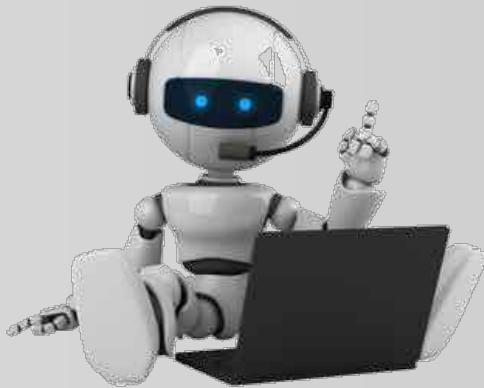


Instructional design and natural language processing in **dialogue-based CALL**



Serge Bibauw

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CALICO Conference
May 11, 2016

KU LEUVEN



UCL
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How do we practice **speaking** in a MOOC ?

coursera SB

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Speak English Professionally: In Person, Online & On the Phone

by Georgia Institute of Technology

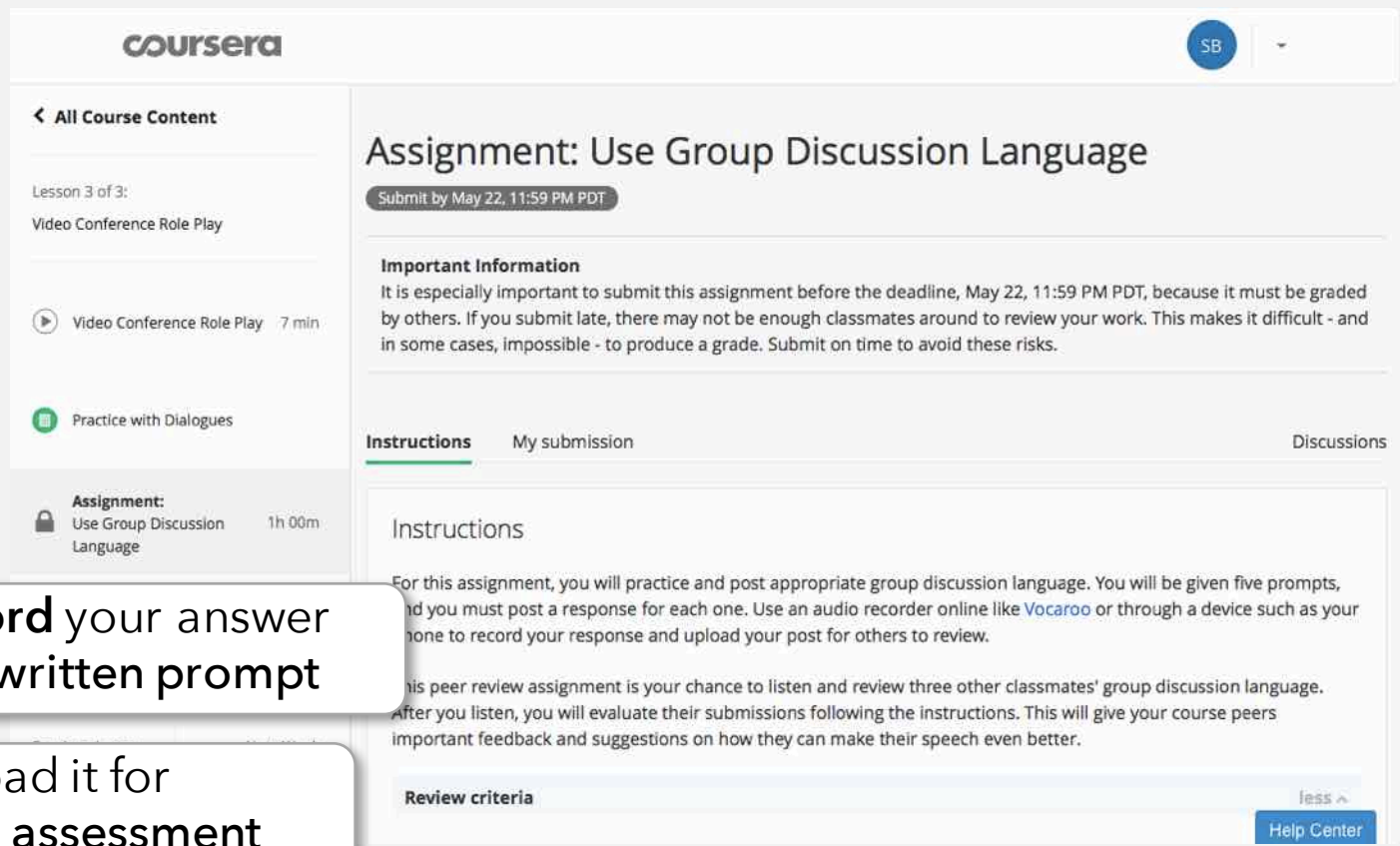
 Amalia B. Stephens

Welcome to Speak English Professionally: In Person, Online & On the Phone! You're joining thousands of learners currently enrolled in the course. I'm excited to have you in the class and look forward to your contributions to the learning community.

To begin, I recommend taking a few minutes to explore the course site. Review the material we'll cover each week, and preview the assignments you'll need to complete to pass the course. Click **Discussions** to see forums where you can discuss the course material with fellow students taking the class. Be sure to introduce yourself to everyone in the Meet and Greet forum.

