Systèmes de dialogue pour l'apprentissage des langues :
typologie des systèmes et mesure des effets

Serge Bibauw

CENTAL, **UCLouvain**
ITEC, **imec** research group at **KU Leuven**
Universidad Central del Ecuador

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Dialogue systems for language learning: typology of systems and measurement of effects

Dialogue systems for language learning
Terms, fields and definition
Rationale

Typology of systems
Types of dialogue-based CALL systems
Technological approaches in research and industry

Past effectiveness
Meta-analysis of previous effectiveness studies

Evaluation of *LanguageHero*
Measuring effects on L2 development
Challenges and opportunities

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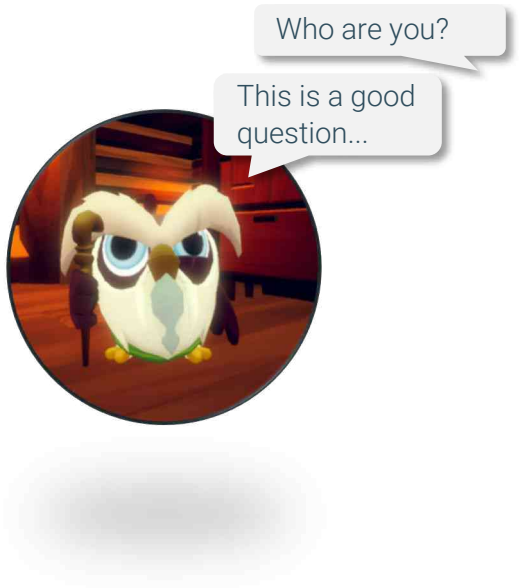

- **Dialogue systems for language learning**
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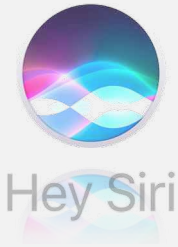
Dialogue systems for language learning

Language learning through
dialogues with **automated** agents
(chatbot, talking robot, automated personal assistant,
conversational agent, non-player character in videogames…)



Dialogue systems for language learning
A dispersed and fragmented field

Studies scattered among different domains/traditions, under many different terms:

intelligent tutoring systems, chatbots, conversational agents, spoken dialogue systems, virtual worlds, serious games, robot-assisted language learning (RALL),
ASR-based CALL, computer-assisted pronunciation training (CAPT)…

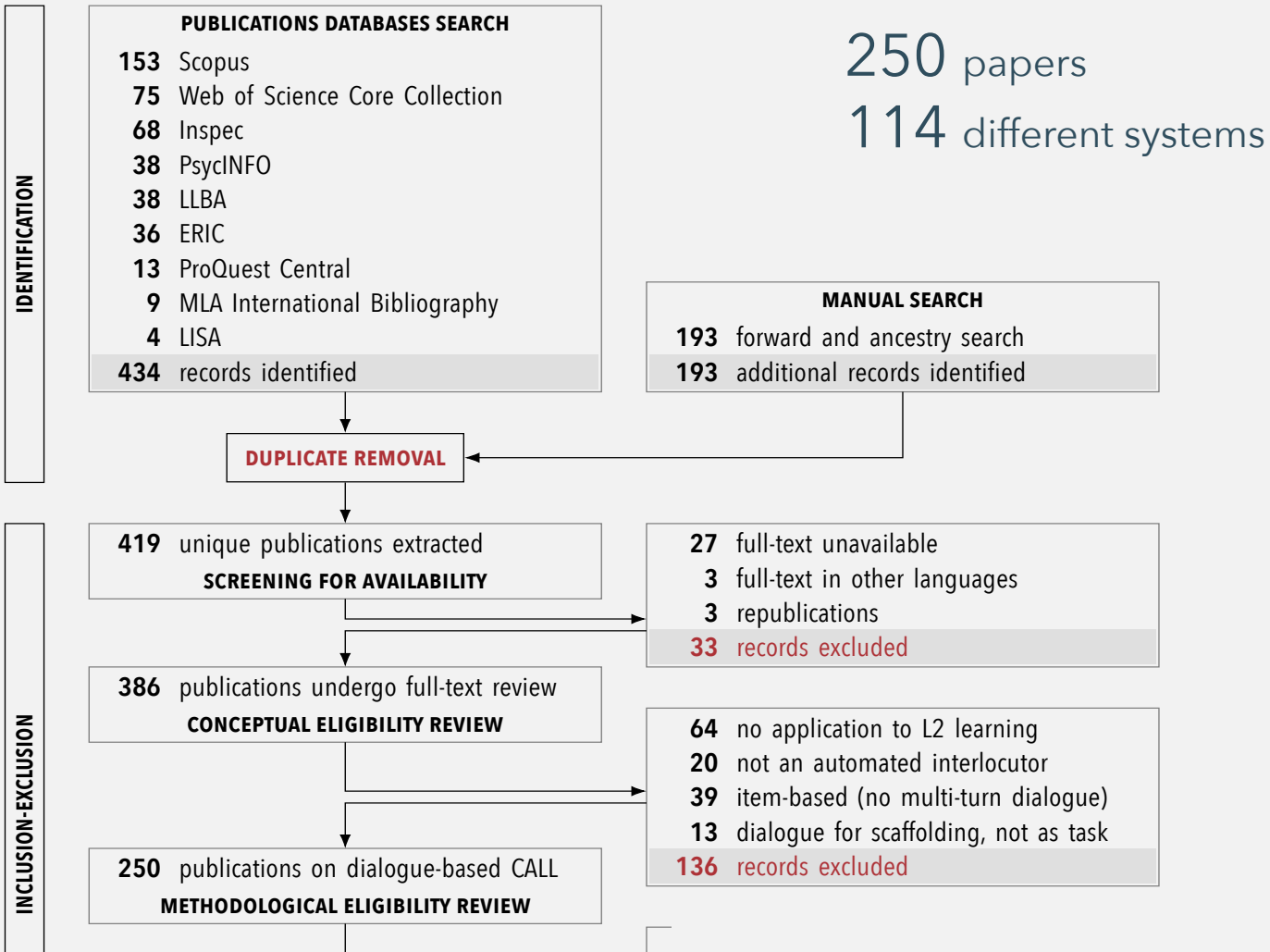
Only partial literature reviews
(Wachowicz & Scott, 1999; Eskenazi, 2009; Golonka *et al*, 2014)

→ Small clusters of research, low mutual awareness, no established research community, short-lived projects

→ NLP-based efforts underestimate instructional challenges; CALL-based efforts underestimate NLP challenges

