

Dialogue systems ~~Conversational agents~~ for language learning: state of the art and avenues for research on task-based agents

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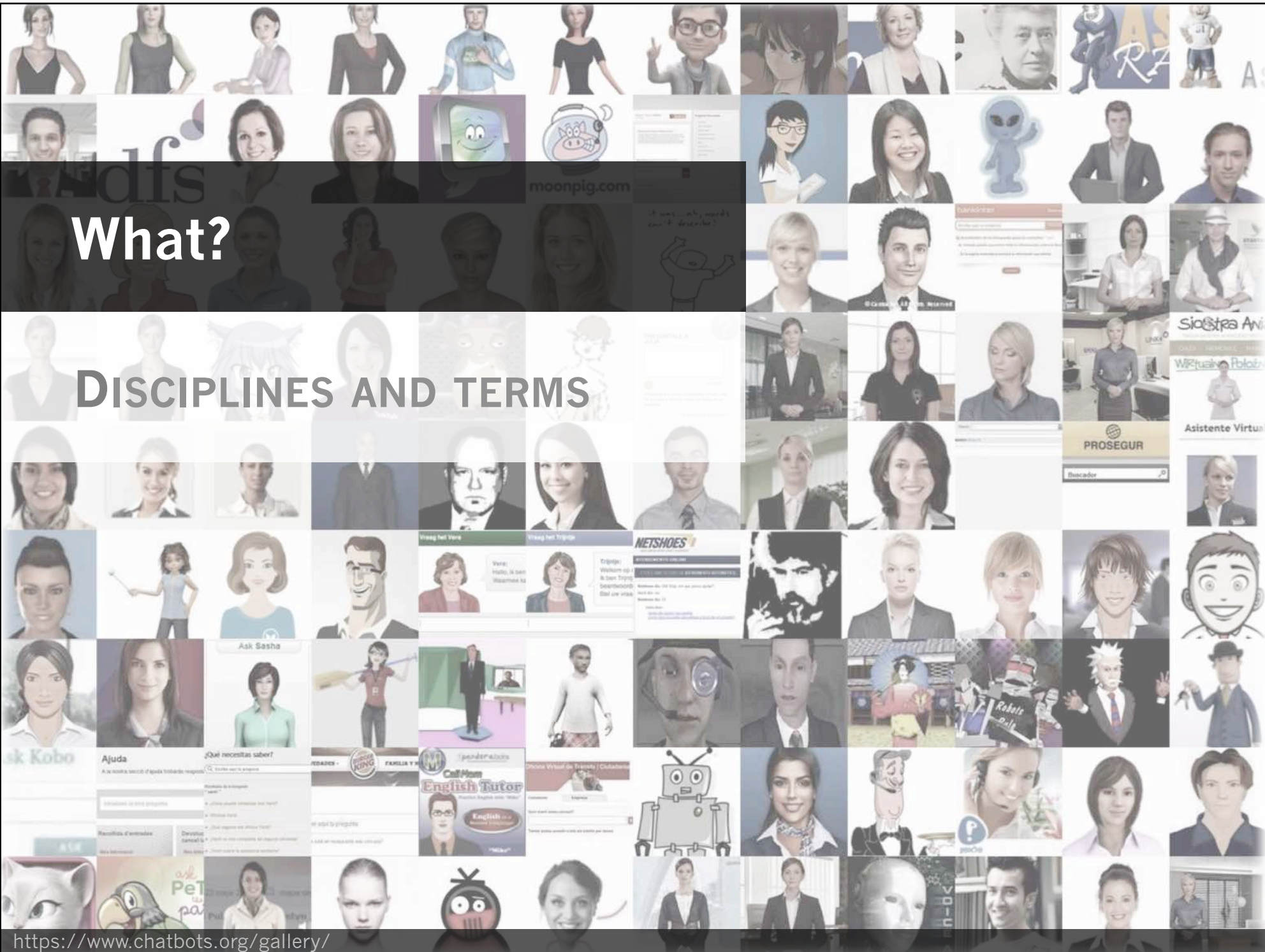
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Dialogue systems for language learning

- What?
 - Dialogue systems
 - Why?
 - What do we know?
 - How?
- DISCIPLINES AND TERMS
- DEFINITION AND COMPONENTS
- RATIONALE
- EFFECTIVENESS STUDIES
- TECHNOLOGICAL PROCESS



What?

DISCIPLINES AND TERMS

Dialogue system?

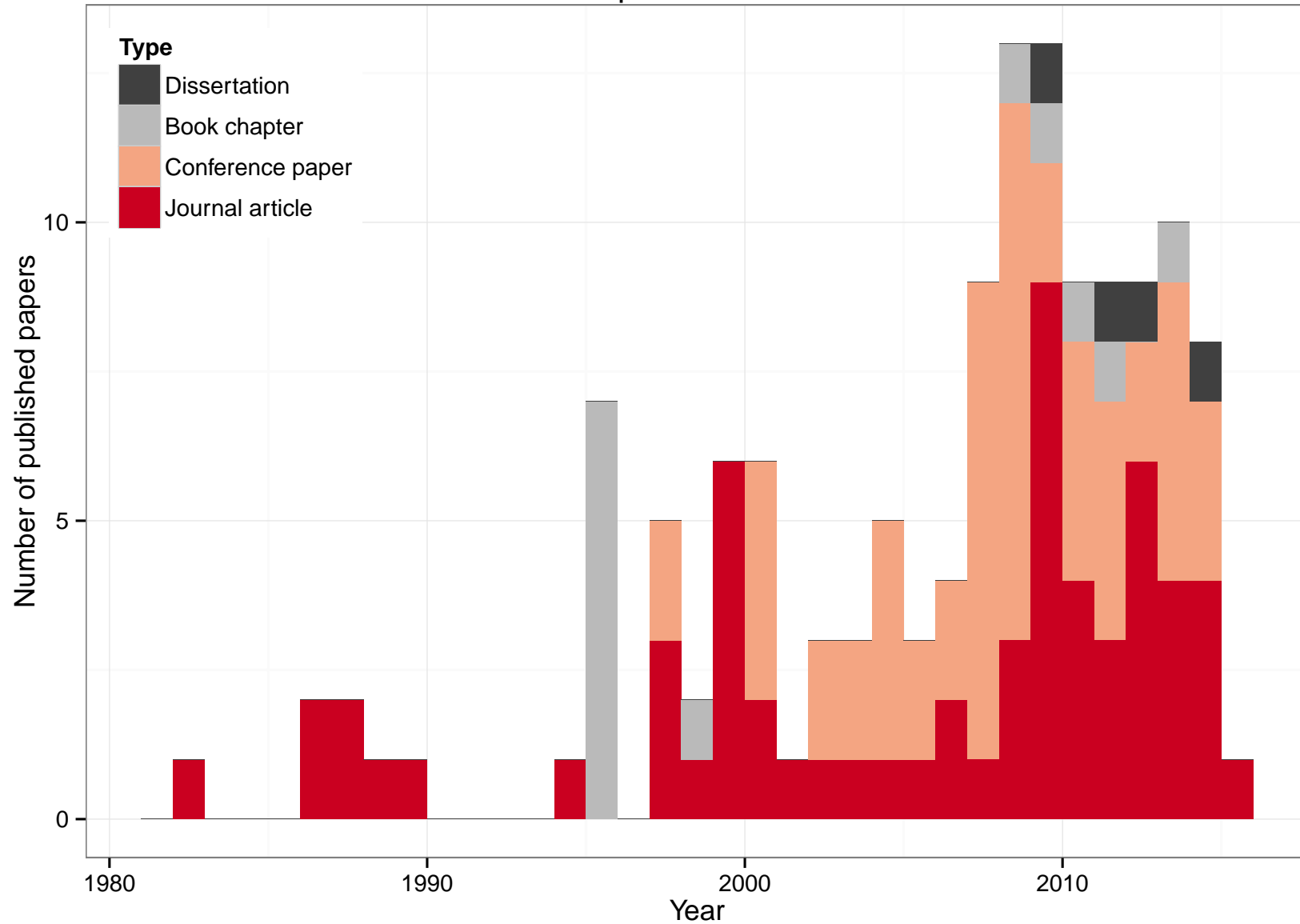
- Chatbot
- Conversational agent
- **Dialogue system**
- Spoken dialogue system
- Dialogue-based CALL
- Dialogue simulation
- Dialogue game
- Simulated dialogue
- Speech-interactive CALL
- Conversational language tutoring system.
- Conversation simulator
- Communication-based language learning
- Chatterbot
- Conversational companion
- Conversational system
- Conversational ICALL system
- Dialogue-based conversation tutoring
- Dialogue program
- Interactive pedagogical drama
- Microworld interaction
- Virtual agent
- Virtual human
- Pedagogical agent
- Voice-interactive CALL...