[Help Center](#)

How do we practice **speaking** in a MOOC ?



The screenshot shows a Coursera assignment page. The title is "Assignment: Use Group Discussion Language" with a deadline of "Submit by May 22, 11:59 PM PDT". The page is divided into sections: "Important Information" (stating the importance of meeting the deadline for peer review), "Instructions" (explaining the task of practicing group discussion language and posting responses to prompts), and "Review criteria" (partially visible). The left sidebar shows the course content, including "Lesson 3 of 3: Video Conference Role Play" and "Practice with Dialogues".



Record your answer to a written prompt



Upload it for peer assessment

In many learning environments, learners lack **speaking in interaction**

Online learning environments

MOOCs, apps & websites for
autonomous language learning

Synchronous computer-mediated
communication (**SCMC**)
- whether **audio, video** or **text chat** -
is difficult to **supervise**
and does not **scale** well.

Foreign language instruction contexts

No L2 outside the classroom
Large classes in developing countries

Limited **teacher-student** interaction
Very rare **peer** interaction
No opportunities **outside** the class

Lack opportunities for
spontaneous interactive
practice of the L2

Dialogue-based CALL

Dialogue-based CALL refers to any application or system allowing

to maintain a **dialogue**

[immediate, synchronous interaction]

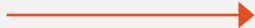
[written or spoken]

with an **automated agent**

[tutorial CALL (≠ CMC)]

for **language learning** purposes.

Designing dialogue-based CALL systems to allow for interactive and meaningful practice

Instructional design  Technological approach

Learning outcomes

Task to accomplish

Learning principle

Degree of interactivity

Scaffolding

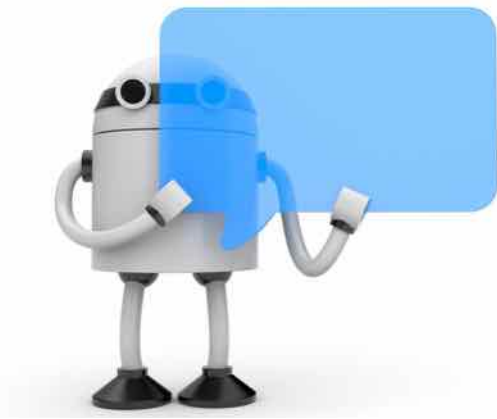
Dialogue modelling

Initiative management

Natural language
understanding

Adaptivity and
user modelling

Instructional design and natural language processing in dialogue-based CALL



Previous research & existing systems

A research synthesis from 1982 to 2015

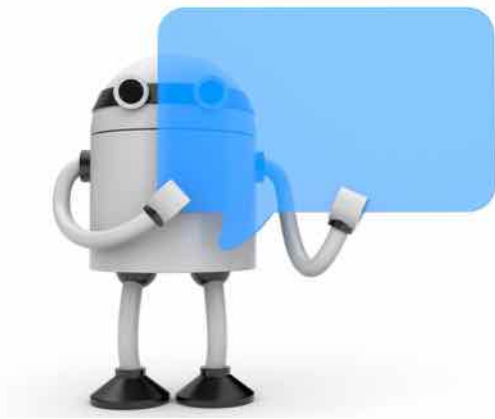
Instructional design & technological challenges

A typology of dialogue-based CALL systems

Natural language processing approaches to dialogue systems

From handcrafted rules to machine learning

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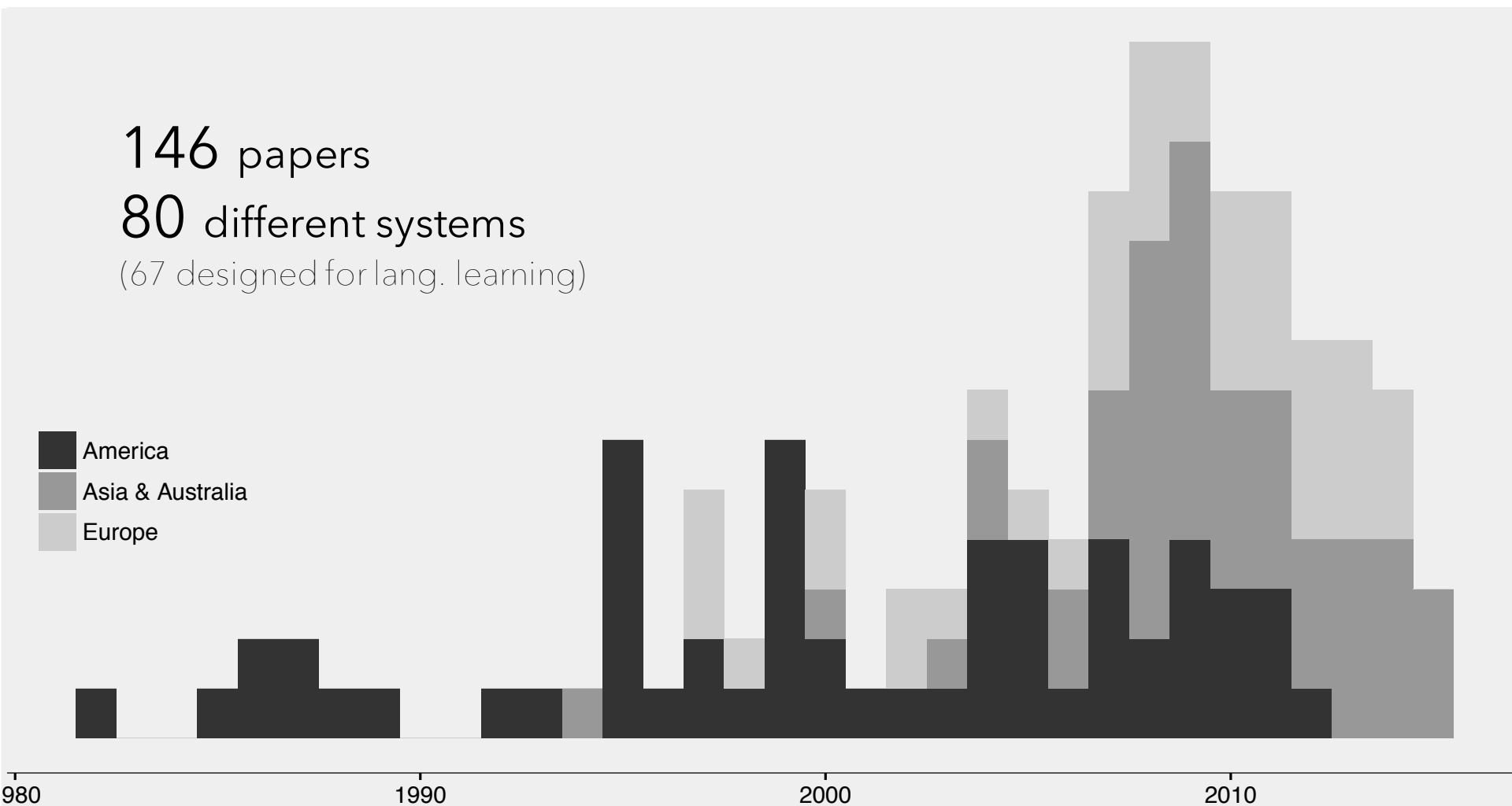
From handcrafted rules to machine learning

