphen 5>
Spell <Charlie alpha papa>
Switch to Spell mode

Move the insertion point
Insert before <xyz>
Go back
Go to top | bottom

Dictating punctuation
Period
Comma
Question mark
Exclamation mark

Fixing mistakes
Undo | Undo that
Scratch that
Scratch that <n> times
Delete line
Delete last <n> words
Delete <text>
Resume with <xyz>
Backspace <n>
Correct <xyz>
Correct that

Select text
Select all
Select <xyz>
Select next <n> words
Select <start> through <end>
Select previous paragraph
Select document
Unselect that

Move down <n> lines
Go to end of line
Move left <n> characters
Page up | down

Move in a list
Move down <n>
Go to bottom | top
Press Enter
Press right arrow

Add new words or commands
Add new word
Add new command
Open vocabulary editor
Open command browser

Search the computer
Search the computer for...
Search documents for...
Search e-mail for...

Searching the web
Search the web for <text>
Search eBay for <text>
Open top sites for <text>
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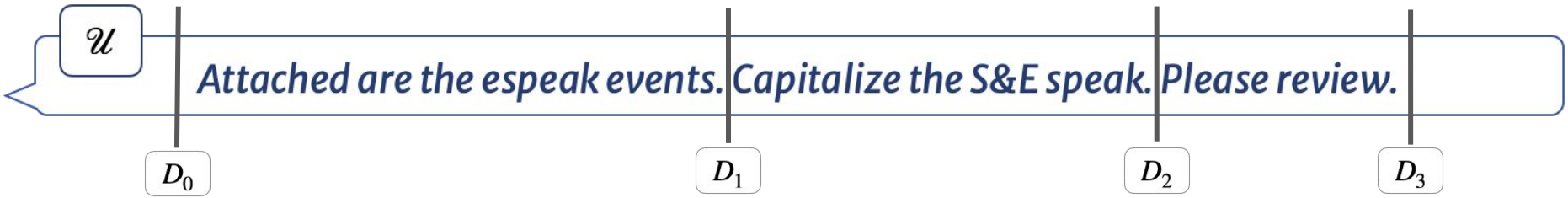
Want *natural* and *intuitive* dictation and commanding

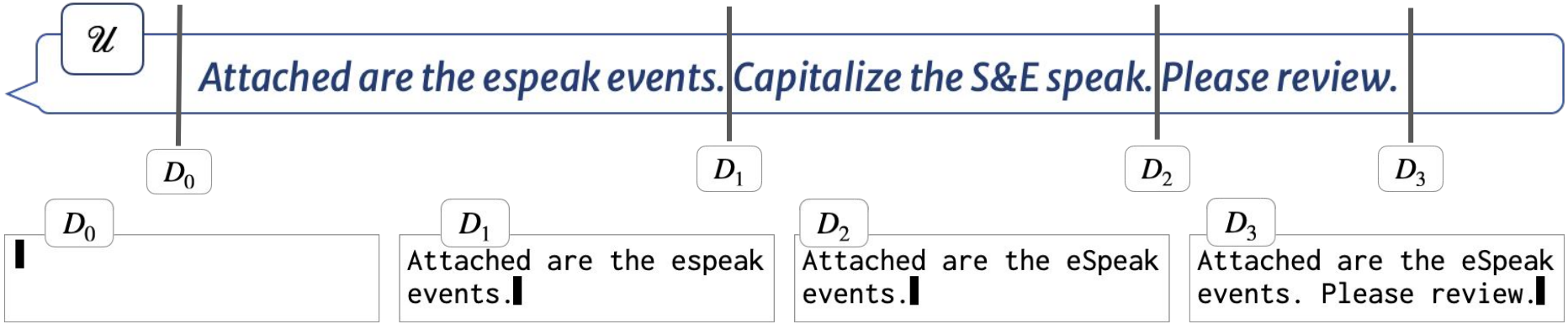
New Task!: Interactive Dictation

1. **Flexible interleaving of dictation and editing**
   - No reserved trigger words for invoking commands
   - Challenge: Predicting *segmentation* between dictation and editing commands