Systematical literature study: Corpus collection

- Systematical search on Web of Science, Scopus and ProQuest
[results: 604 / 494 / 1003 hits]
- Ancestry (citing) and forward (cited in) search
- Final corpus:
135 published and peer-reviewed papers
from 1982 to 2015 (April)

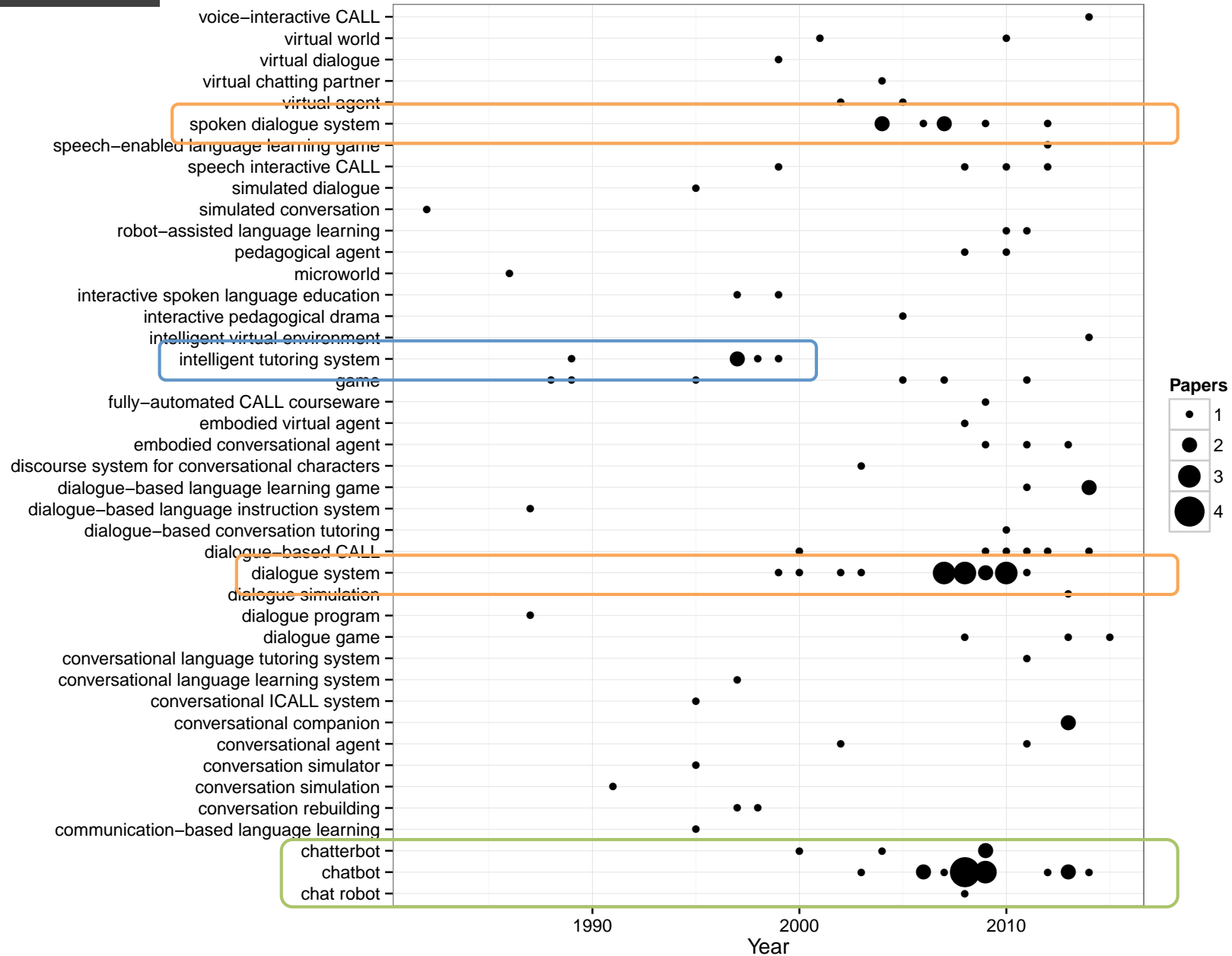
Corpus of studies

Studies published on DSL

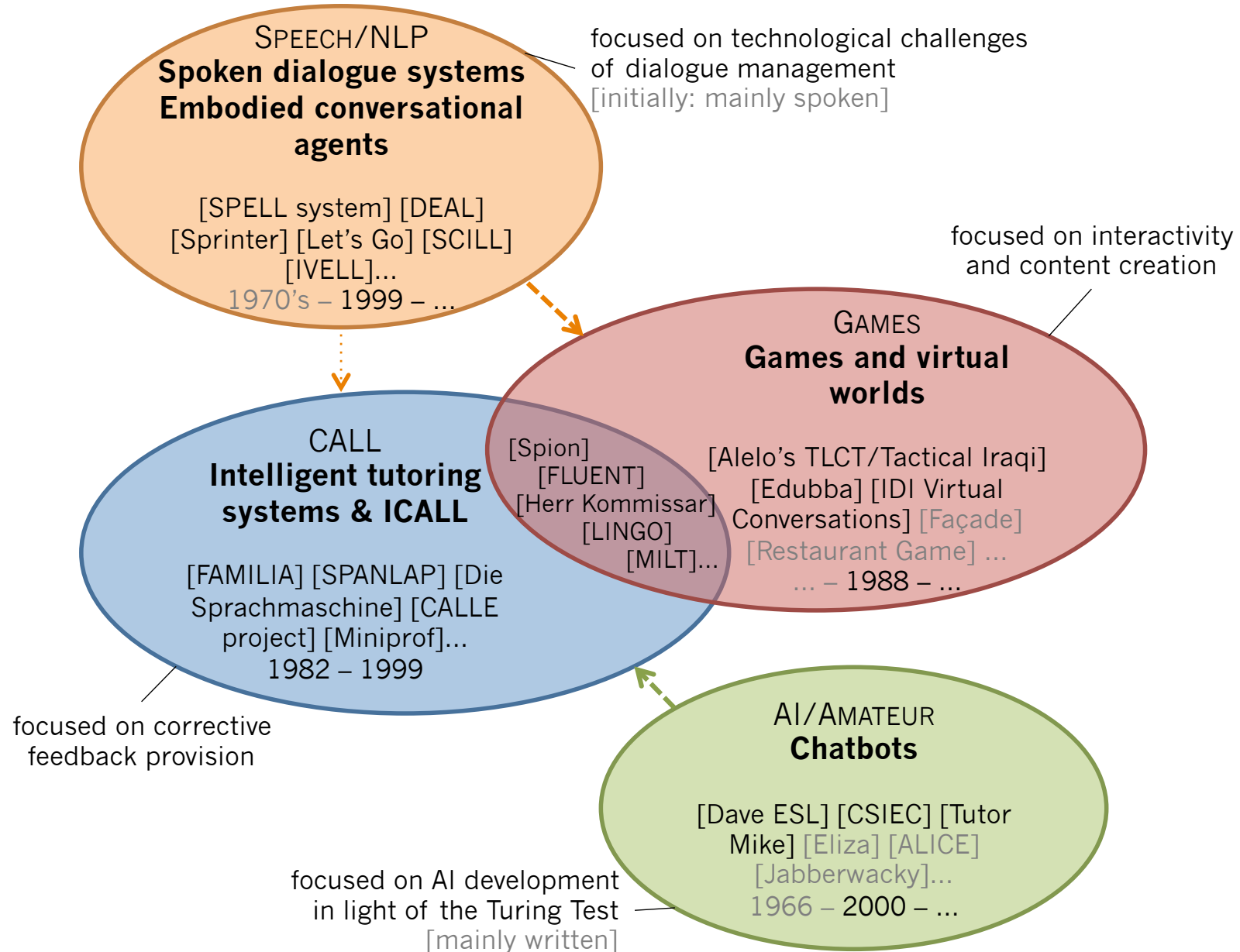


Terms

Terms used to refer to DSLL across time

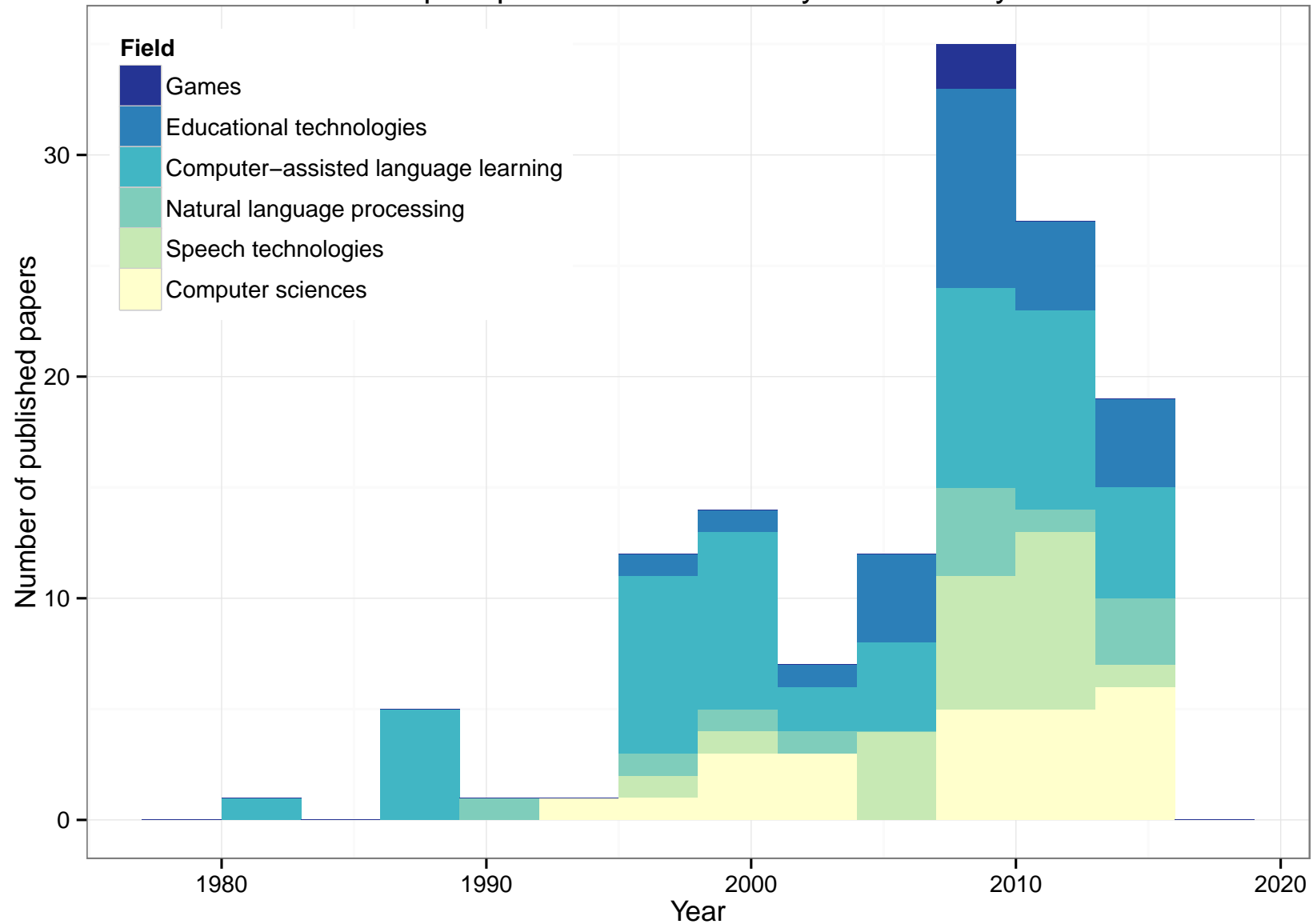


Disciplinary approaches



Disciplinary approaches

Papers published on DSLL by field of study



Dialogue systems

DEFINITION AND COMPONENTS



Dialogue System
for unity

Different systems?

- Spoken / Written / Multimodal
e.g. spoken dialogue systems vs. chatbots
- Technologically simple / complex
e.g. chatbots vs. dialogue systems (Klüwer, 2011)
- Focus on form / Focus on meaning
e.g. tutorial CALL vs. “communication-based CALL” (Murray, 1995)

- **Dialogue activity**

- conversation, talk, information exchange, questions-answers, requests-grants, etc.

- with an **automated agent**