Corpus of studies

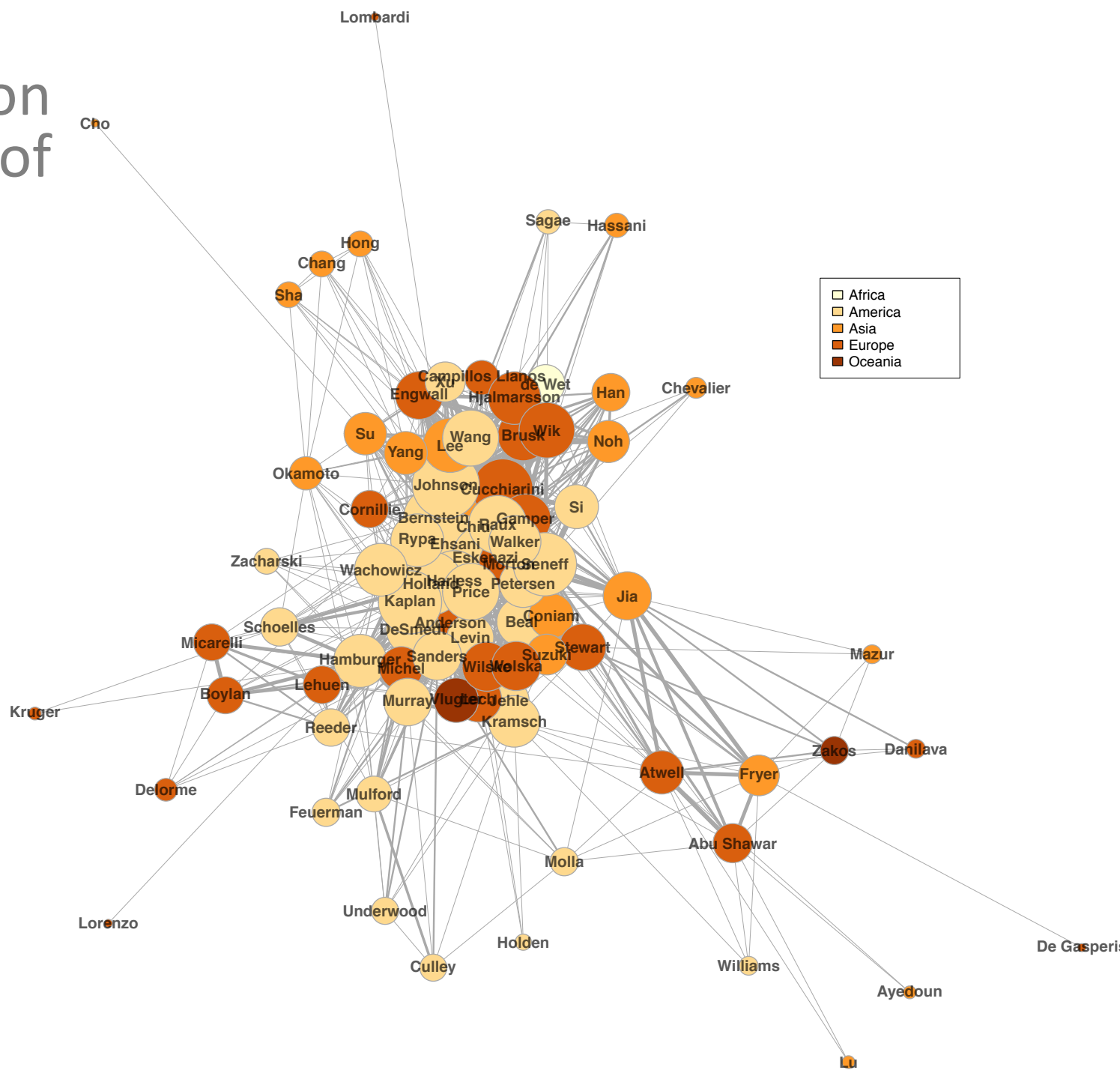
146 papers

80 different systems

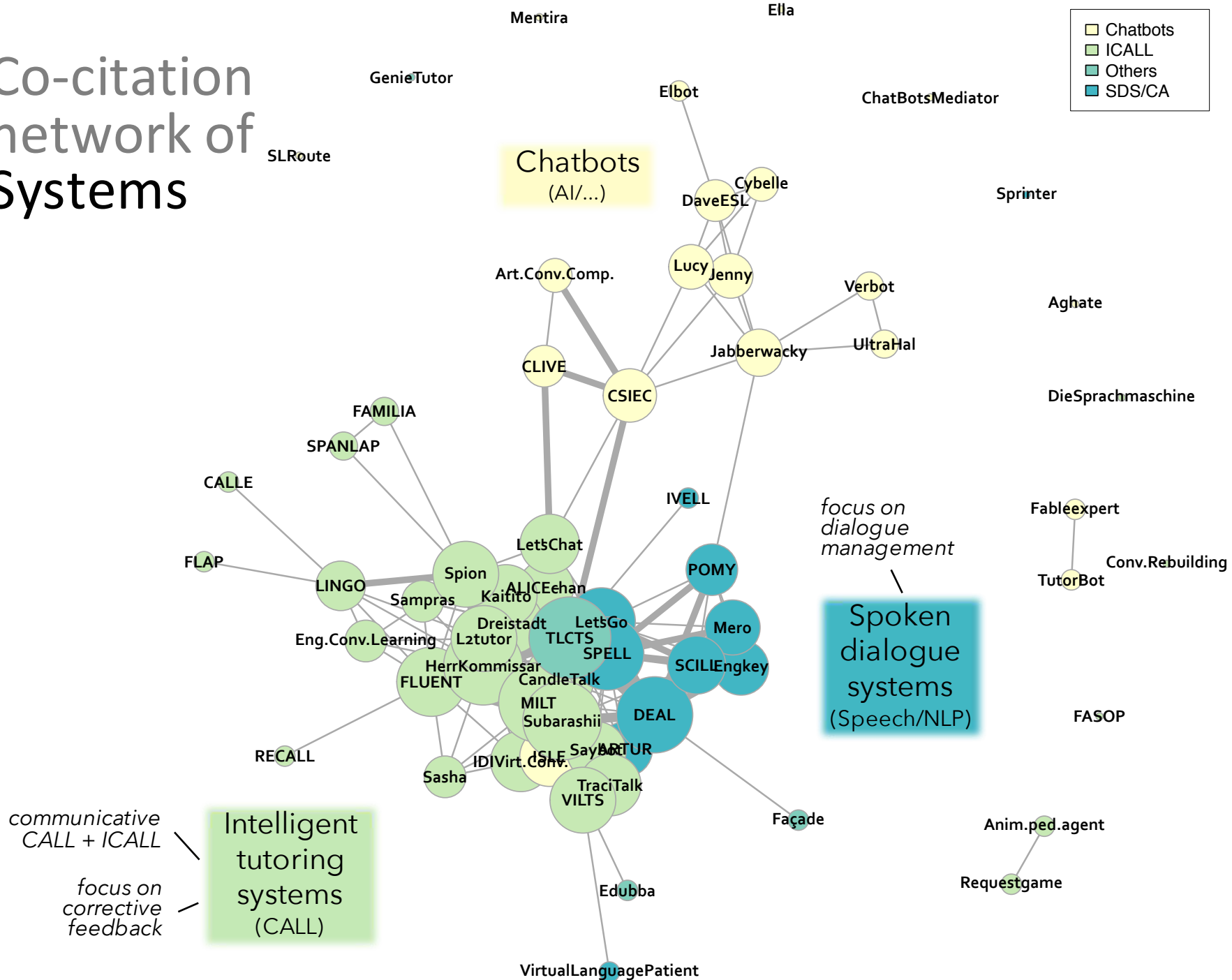
(67 designed for lang. learning)



Co-citation network of Authors



Co-citation network of Systems



Intelligent tutoring system

Map task (Wilske, 2014)

DE ENG

Aufgabe
Sie sind auf dem Campus der Uni.
Jemand fragt Sie nach dem Weg.

das Wohnheim der Parkplatz das Sprachenzentrum

das Cafe

das Denkmal

die Mensa der Briefkasten

die Bushaltestelle der Buchladen

Dialog-Verlauf
A: Entschuldigung, können Sie mir sagen, wie ich zu dem Wohnheim komme?

Feedback
den
✗ Falsch!

Status
Füllen Sie die Lücke mit einem bestimmten Artikel (der, die, das, ...)

Punkte
-1

Gehen Sie zuerst geradeaus bis zu Buchladen.

Enter

Aufgabe 1 Aufgabe 2 Löschen

Spoken dialogue system

SCILL (Seneff et al, 2007)

system: Welcome, please enter your username before we get started.
The conversation history will be maintained here.