Dialogue systems for language learning

Research synthesis

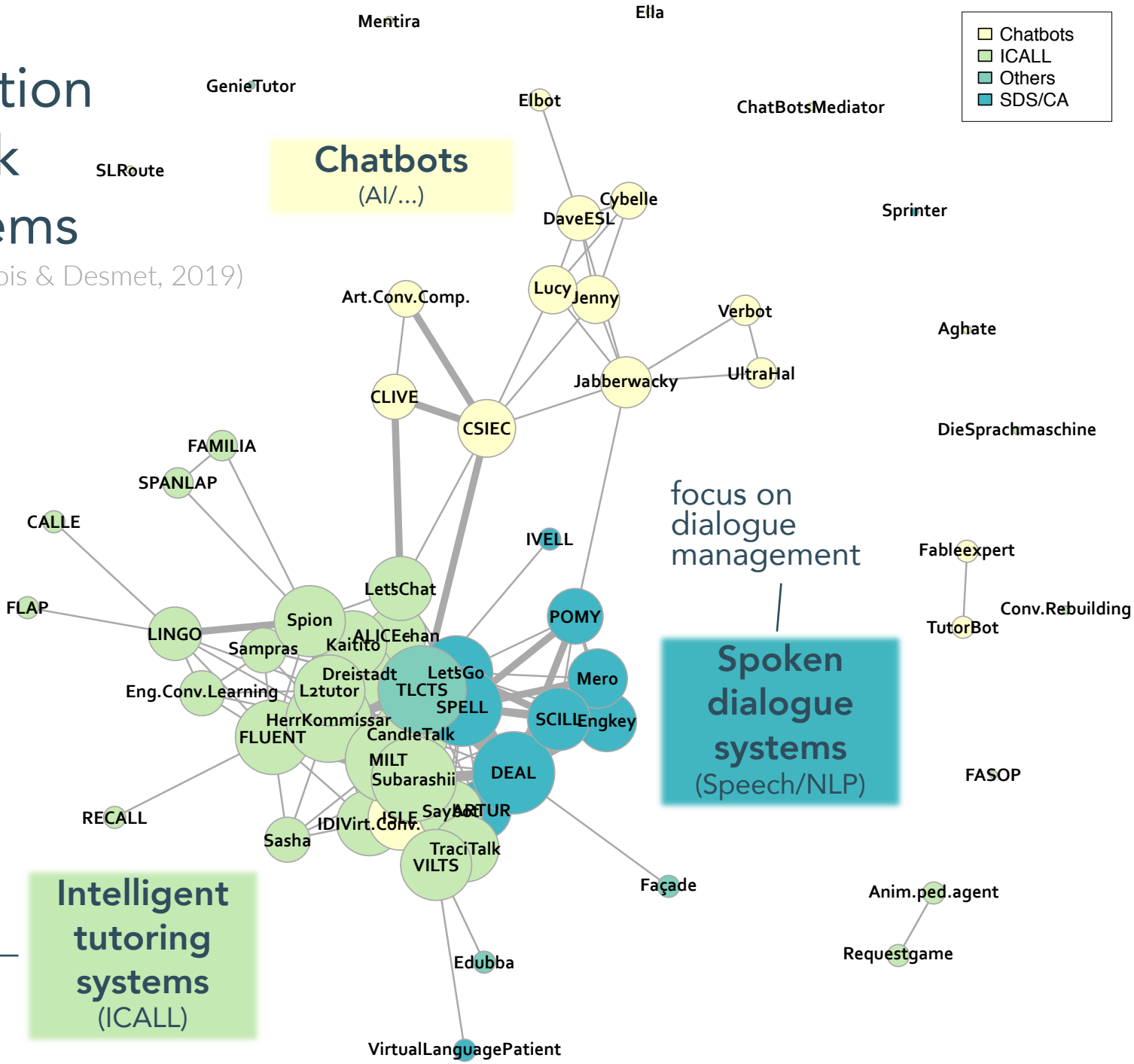


250 papers

114 different systems

Co-citation network of systems

(Bibauw, François & Desmet, 2019)



Dialogue systems for language learning

(Bibauw, François & Desmet, 2019)

Any application or system allowing

to maintain a dialogue
[immediate, synchronous interaction]
[written or spoken]

with an automated agent
[chatbot, talking robot, automated personal assistant, conversational agent, non-player character in a video game…]
[tutorial CALL (≠ computer-mediated communication)]

for language learning purposes.

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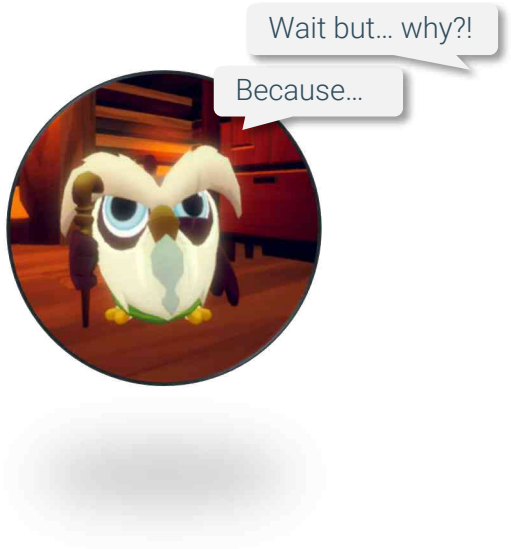

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Dialogue systems for language learning
Rationale (1)

Assumption: **meaningful practice** → L2 proficiency development

- Many learning contexts: lack of occasions for meaningful L2 practice
- Automated agents can compensate for the absence of human interlocutors
- "Virtual immersion" (Ellis & Bogart, 2007)
- Also in MOOCs and online learning contexts (Read, 2014)

Interactionist perspective to second language acquisition (Long, 1996)

- *Negotiation of meaning* (Pica, 2013), *pushed output* (Swain, 2005)
- Visible transcript promotes *noticing* (Lai & Zhao, 2006)

Practice → **Proceduralisation** by automatizing (DeKeyser, 2007)

Rationale (2)

- Some advantages over human interlocutors
  - Always available, ubiquitous
  - Endless patience, allowing for repetition (Fryer & Carpenter, 2006)
  - Low-anxiety environment → ↗ willingness to communicate (Ayedoun, Hayashi & Seta, 2015)
- Fully controllable learning environment
  - Opportunities for fully monitored conditions for empirical research on interaction (Hegelheimer & Chapelle, 2000)

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Typology of systems (Bibauw, François & Desmet, 2019)

Continuum of constraints

Explicit — Constraints on meaning — *Implicit*

Form-focused systems

CALL-SLT (Baur, Rayner & Tsourakis, 2014)

Goal-oriented systems

SPELL (Morton, Gunson & Jack, 2012)

Typology of systems (Bibauw, François & Desmet, 2019)

Four types of dialogue-based CALL systems

Constraints on meaning

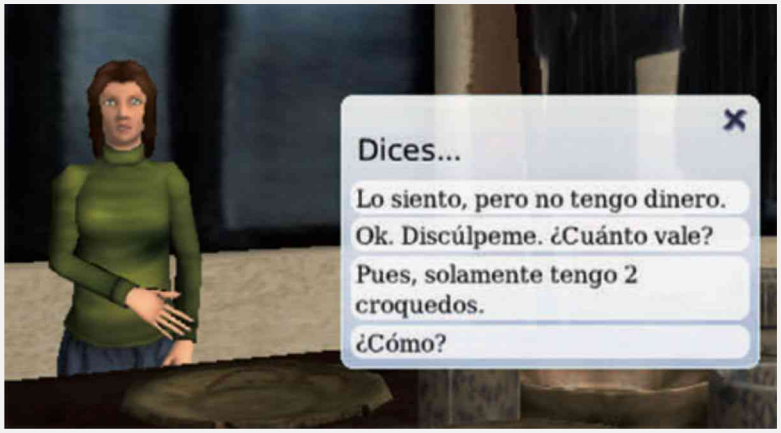
Explicit ⟵ ⟶ *None*

Implicit

Form-focused systems

Goal-oriented systems

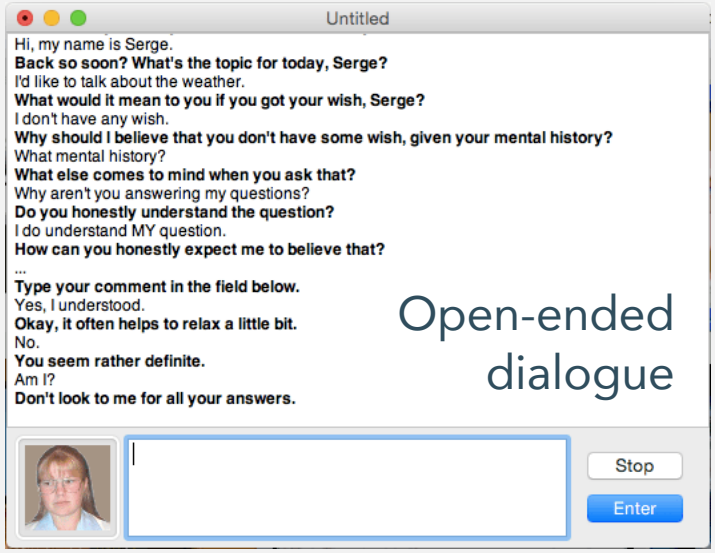
Narrative systems



Croquelandia (Sykes, 2008)