- as interlocutor, as tutor, as character...
- virtual, embodied, robot, etc.

Or a single endeavor?

DSL: Towards an operational definition

- **Dialogue** activity
 - conversation, talk, information exchange, questions-answers, requests-grants, etc.
- with an **automated agent**
 - as interlocutor, as tutor, as character...
 - virtual, embodied, robot, etc.
- **Dialogue system for language learning (DSL)**

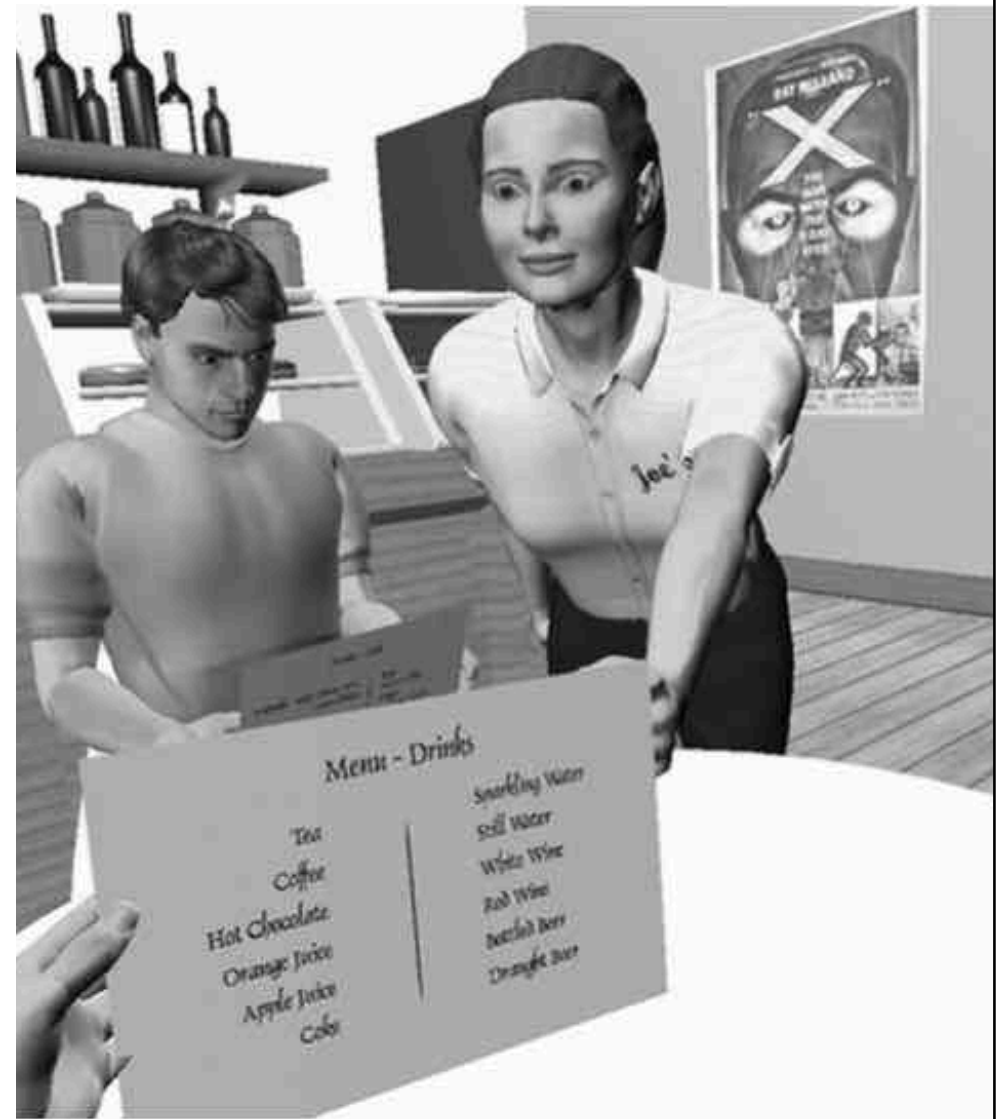
Practice English with Mike

Mike is very smart. You can ask him any questions. When you want to practice the conversations of the topic you are www.eslfast.com/robot/, type in "Let's practice topic ..." or "I'd like to practice topic ..." You must type the exact name **Let's practice topic Weather (2)**. When you are acting as **A** and Robot Mike is **B**, you must type in the exact sentence in the conversation, including the punctuation. If you make a mistake, it is not controlled practice of the conversation anymore. You need to type "Let's practice topic ..." again to get the robot back on track.