Here's your scenario

You want to book a flight from [San Francisco](#) to [Beijing](#). You want to travel on Tue Nov 1, and return on the monday before Nov 15. You prefer [United Airlines](#).

SCORE: 0

Checklist

- airline
- destination
- number of flights booked
- departure date
- return date
- source

You are currently at level 3. Hold down the 'Hold to talk' button and talk in Chinese.

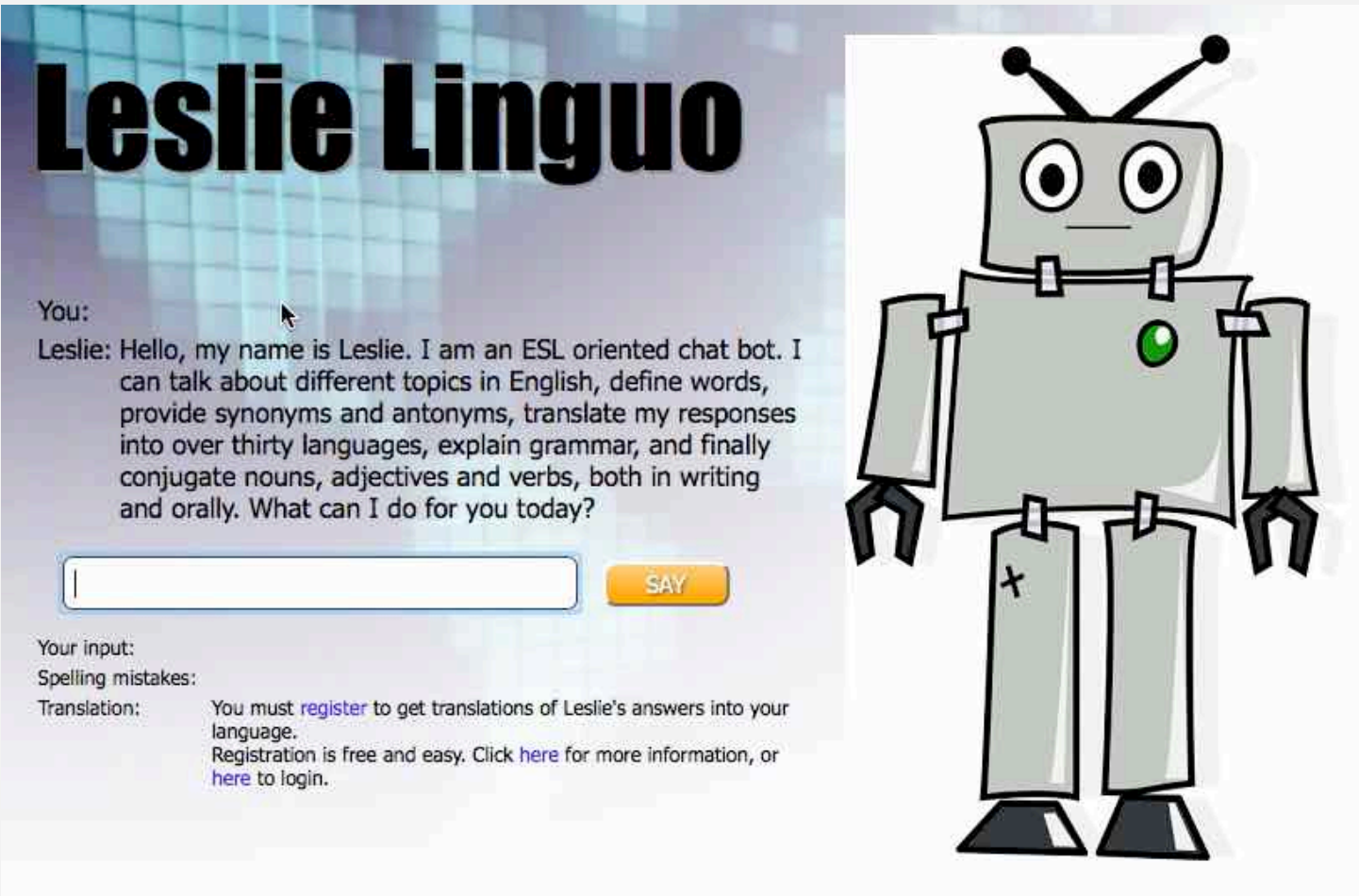
[Hide help](#)

- ☎ 我想要从旧金山出发
- ☎ 从旧金山出发飞北京
- ☎ 飞北京

Your Current Itinerary

No flight booked

Chatbot Leslie Linguo



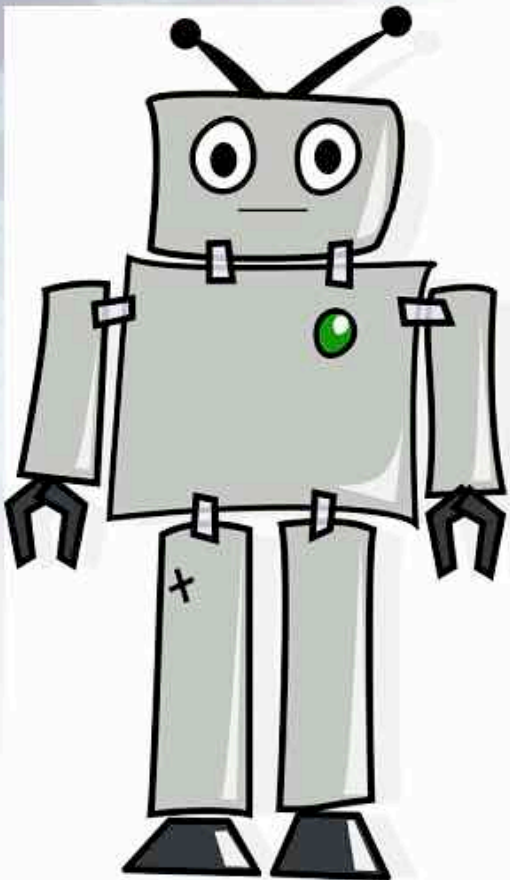
Leslie Linguo

You:

Leslie: Hello, my name is Leslie. I am an ESL oriented chat bot. I can talk about different topics in English, define words, provide synonyms and antonyms, translate my responses into over thirty languages, explain grammar, and finally conjugate nouns, adjectives and verbs, both in writing and orally. What can I do for you today?

SAY

Your input:
Spelling mistakes:
Translation: You must [register](#) to get translations of Leslie's answers into your language. Registration is free and easy. Click [here](#) for more information, or [here](#) to login.



Dialogue simulations in a virtual world

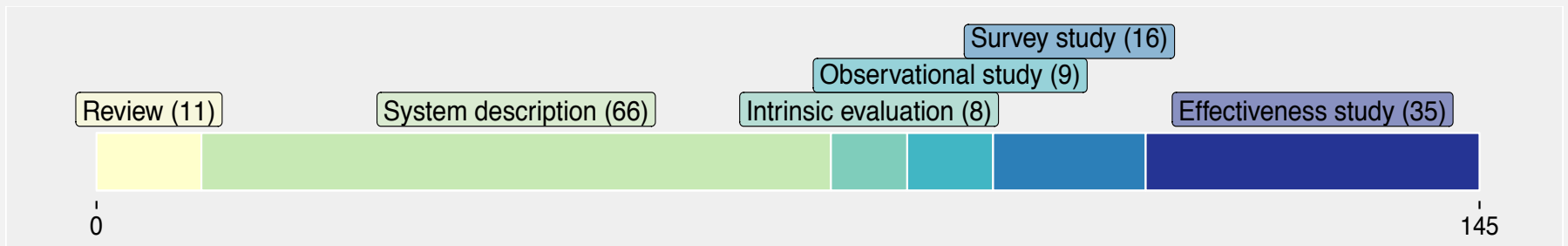
Tactical Language and Culture Training System (Johnson *et al*, 2005)



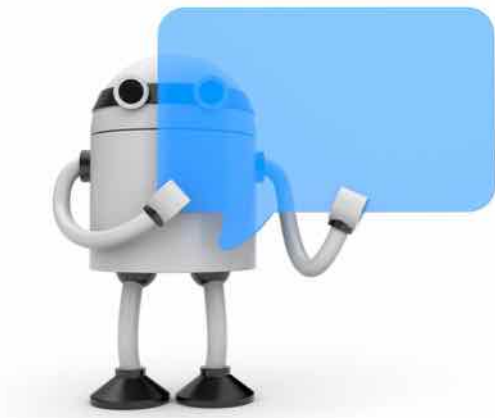
Limitations

Almost none of the 80 systems studied have made it to the **general public**.

We know very little about their **effectiveness on language learning**.



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Need for an instructional design approach of dialogue-based CALL