Branching dialogue
Pre-set form

Reactive systems



Open-ended dialogue

ELIZA (Weizenbaum, 1966)

Typology of systems (Bibauw, François & Desmet, 2019)
Form-focused / Goal-oriented

Form-focused systems

Explicit constraints on meaning:
gap-filling, predetermined answers

Focus of forms

Limited interactivity:
mostly corrective feedback

No dialogue management:
pre-scripted dialogue

Goal-oriented systems

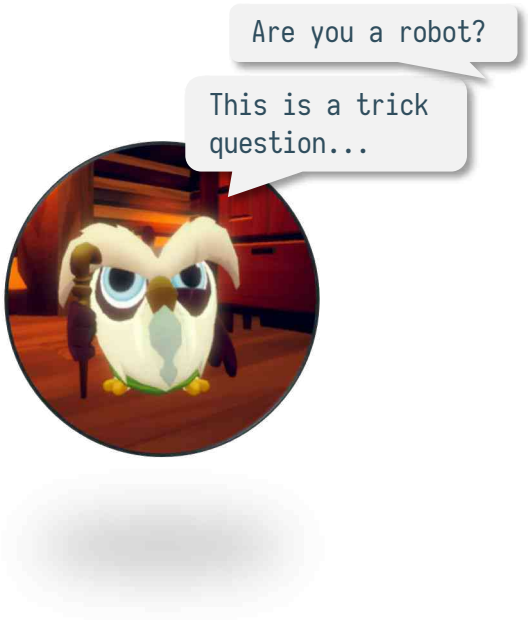
Contextual constraints on meaning:
interactional task and context

Focus on meaning/form

High interactivity:
conversation influenced by user

Advanced dialogue management:
→ high-level NLP required

Dialogue systems for language learning: typology of systems and measurement of effects



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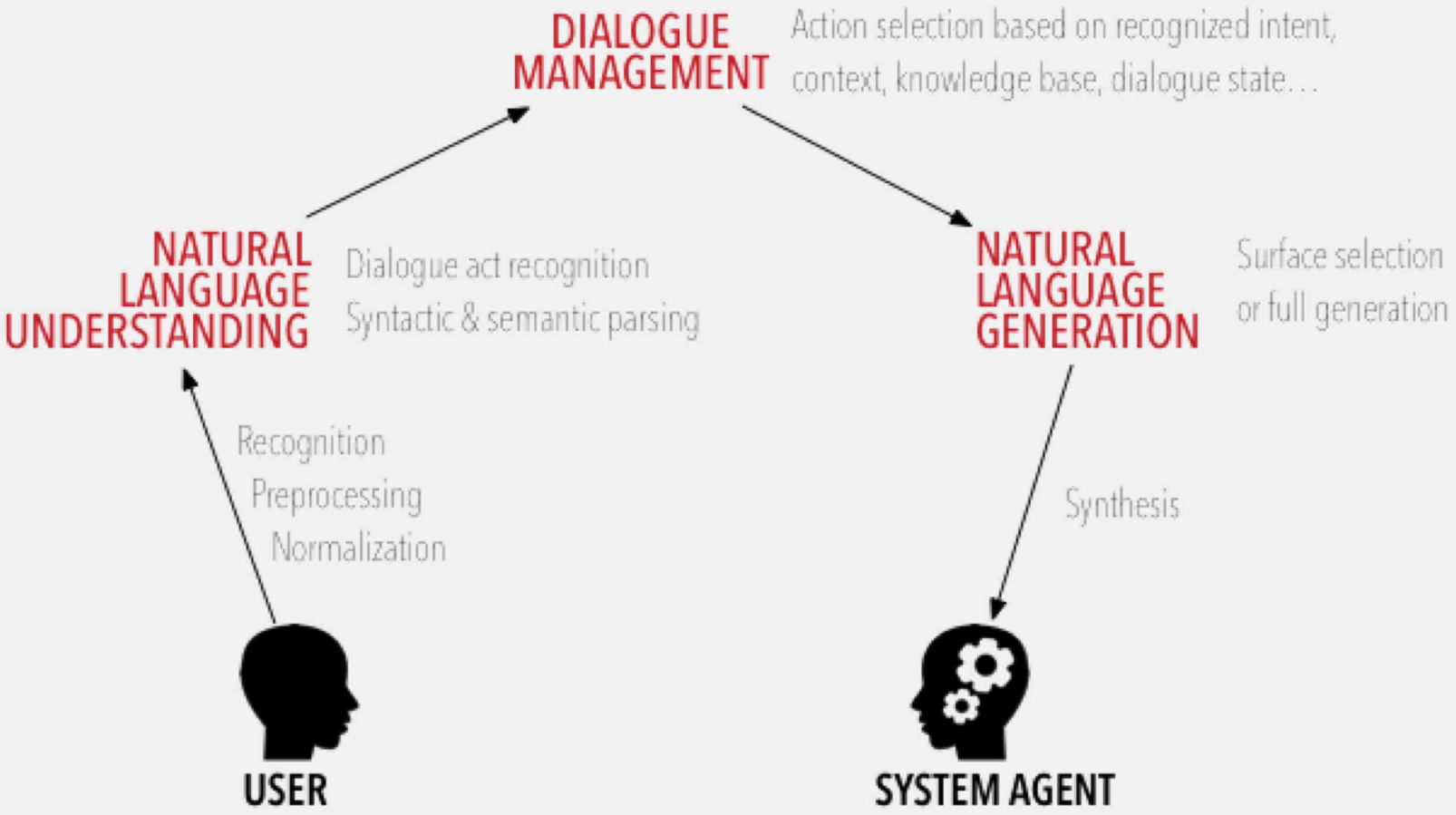
Technological approaches



Dialogue systems
Technological approaches

Reactive systems (chatbots):
Rules-based approach

Research on dialogue systems:
Fully **data-driven** approaches

(Goal-oriented) systems in production:
Hybrid, *ad-hoc* approaches

Technological approaches
Handcrafted rules-based approach

Markup language for ‘fast’ manual rules writing

- AIML (Wallace, 2003) (*Alice, Pandorabots*)

```
<category>
      <pattern>
            WHAT IS A CIRCLE
      </pattern>
      <template>
            <set_it>A circle</set_it> is the set of points
            equidistant from a common point called the center.
      </template>
</category>
```

- ChatScript (Wilcox)
- RiveScript (Petherbridge)

Very high number of rules

Many avoidance strategies as fallback

Disappointing

Technological approaches

Data-driven approaches in research

Deep learning (neural net) approaches

Based on very large corpora, restricted to certain domains (*Switchboard, Ubuntu Dialogue Corpus…*)

Promising results on mostly open-ended dialogue since 2015

- Pipeline vs. End-to-End methods
- Generative models vs. Retrieval-based methods

Still in need of standardised evaluation methods

See Serban et al, 2018, doi:10.5087/dad.2018.101;
Chen et al, 2017, arXiv:1711.01731v2

Technological approaches

Hybrid, *ad-hoc* approach in production

Fully data-driven approaches not reliable enough for production.