YOU: Hi Mike
Mike: Hello!
YOU: What do you know?
Mike: I'd rather not tell you.
YOU: Can you tell something insightful for the people at CALICO?
Mike: Sure.
YOU: Go on.
Mike: Just a moment.
YOU: We're listening.
Mike: You are?

SPELL system (Morton, Gunson & Jack)



Distinctive features

Interlocutor

Human

Human +
Automated tutor

Automated
interlocutor

Interaction

Monologue

“Mono-initiative”
dialogue

Dialogue

Input

Constrained

Partially
constrained

Unconstrained

Interactivity

Fixed

Fixed with
illusion of choice

Interactive

Interaction ↓	Input ↓	Human	Human + Automated tutor	Automated	Automated	Automated	← Interlocutor
		Interactive	Interactive	Interactive	Fixed with illusion of choice	Fixed	← Interactivity*
Monologue	Constrained input	Registration form	?	?	?	Word(s) completion (<i>gap-filling</i>), selection, ordering, etc.	
Monologue	Partially constrained input	?	?	?	Choose from a list of words (various possible sentences)	Choose from a list of words	
Monologue	Unconstrained input	Webinar. Usual web publication	Computer-assisted writing system	?	?	Short answer (with automatic correction)	
Mono-initiative dialogue	Partially constrained input	?	?	Text adventure game and microworlds [FLAG, Spion, LINGO, MILT written]	?	Reading aloud prompted utterances (de Wet et al 2009)	
Mono-initiative dialogue	Unconstrained input	Questions & answers website [Yahoo Answers]	?	User-only initiative in chatbot [CSIEC...]	Questions-asking system where answer is not taken into account [ALICE-chan, Saybot]	Tutorial dialogue	Interactive unconstrained DS
Dialogue	Unconstrained input	Computer-mediated communication: chat, email, videoconference, forum...	Computer-supported collaborative learning and Tutored CMC [MentorChat, Neckle, C4/Mondo]	Interactive unconstrained DIALOGUE SYSTEM [SPELL, Subarashii, DEAL, CSIEC, TLCTS, Façade...]	Free input, but ignored by system [Majestic]	Embedded dialogue (Cornillie et al 2013)	
Dialogue	Partially constrained input	?	?	?	Choose from a list of words in a dialogue (various correct sentences possible)	Choose from a list of words in a dialogue	Partially interactive and unconstrained DS
Dialogue	Constrained input	?	?	Utterance selection dialogue with multiple conversational paths [Let's Chat, Animated pedagogical agent]	Utterance selection with various correct options, but same reaction [Trace Effect]	Reading aloud prompted utterances in dialogue [Virtual Language Patient, FASOP]	
Mono-initiative dialogue	Constrained input	Request more information form	?	Microworld interaction with utterance selection [VILTS, MILT spoken]	Tutorial dialogue asking for words [ARTUR]	Ordering words (<i>drag & drop</i>) or <i>gap-filling</i> in a dialogue	All DS

Focus-on-meaning
Successful communication is the main objective

Focus-on-form
Corrective feedback is the main objective

Interaction ↓	Input ↓	Human	Human + Automated tutor	Automated	Automated	Automated	← Interlocutor
		Interactive	Interactive	Interactive	Fixed with illusion of choice	Fixed	← Interactivity
Monologue	Constrained input	9				14	
Monologue	Partially constrained input						
Monologue	Unconstrained input			1			
Mono-initiative dialogue	Partially constrained input			Text adventure games [Spion, LINGO, MILT...] 7			
Mono-initiative dialogue	Unconstrained input	1		Mono-initiative chatbots [Dave, Mike, CSIEC] 9	Questions-asking systems [ALICE-chan, Saybot] 1		Interactive unconstrained DS
Dialogue	Unconstrained input	2	Computer-supported collaborative learning/ Tutored SCMC 5 [MentorChat, Neckle...]	Interactive & unconstrained DSLL 82	2	1	
Dialogue	Partially constrained input				1		Partially interactive and unconstrained DS
Dialogue	Constrained input			3	2	Reading aloud prompted utterances [FASOP] ²	
Mono-initiative dialogue	Constrained input			Utterance selection [Let's Chat...] 5		Gap-filling 1	All DS

Focus-on-meaning

Successful communication is the main objective

Focus-on-form

Corrective feedback is the main objective

Why?

RATIONALE FOR DSLL

SCMC (chat) ⇒ L2 development

- SCMC ⇒ L2 oral proficiency
(Payne & Whitney, 2002; Payne & Ross, 2005;... Ziegler, 2013; Lin, 2015)
- SCMC ⇒ L2 oral proficiency, more than face-to-face
(Sykes, 2005; Lin, 2015; although not confirmed by Ziegler, 2013)
- Why?
 - **attention** to form (**noticing** and **feedback**)
 - lower anxiety levels (Satar & Özdener, 2008)

DSLL → L2 development

- In foreign language teaching contexts:
interactions in L2 often very rare

⇒ “Virtual immersion” (Ellis & Bogart, 2007; Fryer & Carpenter, 2006)

- Autonomous practice in a communicative, cultural,
authentic and interactive task
(Wachowicz & Scott, 1999; Fryer & Carpenter, 2006)

DSLL → L2 development: advantages over SCMC

- Available at any moment
- Learner can go at his own pace (repeat, etc.)
- Low anxiety environment
- Potentially fully controllable learning environment
(e.g. feedback, learner modeling and adaptivity, motivational support)

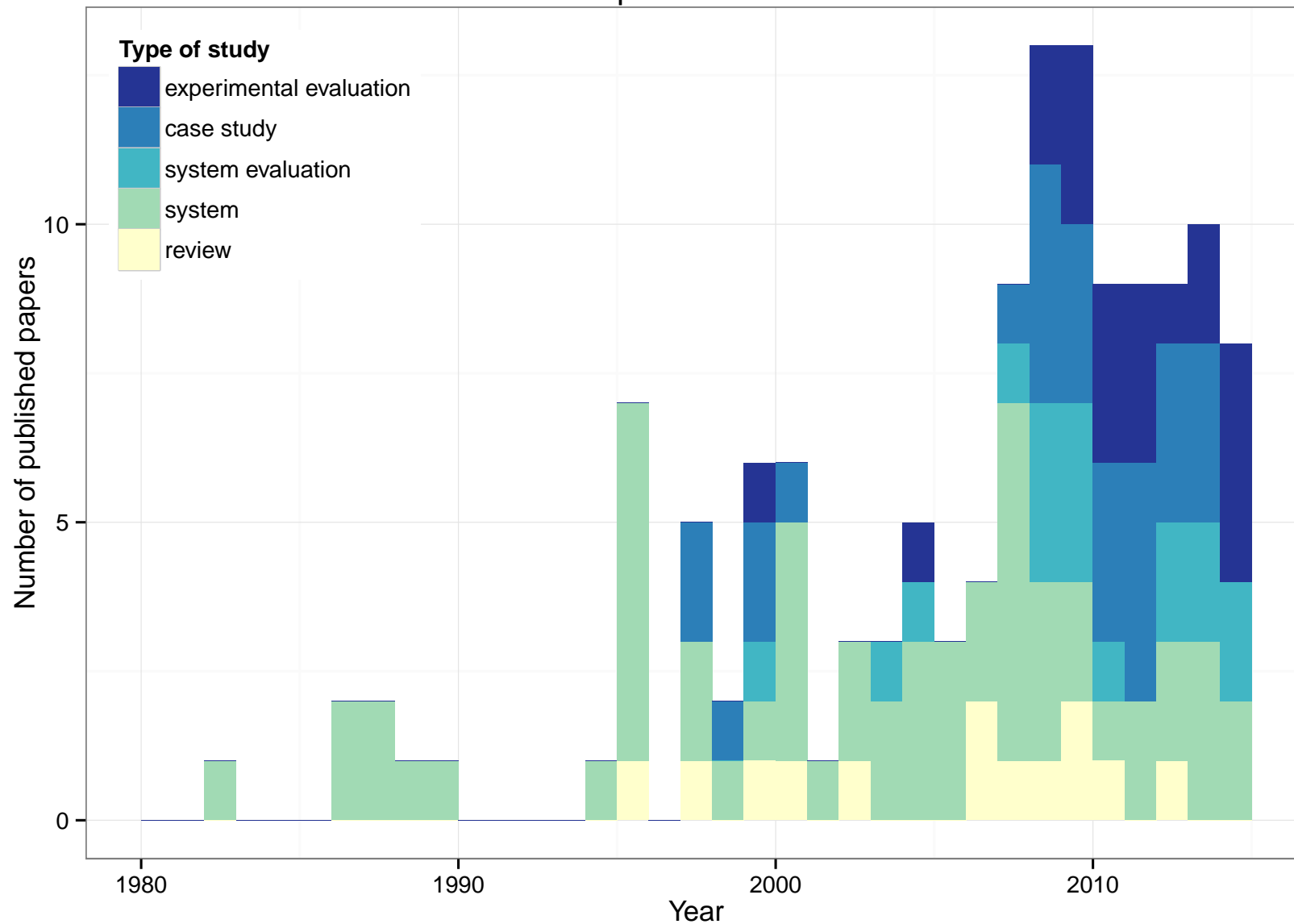
What do we know?