New Task!: Interactive Dictation

1. **Flexible interleaving of dictation and editing**
   - No reserved trigger words for invoking commands
   - Challenge: Predicting *segmentation* between dictation and editing commands
2. **Intuitive and open-ended natural language for editing**
   - No fixed templates for different types of command
   - Challenge: *Interpreting* which command to invoke and where/how



Our Contributions

1. Introducing and formalizing a new task, **Interactive Dictation**

2. Designing a data collection interface and build a dataset for this task

3. Creating a baseline system for the task

Interactive Dictation: Basic Procedure

Interactive Dictation: Building a System

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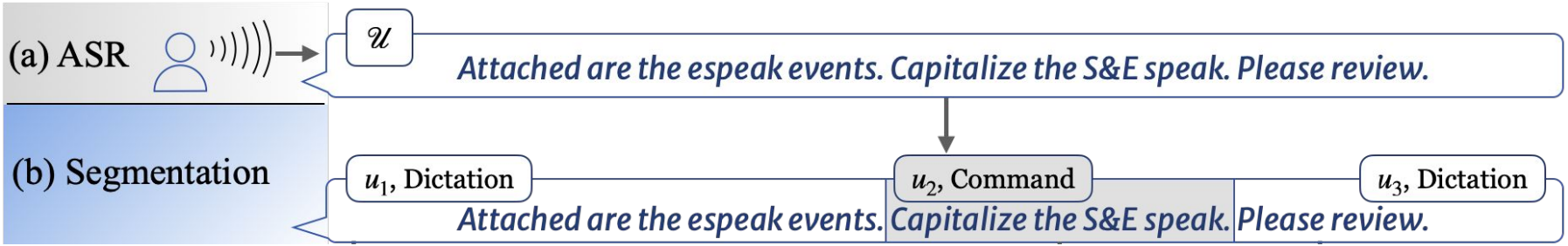
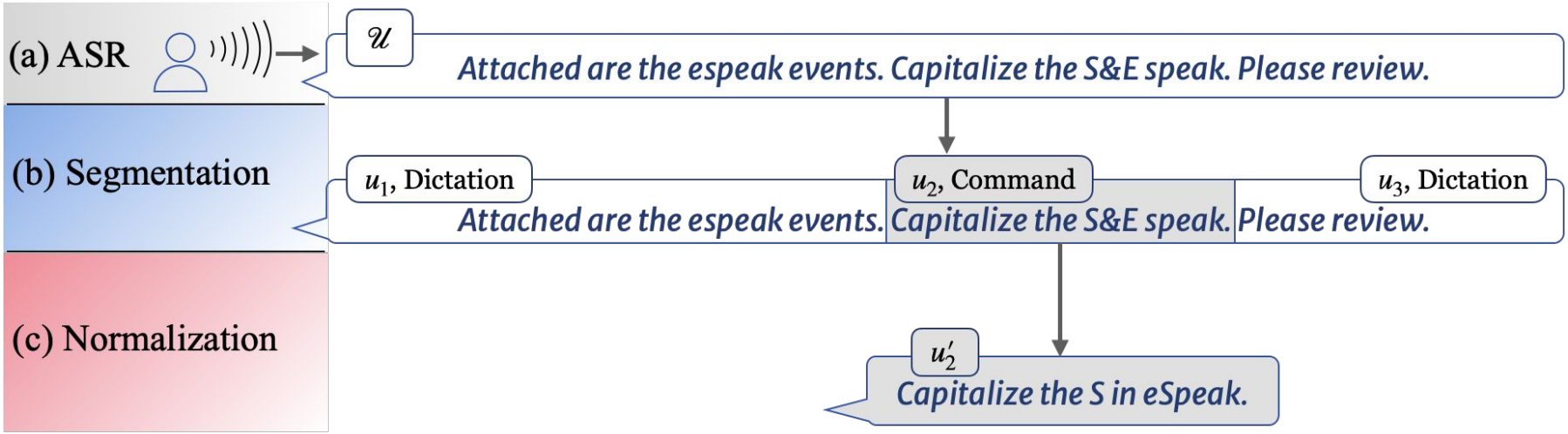