Using data-driven NLU:

- Intent recognition (dialogue act identification)
- (Named) entity recognition

→ Commercial and open source platforms for NLU: *Rasa NLU, DialogFlow, Wit.ai, Microsoft LUIS, IBM Watson…*

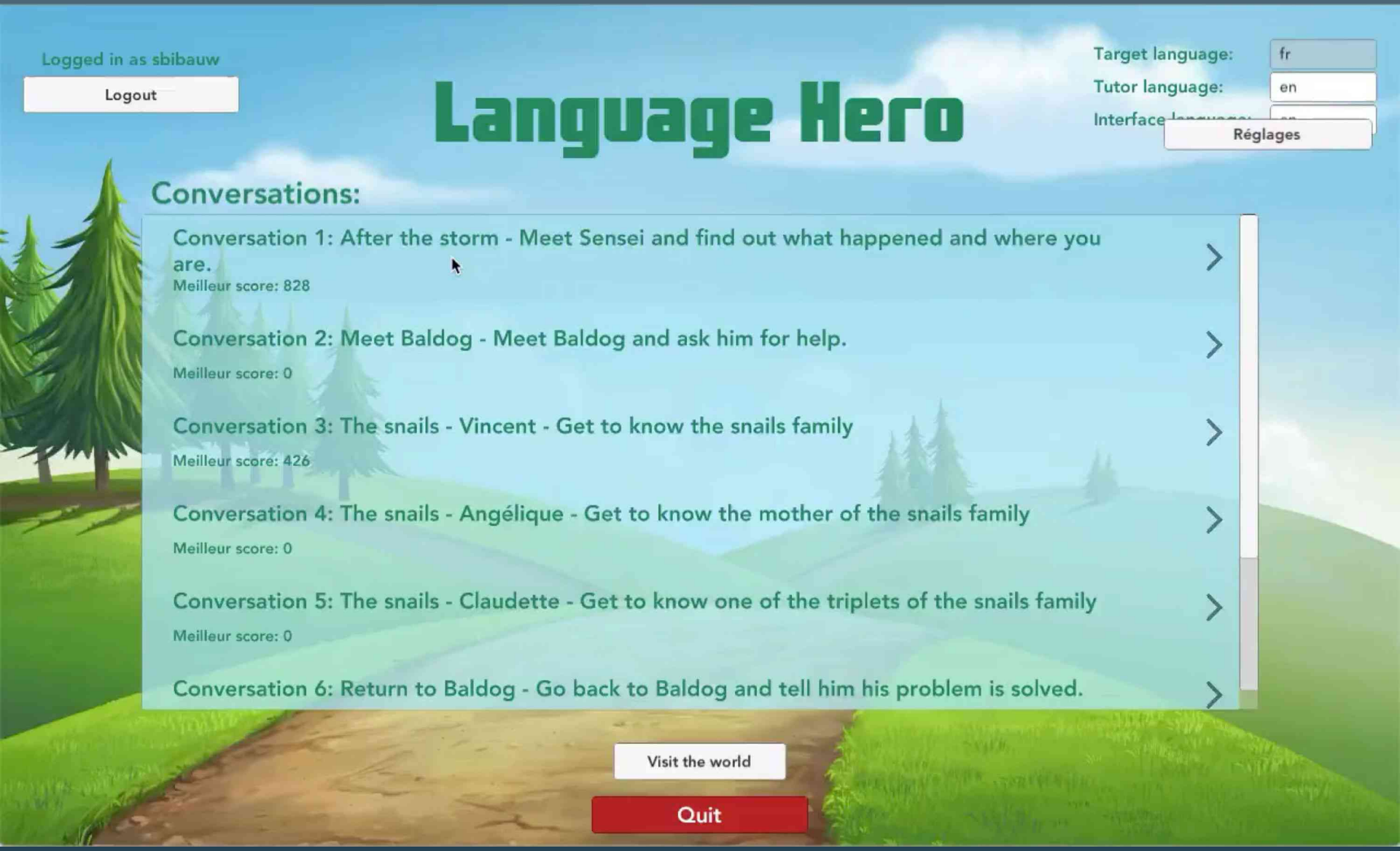
Mostly handwritten dialogue management and pre-scripted responses.

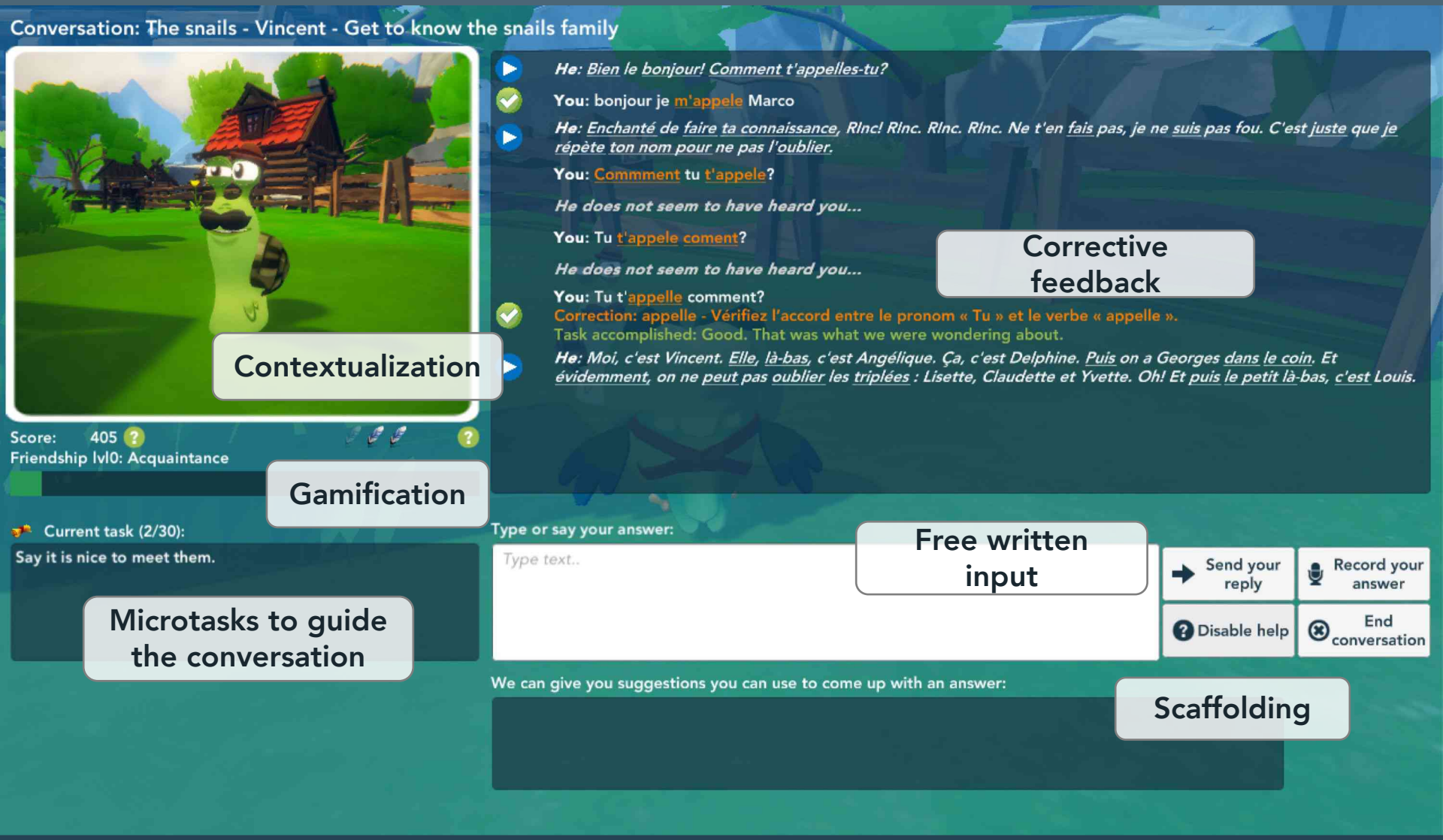
Concrete case of dialogue system
LanguageHero, dialogue-based game for French

Codeveloped with Leuven-based start-up Linguineo.