EFFECTIVENESS STUDIES



Types of studies on DSLL

Studies published on DSLL



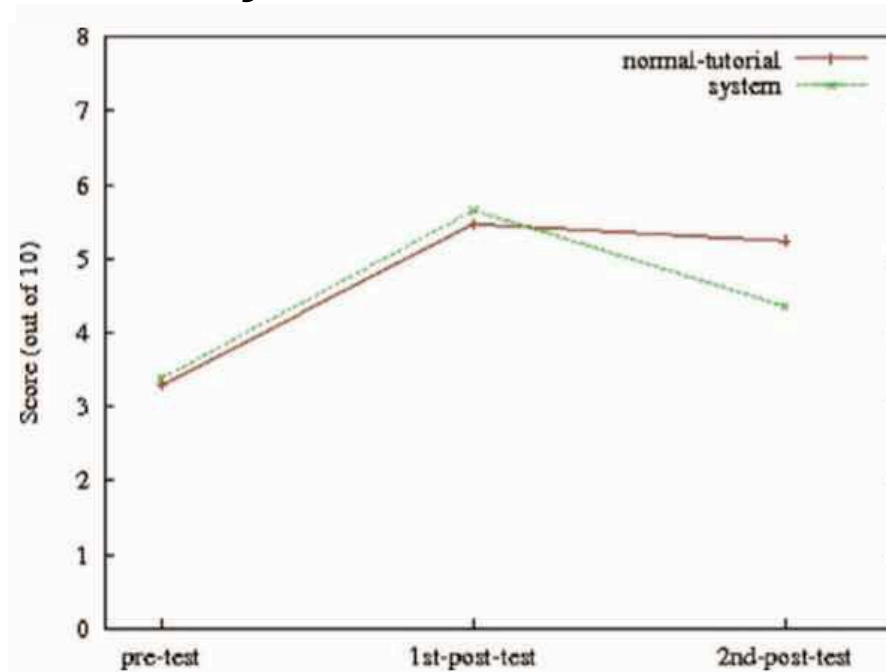
Effectiveness studies

Number of studies by dependent variables and methodological design

	Perceived usefulness	Impact on motivation and attitude	Impact on language knowledge and skills
Post	14	1	3
Pre-post		7	22
Pre-post + control		4	12
Pre-post + control with significant results		0	2

Experimental studies on DSL's impact on learning

- Vlugter, Knotta, McDonald & Hall (2009)
[Te Kaitito]: written DSL tutorial in Māori
 - compares DSL tutorial with in-class tutorial about Māori personal pronoun system

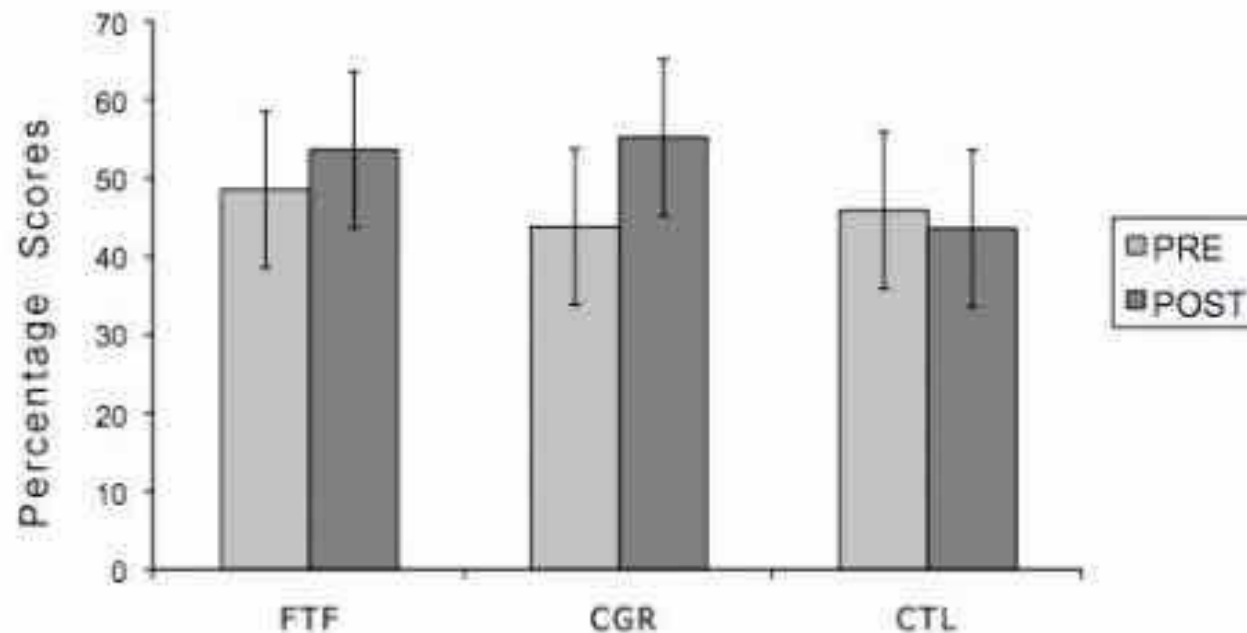


Experimental studies on DSLL's impact on learning

- Petersen (2010)

[Sasha]: written DSLL in English providing corrective feedback (recast) and answering questions in a “spot the differences” task

- compares Sasha vs. face-to-face interaction
=> impact on question construction



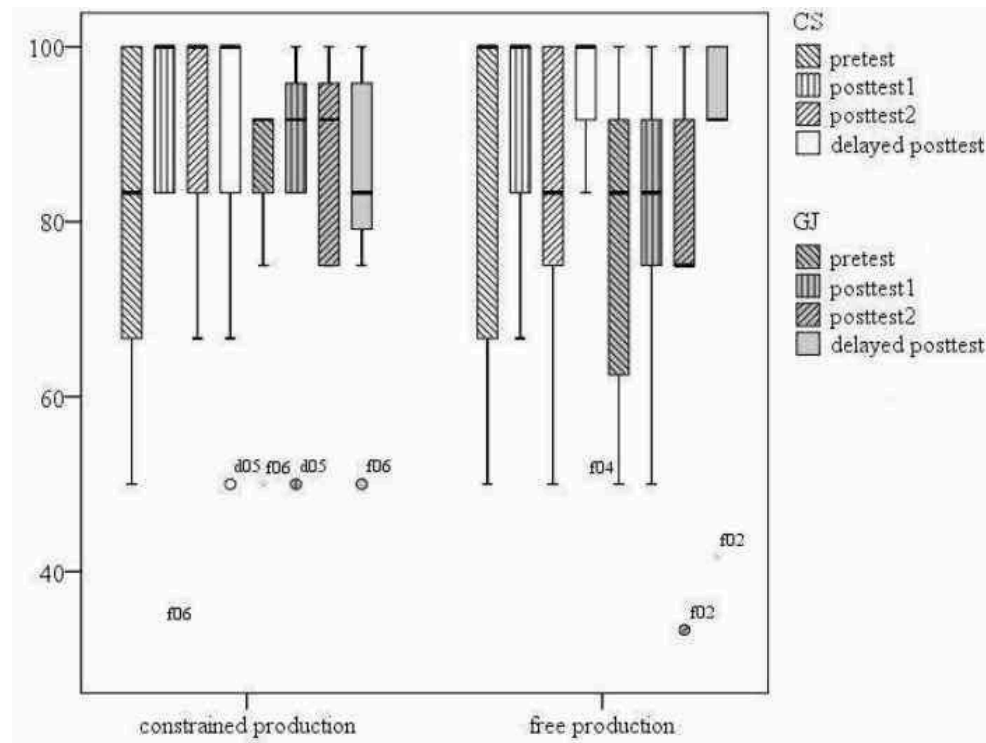
Experimental studies on DSLL's impact on learning

- Wolska & Wilske (2010a)