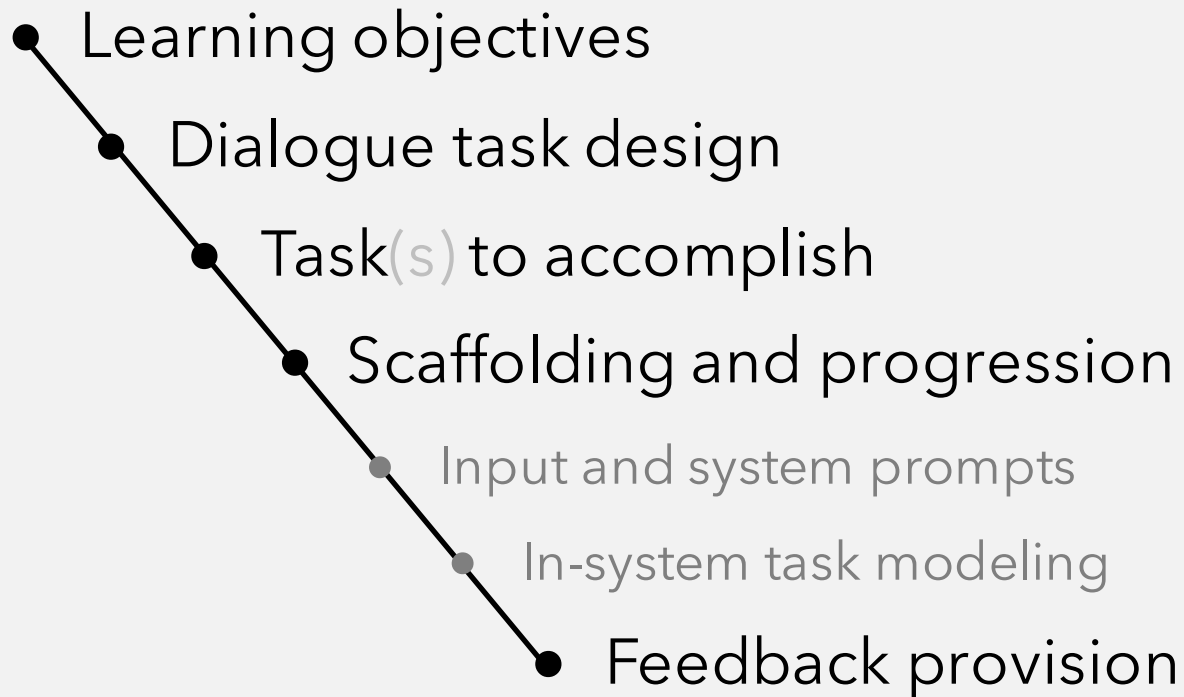
Available technology is not enough

“Free conversation” with an all-purpose “question answering” chatbot: ineffective, aimless, vapid.

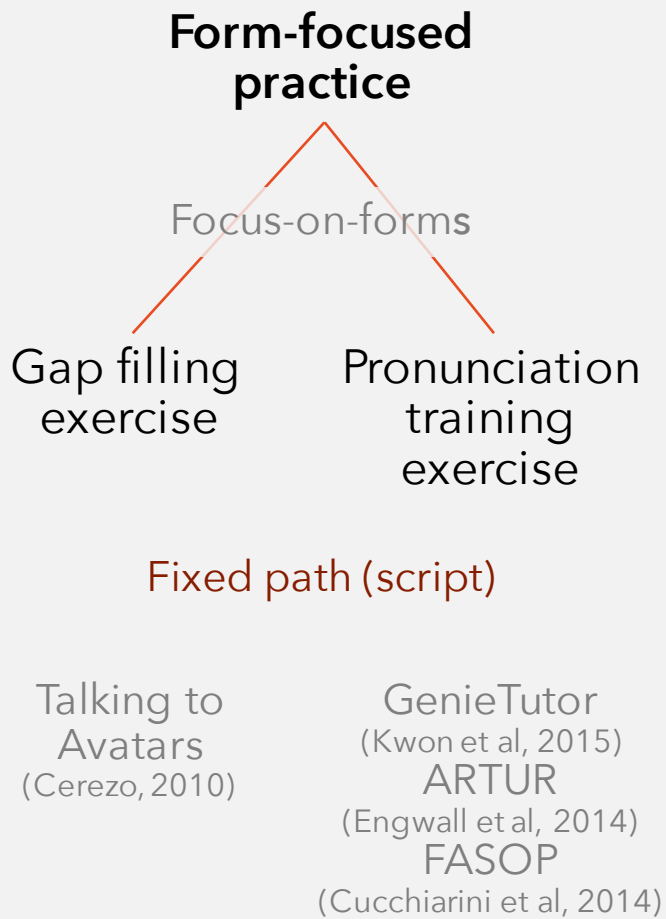
Various learning goals ↔ various technologies