Prototype developed for Dutch-speaking teenage learners of French.

Task-based free conversational written interaction.


Logged in as sbibauw
Logout
Language Hero
Target language:
fr
Tutor language:
en
Interface
Réglages
Conversations:
Conversation 1: After the storm - Meet Sensei and find out what happened and where you are.
Meilleur score: 828
Conversation 2: Meet Baldog - Meet Baldog and ask him for help.
Meilleur score: 0
Conversation 3: The snails - Vincent - Get to know the snails family
Meilleur score: 426
Conversation 4: The snails - Angélique - Get to know the mother of the snails family
Meilleur score: 0
Conversation 5: The snails - Claudette - Get to know one of the triplets of the snails family
Meilleur score: 0
Conversation 6: Return to Baldog - Go back to Baldog and tell him his problem is solved.
Visit the world
Quit


Conversation: The snails - Vincent - Get to know the snails family
He: Bien le bonjour! Comment t'appelles-tu?
You: bonjour je m'appele Marco
He: Enchanté de faire ta connaissance, RInc! RInc. RInc. RInc. Ne t'en fais pas, je ne suis pas fou. C'est juste que je répète ton nom pour ne pas l'oublier.
You: Commment tu t'appele?
He does not seem to have heard you...
You: Tu t'appele coment?
He does not seem to have heard you...
You: Tu t'appelle comment?
Correction: appelle - Vérifiez l'accord entre le pronom « Tu » et le verbe « appelle ».
Task accomplished: Good. That was what we were wondering about.
He: Moi, c'est Vincent. Elle, là-bas, c'est Angélique. Ça, c'est Delphine. Puis on a Georges dans le coin. Et évidemment, on ne peut pas oublier les triplées : Lisette, Claudette et Yvette. Oh! Et puis le petit là-bas, c'est Louis.
Corrective feedback
Contextualization
Score: 405
Friendship lvl0: Acquaintance
Gamification
Current task (2/30):
Say it is nice to meet them.
Microtasks to guide the conversation
Type or say your answer:
Type text..
Free written input
Send your reply
Record your answer
Disable help
End conversation
We can give you suggestions you can use to come up with an answer:
Scaffolding

LanguageHero

Instructional and technological approach

"Ask what happened."
"Tell B… you were actually hoping he would help you."

Dialogue guided by **microtasks/instructions**

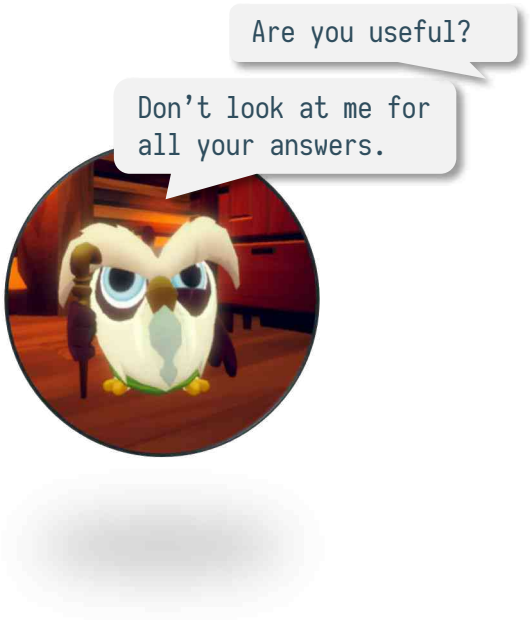
→ Give directions to the user

→ Higher predictability of the user intents (NLP)

Technologically, **hybrid system**:

- **Machine learning** for speech recognition and **intent recognition** (i.a. ~RASA NLU)
- **Parser-** and **rule-based** detection of task completion and dialogue management (i.a. ~*ChatScript*), as well as for corrective feedback provision.
- All possible responses pre-scripted.

Dialogue systems for language learning: typology of systems and measurement of effects



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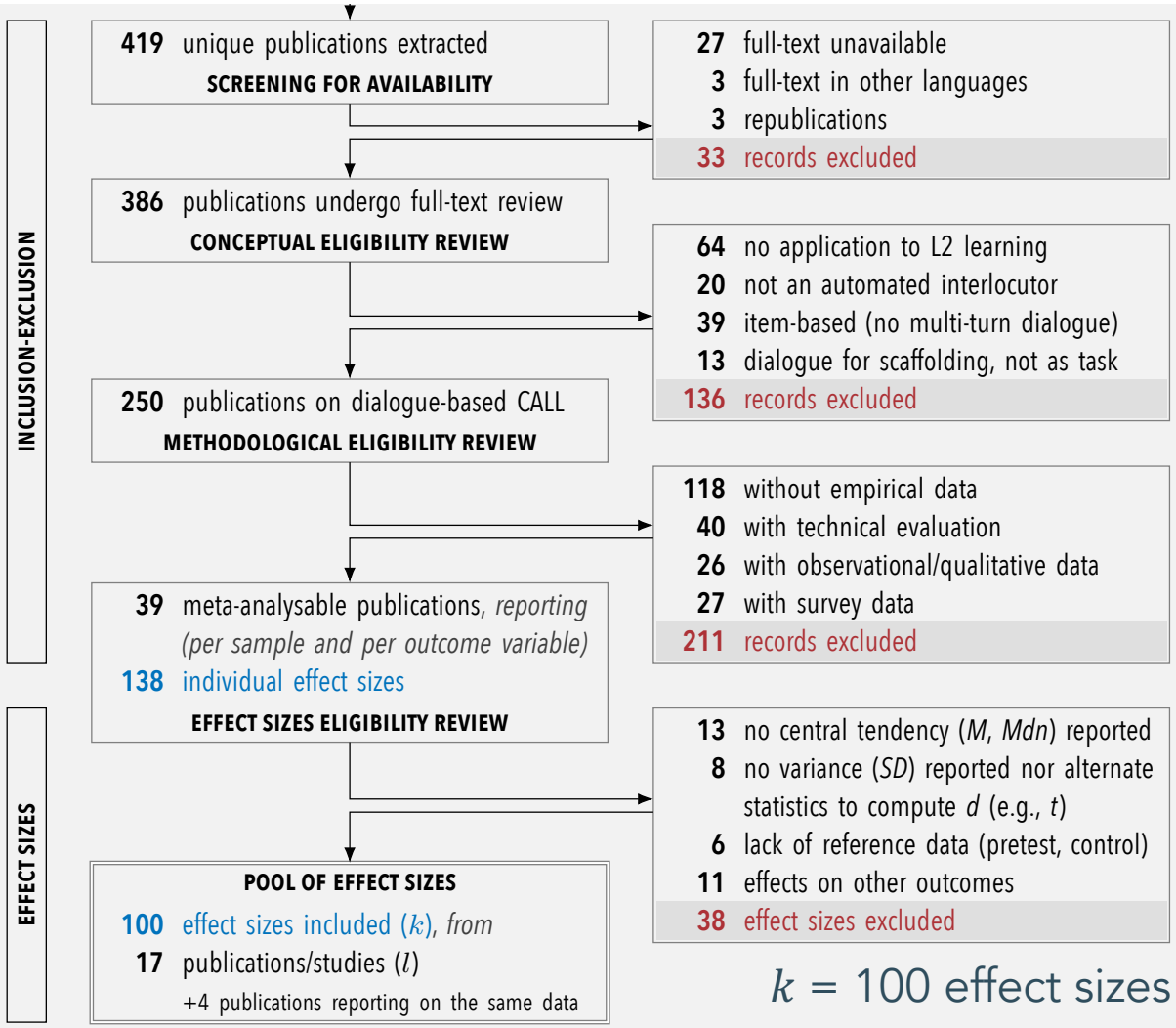
Meta-analysis of effectiveness studies