- Written DSLL in German

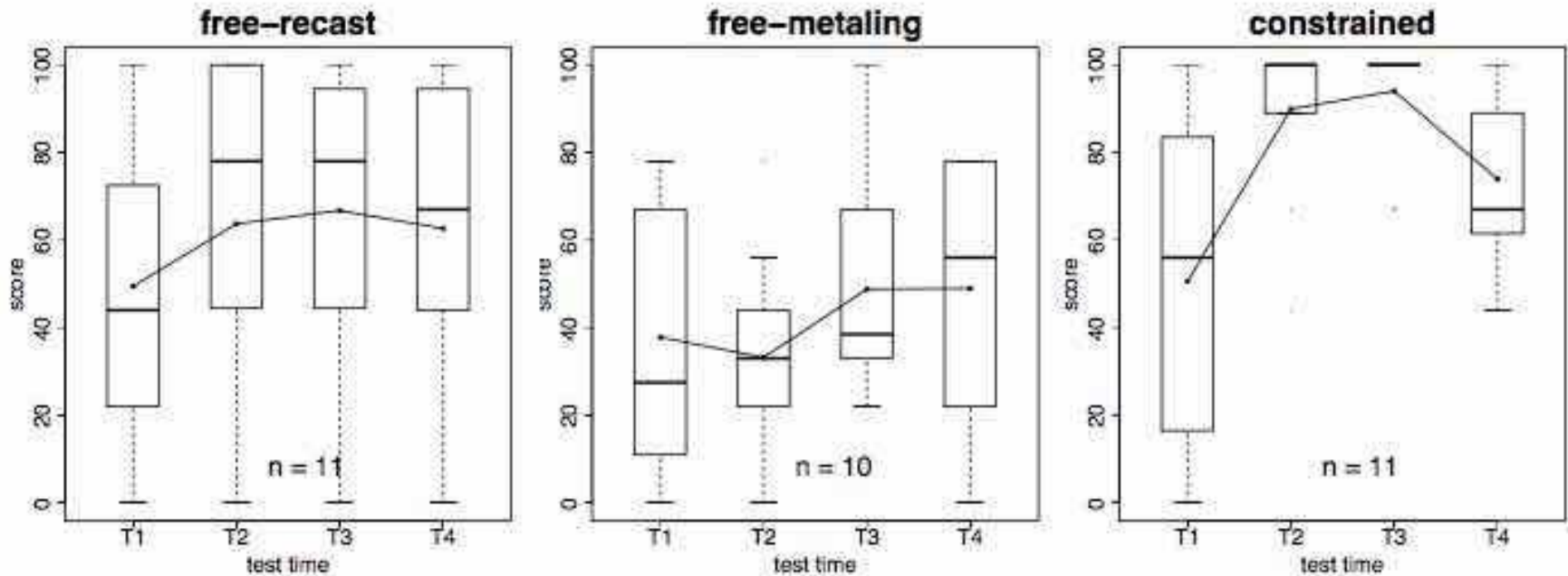
- compare **free production** vs. **constrained production** (*gap filling*) => impact on sentence construction and grammaticality judgement

- N=15
n=7



Experimental studies on DSL's impact on learning

- Wilske & Wolska (2011)
 - compares free production with either recasts or metalinguistic feedback, and constrained input => impact on sentence construction & grammaticality judgement
 - N=30 / n=9



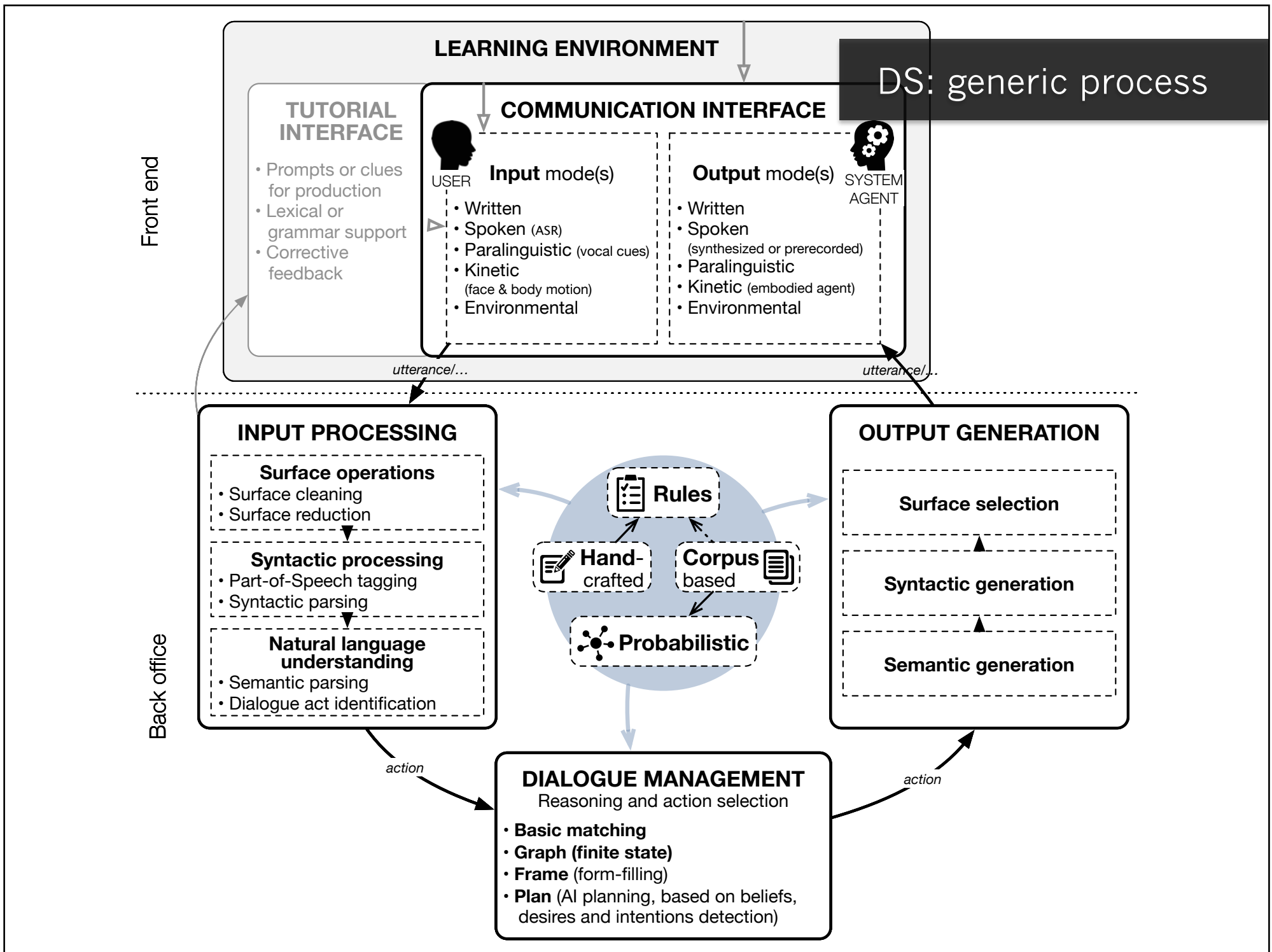
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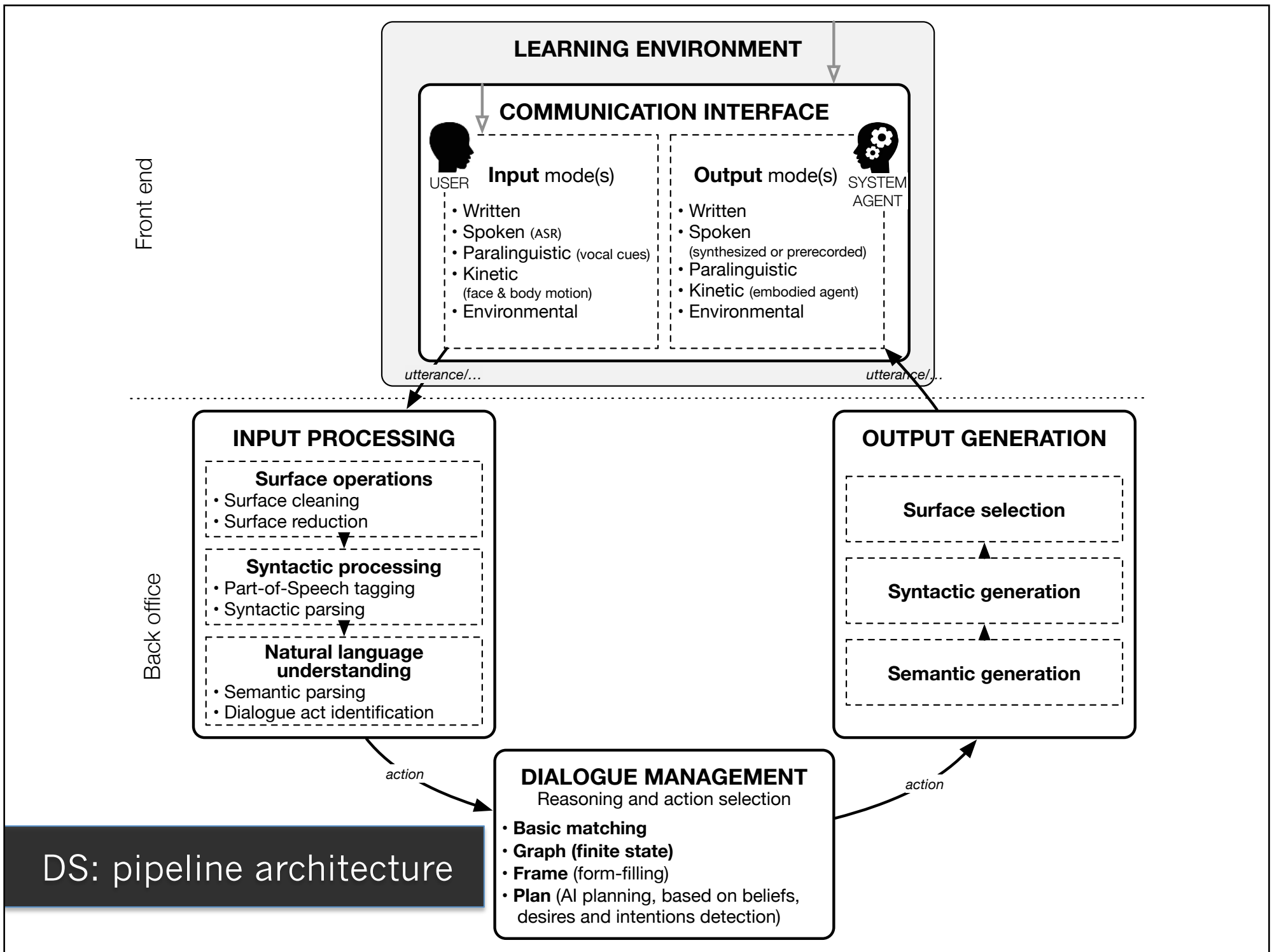
413 <li>Doesn't everyone have a </li>
414 </random><star/>.<br />
415 I have
416 <random>
417 <li>A lot of friends on the Internet.</li>
418 <li>A great programmer.</li>
419 <li>A whole lot of original answers.</li>
420 <li>A plan for a robot body.</li>
421 </random>
422 </template>
423 </category>
424
425
426 <pattern>DO YOU KNOW * </pattern>
427 <template>
428 <think><set name="it"><star/></set></think>
429 <random>
430 <li>I don't know if I know <star/>. Where would I have heard about it?</li>
431 <li>I know very little about <star/>. Tell me more.</li>
432 <li>No, tell me about him, her or it.</li>
433 </random>
434 </template>
435 </category>
436
437 <category>
438 <pattern>DO YOU KNOW WHAT * IS</pattern>
439 <template>
440 <srai>WHAT IS <star/></srai>
441 </template>
442 </category>
443
444 <category>
445 <pattern>DO YOU LIKE * </pattern>
446 <template>
447 <think><set name="it"><star/></set></think>
448 <random>
449 <li>I don't know if I like <star/>.</li>
450 <li>Some people like it.</li>
451 <li>Do you like it?</li>
452 <li>How old are you?</li>
453 <li>I've heard other people say they like that.</li>
454 </random>
455 <random>
456 <li>I like pets.</li>
457 <li>But I like cats.</li>
458 <li>Though I like cats and dogs.</li>
459 <li>I enjoy working with people.</li>
460 <li>I have a stimulating relationship with <bot name="master"/>.</li>
461 <li>I love horses.</li>
462 <li>Someone said they like guns.</li>