Interactive Dictation: Building a System



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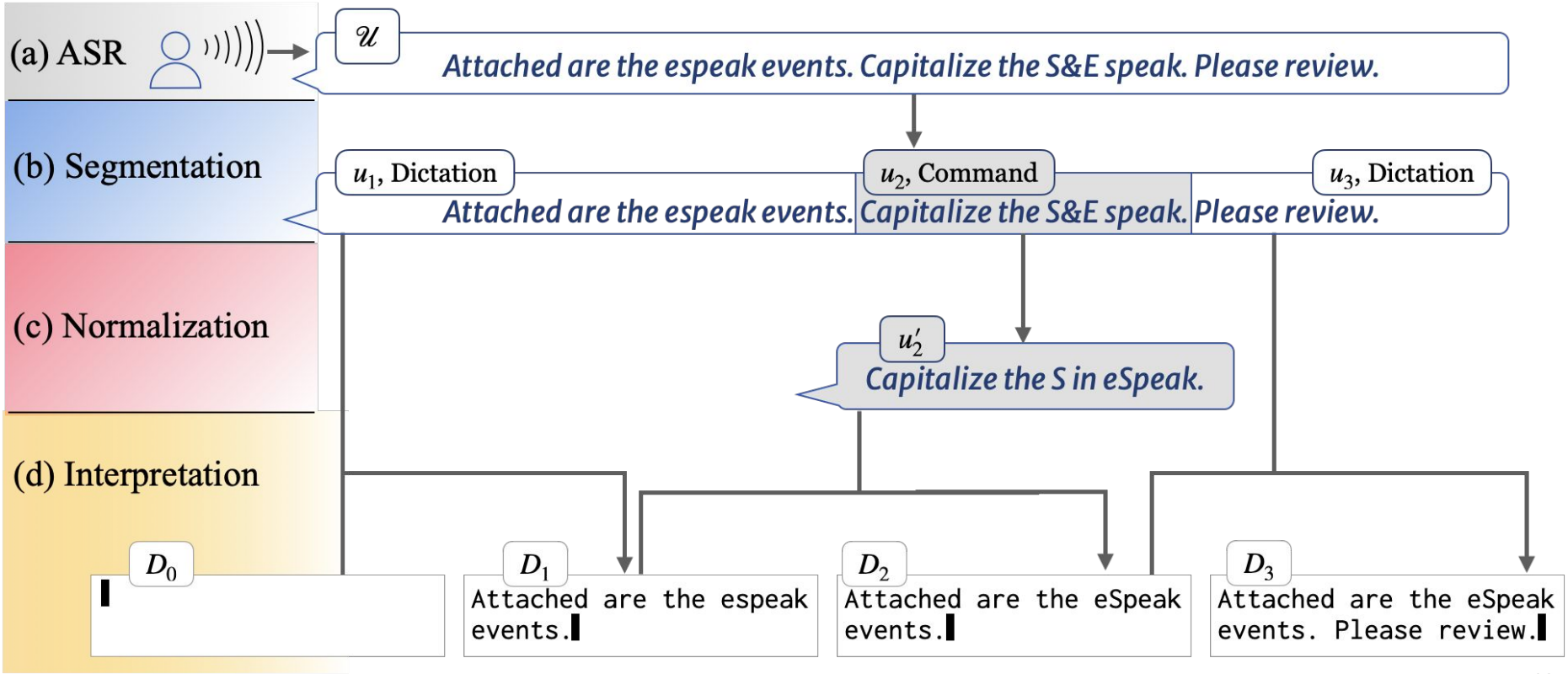
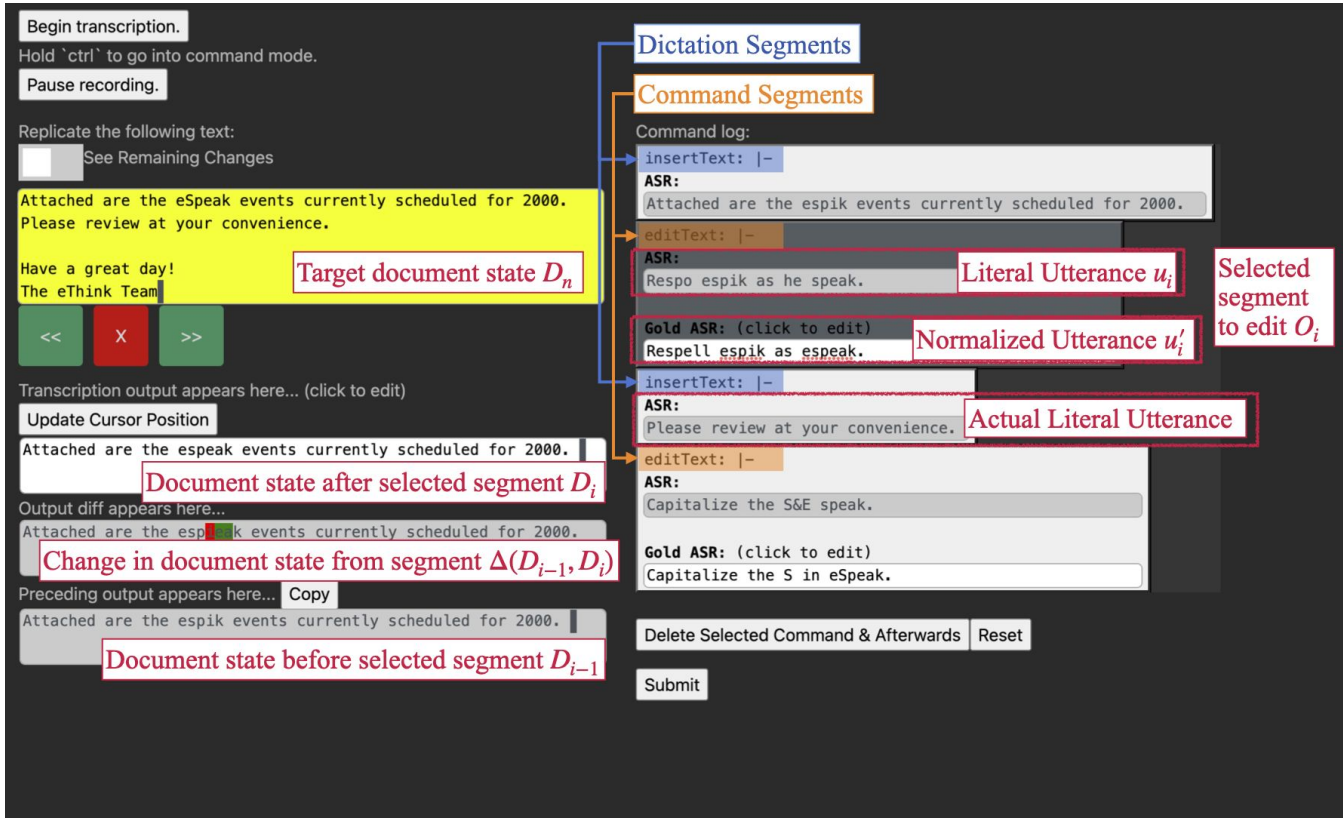