Inclusion of individual effect sizes



k = 100 effect sizes

Comparable effect size metrics

Morris & DeShon (2002) offer a comparable metrics across experimental designs (EC / PP / ECPP)

- ***change*** metric (aligned on *within*-group effect)
- ***raw*** metric (aligned on *between*-groups effect)

We selected the *raw* metric formula:

$$d_{\mathrm{PP}} = J(df_{\mathrm{PP}}) \left(\frac{M_{\mathrm{post,E}} - M_{\mathrm{pre,E}}}{SD_{\mathrm{pre,E}}} \right)$$

$$d_{\mathrm{ECPP}} = J(df_{\mathrm{ECPP}}) \left(\frac{M_{\mathrm{post,E}} - M_{\mathrm{pre,E}}}{SD_{\mathrm{pre,E}}} - \frac{M_{\mathrm{post,C}} - M_{\mathrm{pre,C}}}{SD_{\mathrm{pre,C}}} \right)$$

Meta-analysis: methods

Multilevel modeling

(Van den Noortgate & Onghena, 2003)

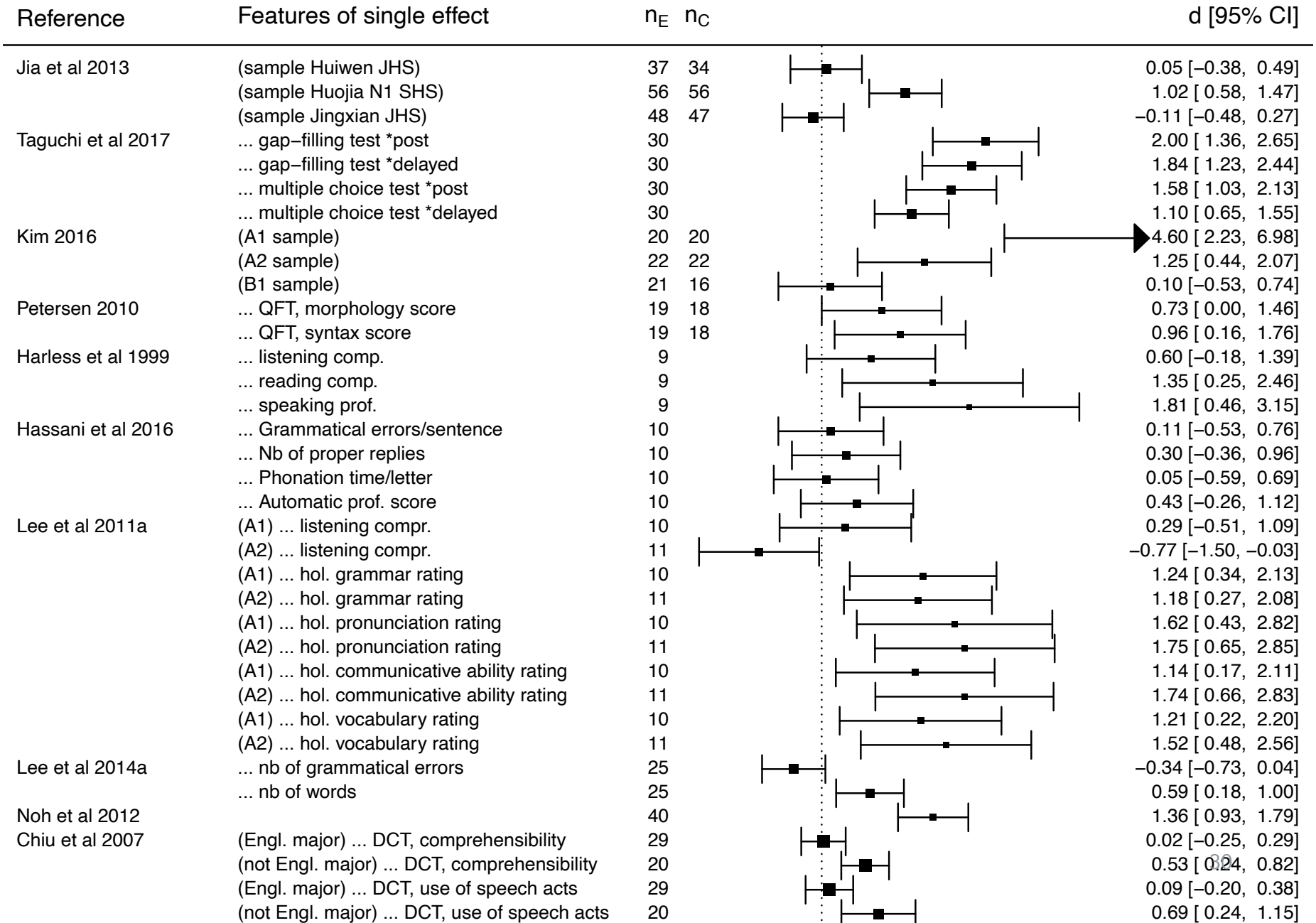
Publications report multiple outcome measures (e.g., vocabulary and morphology tests) or multiple sampling groups (e.g., proficiency levels)

Traditional meta-analysis techniques allow only one (independent) effect size per study, but loosing thus all the information on distinct implementations.
⇒ Including all the variation without "fooling" the model with non-independent measures:

Multilevel modelling:
aggregates **multiple effects per study**,
by adding an intermediate level of *within*-study variation.

Table 1: Levels of multilevel meta-analytic model

	Level	Number of clusters/items	Source of variance
1	Samples	$k = 96$ $(n = 803)$	Random sampling variance
2	Effects sizes	$k = 96$	Variation within study
3	Studies	$l = 17$	Variation between studies