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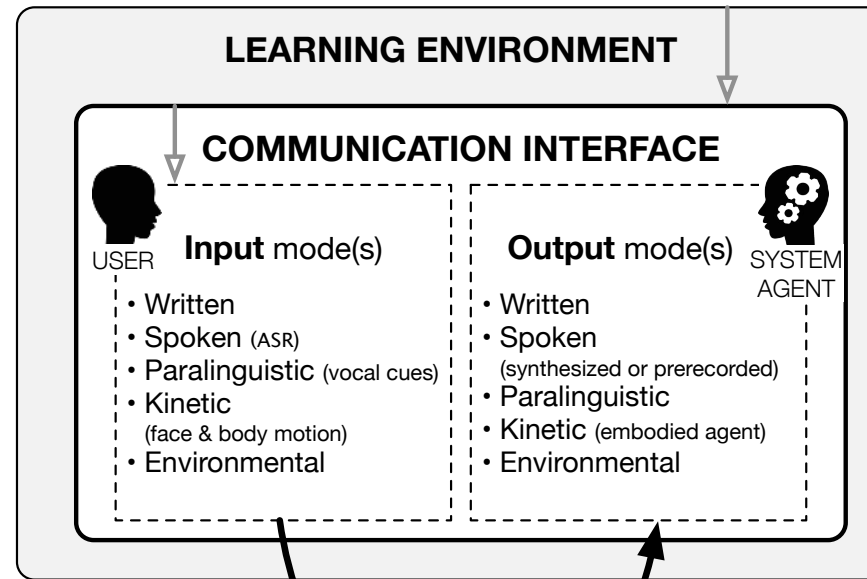
How?