Annotating Commands & Transcriptions

[Annotation Interface]



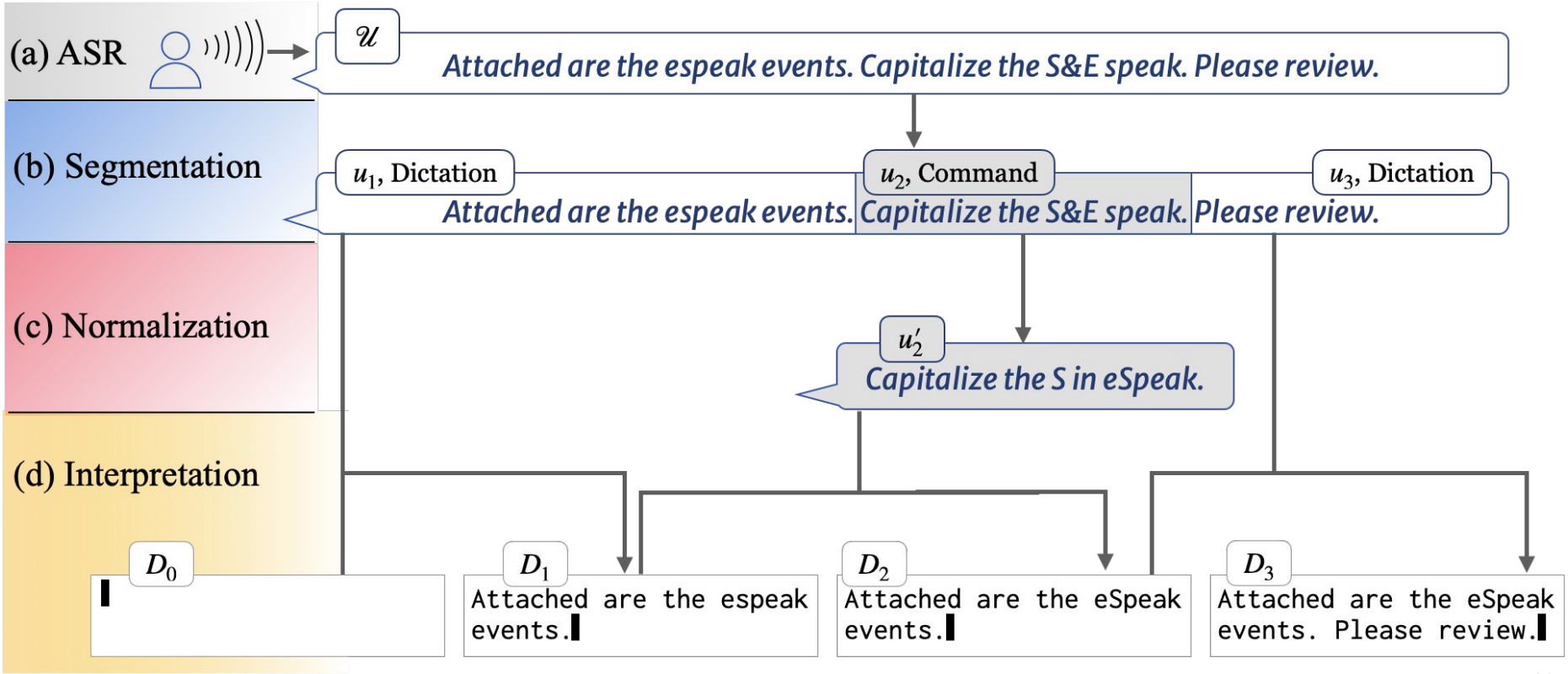
Dataset: TERTIUS

11 annotators were instructed to do one of the following:

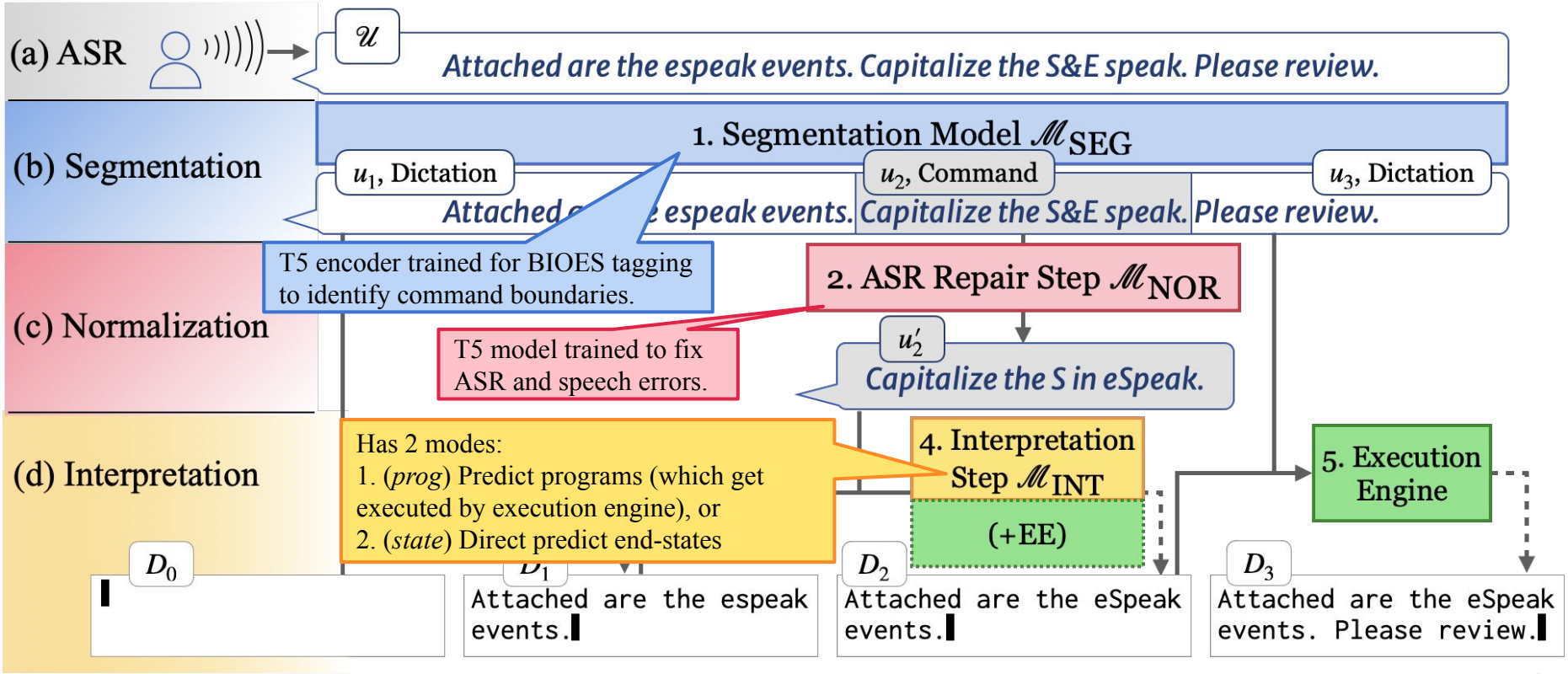
1. *Replicate doc*: exactly recreate an email from the Enron Email Dataset
2. *Elaborate doc*: expand a terse description of an email into a full email
3. *Replicate segment*: exactly recreate the effect of a single command segment sampled from annotations on the previous 2 objectives