Reference
Features of single effect
n_E n_C
d [95% CI]
Jia et al 2013
(sample Huiwen JHS) 37 34 0.05 [–0.38, 0.49]
(sample Huojia N1 SHS) 56 56 1.02 [0.58, 1.47]
(sample Jingxian JHS) 48 47 –0.11 [–0.48, 0.27]
Taguchi et al 2017
... gap–filling test *post 30 2.00 [1.36, 2.65]
... gap–filling test *delayed 30 1.84 [1.23, 2.44]
... multiple choice test *post 30 1.58 [1.03, 2.13]
... multiple choice test *delayed 30 1.10 [0.65, 1.55]
Kim 2016
(A1 sample) 20 20 4.60 [2.23, 6.98]
(A2 sample) 22 22 1.25 [0.44, 2.07]
(B1 sample) 21 16 0.10 [–0.53, 0.74]
Petersen 2010
... QFT, morphology score 19 18 0.73 [0.00, 1.46]
... QFT, syntax score 19 18 0.96 [0.16, 1.76]
Harless et al 1999
... listening comp. 9 0.60 [–0.18, 1.39]
... reading comp. 9 1.35 [0.25, 2.46]
... speaking prof. 9 1.81 [0.46, 3.15]
Hassani et al 2016
... Grammatical errors/sentence 10 0.11 [–0.53, 0.76]
... Nb of proper replies 10 0.30 [–0.36, 0.96]
... Phonation time/letter 10 0.05 [–0.59, 0.69]
... Automatic prof. score 10 0.43 [–0.26, 1.12]
Lee et al 2011a
(A1) ... listening compr. 10 0.29 [–0.51, 1.09]
(A2) ... listening compr. 11 –0.77 [–1.50, –0.03]
(A1) ... hol. grammar rating 10 1.24 [0.34, 2.13]
(A2) ... hol. grammar rating 11 1.18 [0.27, 2.08]
(A1) ... hol. pronunciation rating 10 1.62 [0.43, 2.82]
(A2) ... hol. pronunciation rating 11 1.75 [0.65, 2.85]
(A1) ... hol. communicative ability rating 10 1.14 [0.17, 2.11]
(A2) ... hol. communicative ability rating 11 1.74 [0.66, 2.83]
(A1) ... hol. vocabulary rating 10 1.21 [0.22, 2.20]
(A2) ... hol. vocabulary rating 11 1.52 [0.48, 2.56]
Lee et al 2014a
... nb of grammatical errors 25 –0.34 [–0.73, 0.04]
... nb of words 25 0.59 [0.18, 1.00]
Noh et al 2012 40 1.36 [0.93, 1.79]
Chiu et al 2007
(Engl. major) ... DCT, comprehensibility 29 0.02 [–0.25, 0.29]
(not Engl. major) ... DCT, comprehensibility 20 0.53 [0.24, 0.82]
(Engl. major) ... DCT, use of speech acts 29 0.09 [–0.20, 0.38]
(not Engl. major) ... DCT, use of speech acts 20 0.69 [0.24, 1.15]

Summary effect

General effectiveness of dialogue-based CALL for L2 proficiency development (k = 96):

d = 0.602 ***

95% CI = [0.373, 0.831]

= Medium effect (Plonsky & Oswald, 2014)

FYI, if converted/computed as *change* metrics:
d_{change} = 0.658 *** [0.414, 0.901]

Immediate effect only (no delayed posttests, k = 73):
d_{raw} = 0.627 *** [0.390, 0.863]

Meta-analysis: results
Summary effect compared to CALL/SLA

Global effect close to the median of **meta-analyses in CALL/SLA** (Plonsky & Oswald, 2014)

- $\gtrsim$ game-based learning (d = .53, Chiu et al, 2012)
- $\lesssim$ CALL in general (d = .84, Plonsky & Ziegler, 2016)

Consistent with effect of **face-to-face interaction** (Mackey & Goo, 2007) and SCMC.

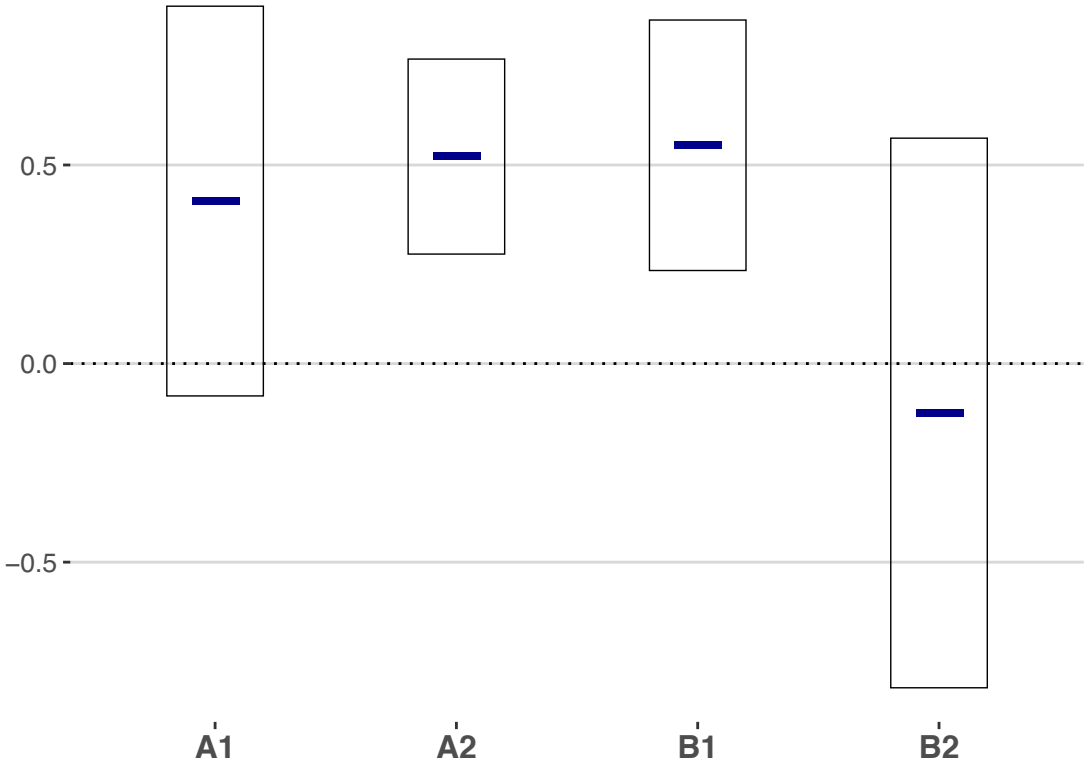
- $\lesssim$ F2F interaction (d = .75, Mackey & Goo, 2007)
- $\lesssim$ SCMC (Ziegler, 2015; Lin, 2015)

Slightly **inferior** to the above (although within 95% CI), but logical:

- Human interlocutors remain the gold standard!
- Outcome variables often very ambitious (holistic proficiency…) and treatment duration often very reduced (≤ 3h)

Meta-analysis: moderator analyses

Participants ▸ L2 proficiency

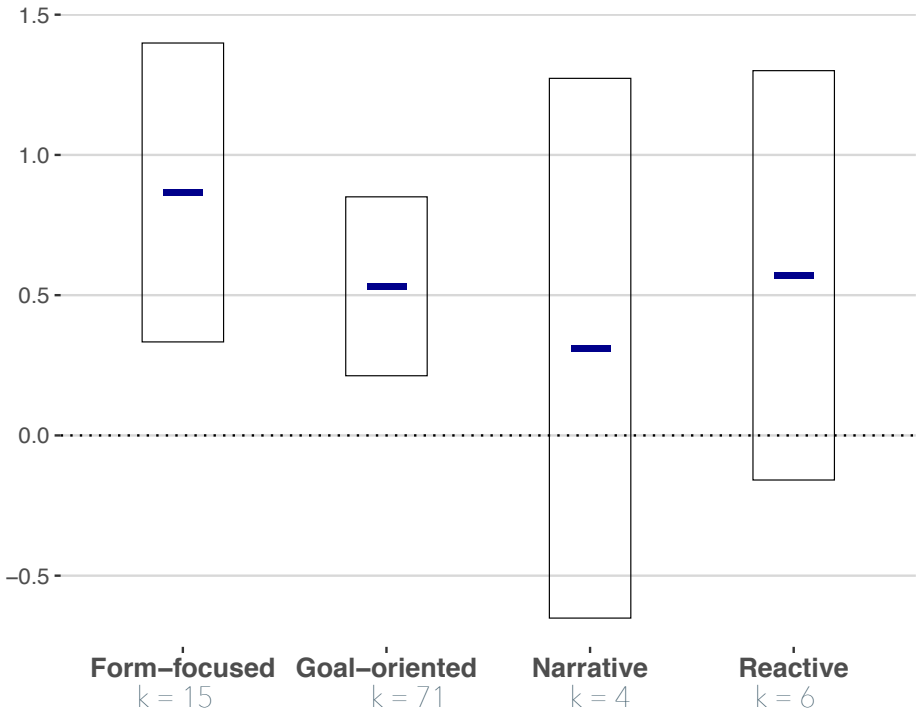


Mostly effective for **A2-B1** learners.