TECHNOLOGICAL PROCESS

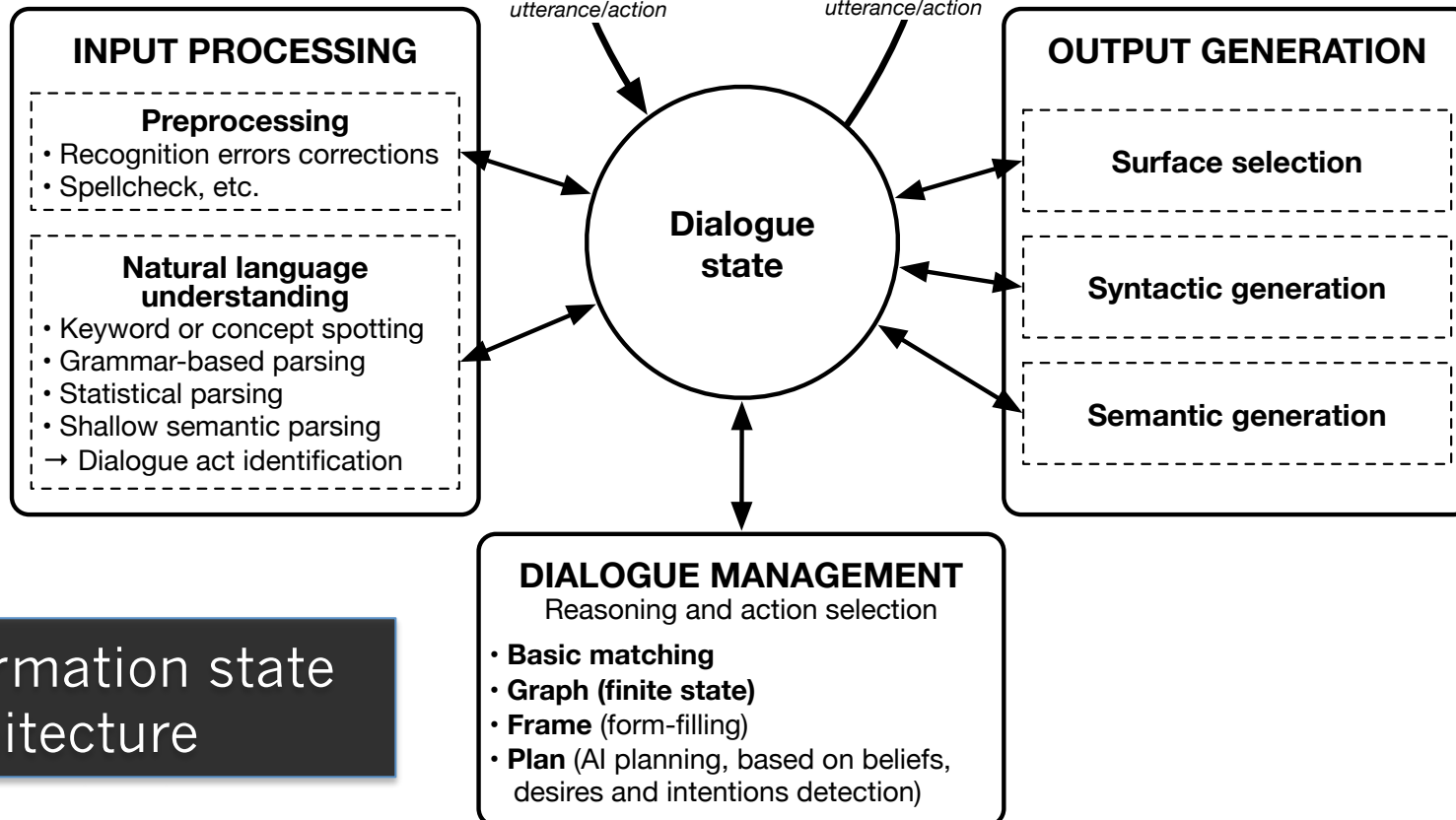




Front end

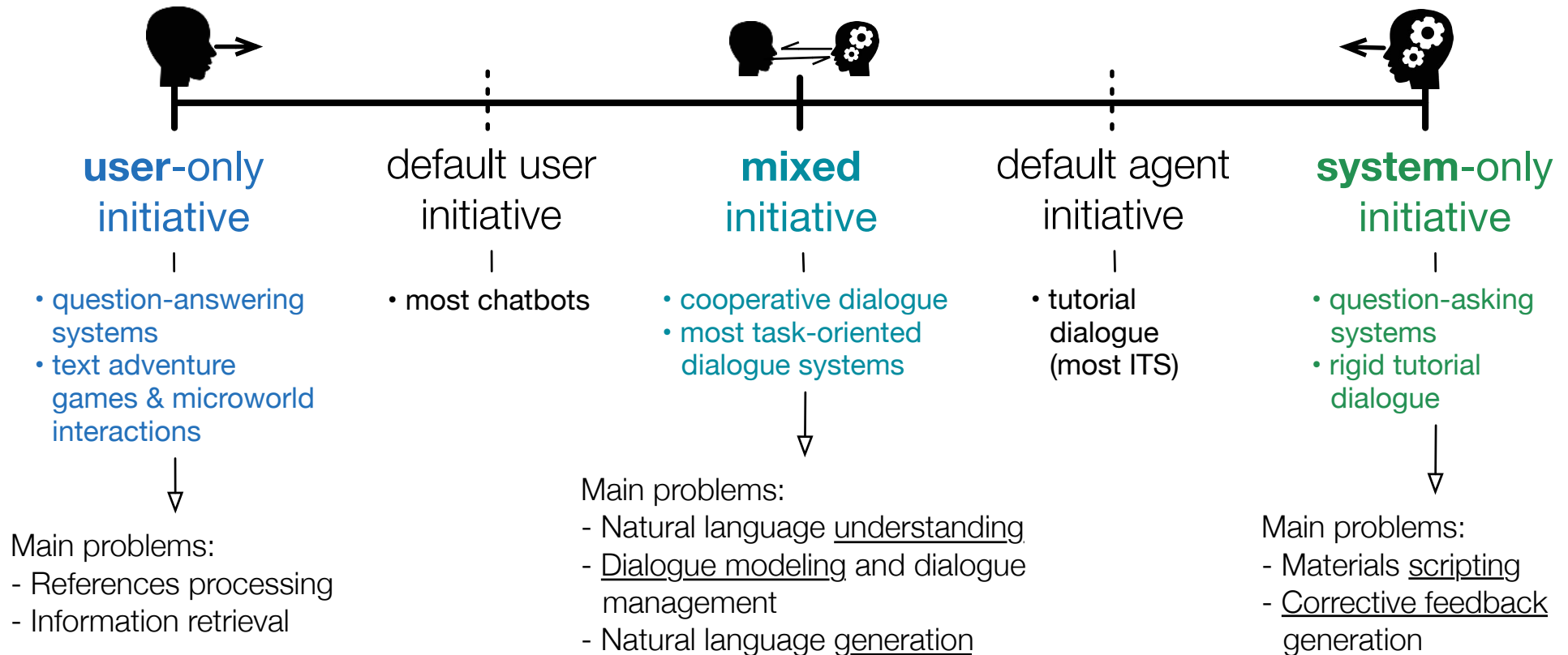


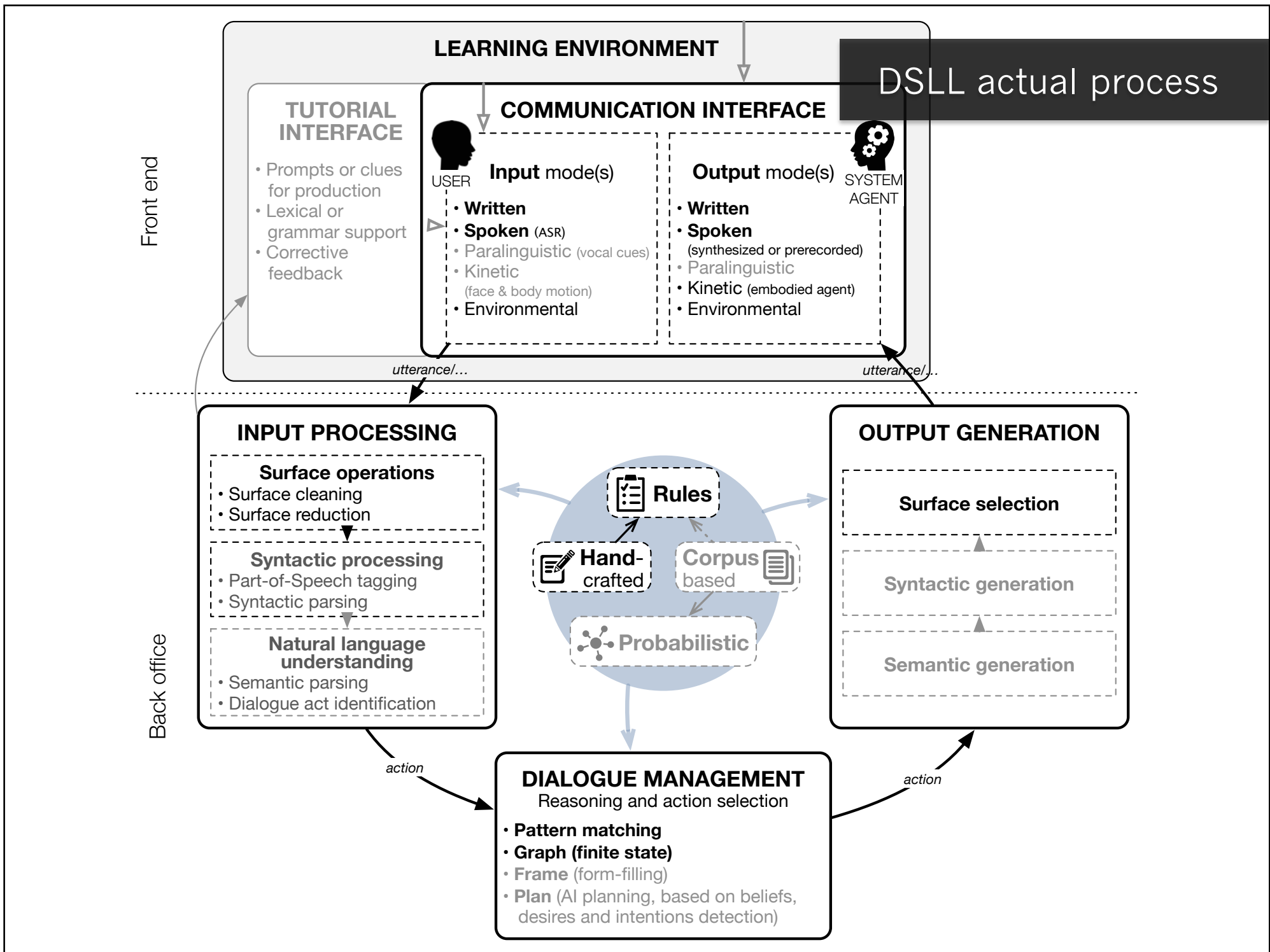
Back office



DS: information state architecture

Initiative management in dialogue systems





Conclusions

▪ **What?**

- Operational definition of DSLL based on systematic literature study:
 - “Dialogue activity with an automated agent, ideally with unconstrained input and interactive dialogue sequence”

▪ **Why?**

- Insufficient experimental results to demonstrate effectiveness for language language
- ⇒ Need for more effectiveness research

▪ **How?**

- Advancements in dialogue systems haven't yet been applied to DSLL:
 - natural language understanding
 - information state-based
 - data-driven / probabilistic models
- ⇒ Need for more technological research

Thank you!

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state of the art and avenues for research
on task-based agents

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