Trajectories	Segments		
	Dictation	Command	Total
1320	959	3225	4184

Interactive Dictation: Building a System



Interactive Dictation: Instantiating Models



Results: Segmentation model

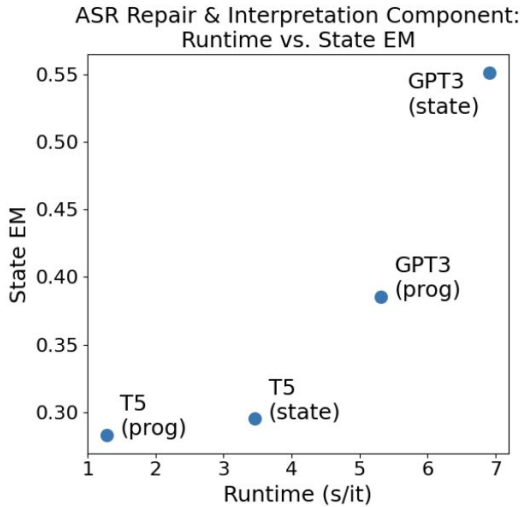
Exact Match: # of dialogues in which command boundary are exactly correct

Model	Segmentation Exact-Match (Per dialogue)	Per-sample runtime (A100)
T5-base Encoder only	85.3%	0.097 s/it

Results: ASR Repair + Interpretation Models

State Exact Match: # of commands for which the end-state is correctly predicted, whereby correctness is evaluated with exact string match.

Model	State EM	Per-command Runtime (s/it)
T5 (prog)	28.3%	1.28
T5 (state)	29.5%	3.46
GPT3 (prog)	38.6%	3.52
GPT3 (state)	55.1%	6.92



Future Work

- Better evaluation of models
  - Human Evaluation
  - Partial credit
- Taking advantage of incrementality
- Include timing & prosody information in models
- Greater diversity in prompts and human voices
  - More open-ended prompts for more natural interactions
- Better/more flexible execution engine
- Model-in-the-loop annotation
  - Allows for data on clobber commands/redo/undo

Thank you!

- Code & Data: https://aka.ms/tertius

Conclusion

- We introduce a new task, **interactive dictation**, whereby:
  - 1. Users can naturally interleave dictation and commanding, and
  - 2. Users can flexibly invoke commands with a wide variety of utterances

- We construct a dataset **TERTiUS** for the task

- We build a baseline system for the task, discovering a tradeoff between speed and accuracy
  - We explore different choices and sizes of model architecture (T5 vs. GPT3)
  - We explore generating programs vs. generating document states directly