Bottom-up typology of dialogue-based CALL

Instructional design framework for dialogue-based CALL



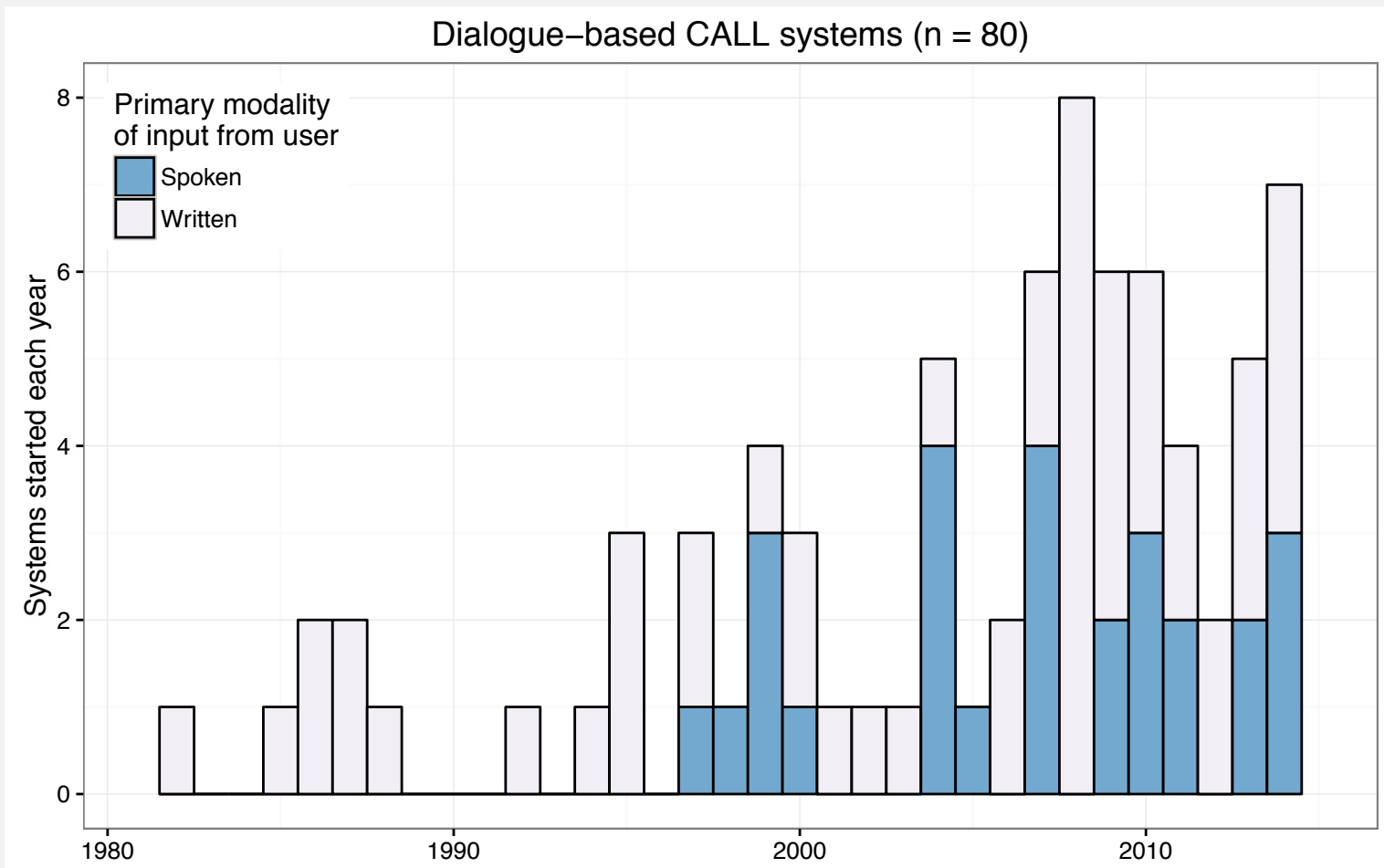
Learning principles



Dialogue task design for interactive dialogue management

	User-initiated open-ended practice	Pre-scripted interaction	Interaction in fixed task	Interaction in multiple task
Goal-orientation	Open-ended	Goal	Goal	Goal
Initiative	User	System	Mixed	Mixed
Interactivity	High	Low	Medium	High
	↓	↓	↓	↓
Dialogue control	Pattern matching	Graph	Frame	Probabilistic control
Information extracted	Keywords	–	Entities	Intent + Entities
	Chatbots CSIEC (Jia, 2009)	Subarashii (Ehsani et al, 1997) Kaitito (Vlugter et al, 2009)	Let's Go (Raux et al, 2003) SPELL (Morton et al, 2011)	POMY (Lee et al, 2014)

A short detour by Modalities (spoken vs. written)



Spoken or written

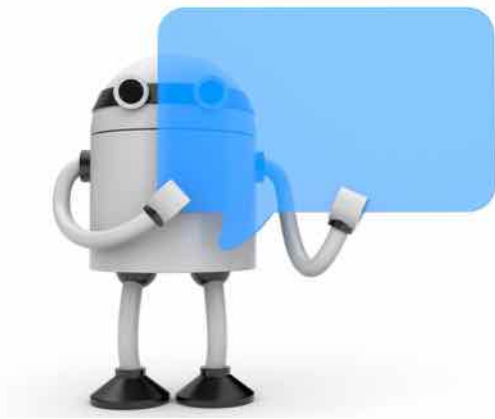
Beyond the modality dichotomy

Not so much of an issue today.

Speech recognition^(ASR) and
speech synthesis^(TTS) **as services**^(SaaS)
can be implemented into any system
to enable speech capabilities

Spontaneous output vs. **prepared** output
(synchronous, interactive) × (asynchronous, monologic)
as a more relevant distinction, with
major consequences on L2 acquisition

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Dominant dialogue management paradigms and frameworks

Paradigm	Chatbot	Frame-based dialogue system	Deep learning	Probabilistic rules
Principle	Handcrafted rules	Handcrafted rules	Machine learning	Handcrafted rules + machine learn.
Dialogue control on	Normalized utterance	Slot-value pairs	Internal neural network representation	Intent & entities recognition
Frameworks	ChatScript AIML <small>(see Pandorabots)</small> Rivescript	VoiceXML CSLU Toolkit CMU Olympus	– Note: requires extremely large corpus	OpenDial Wit.ai BotEngine Api.ai Recast.ai IBM Watson Microsoft LUIS
	1990s-2000s	1980s-2000s	2013-...	2014-...

Why probabilistic approaches to dialogue management?

Chatbots

Some systems with 250 000 rules!

And still dramatically limited, using massive avoidance strategies.

Deterministic rules cannot describe all cases.

Ambiguity pervades language.

Deep learning techniques have obtained good results, but require huge corpora

(Mesnil et al, 2013; Vinyals & Le, 2015; Shang et al, 2015)

Probabilistic rules offer the best of both worlds: statistical, data-driven techniques possible with small corpora

Intent and entities recognition with Wit.ai Bot Engine

Try out an expression

Test out and train how well your app can extract entities.

I would like to buy a medium-sized shirt

intent

buy



item

shirt



wit/number

a



size

medium



Add a new entity

Dialogue-based CALL

Summarizing

Need for spontaneous interaction

Previous research & systems

Scattered field, between ICALL,
spoken dialogue systems and chatbots

Instructional design framework

Towards goal-oriented,
mixed initiative interactions

NLP approaches to dialogue

From handcrafted rules to probabilistic rules
for intent recognition and dialogue control



Thank **you** for your attention! Do you have **any** questions?

<input type="radio"/> addressee	you
<input type="radio"/> intent	ask-if-questions
<input type="radio"/> intent	inquiry
<input type="radio"/> wit/quantity	any
<input type="radio"/> reason	your attention

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