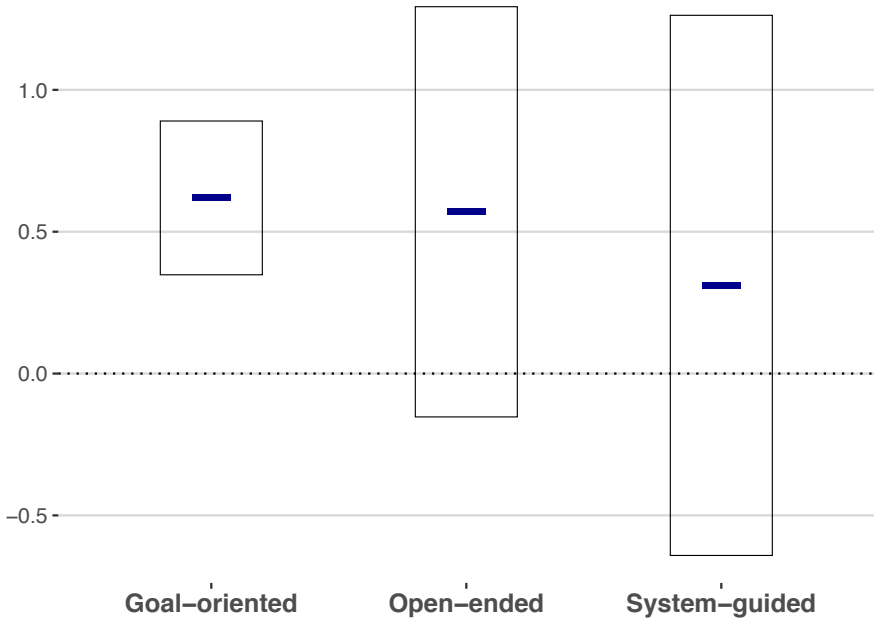
After consolidating basic structures?

Meta-analysis: moderator analyses

System ▸ Type of system



Form-focused and goal-oriented systems confirm their effectiveness. Unclear difference though.

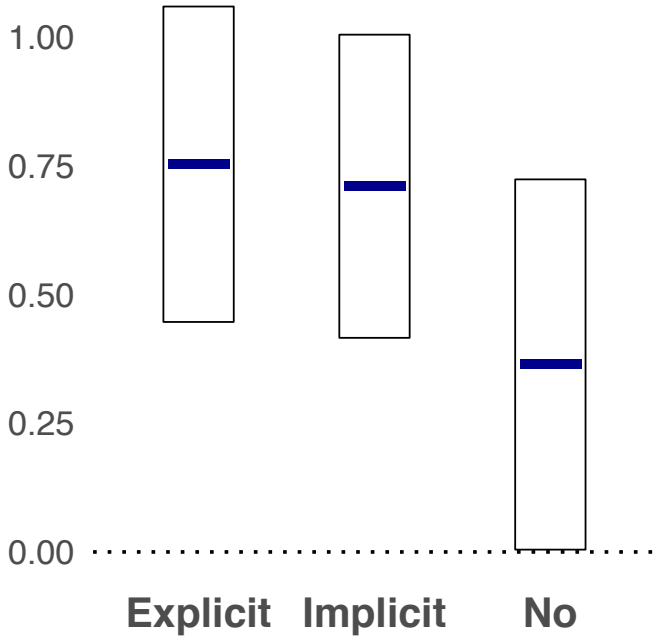


Meta-analysis: moderator analyses

System ▸ Corrective feedback

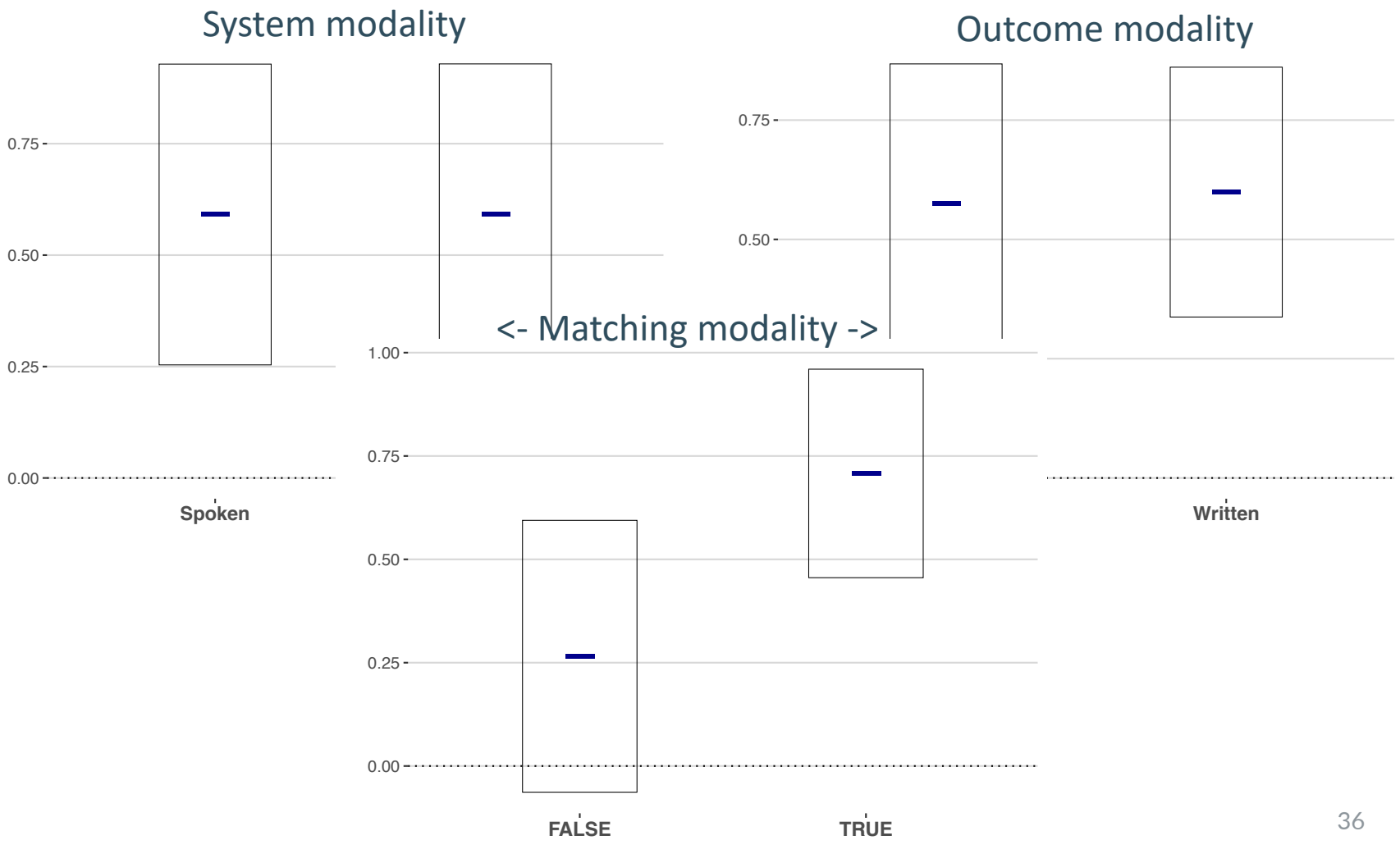
Consistently with what we know about corrective feedback, systems providing **feedback** are **much more effective.**

If binary (w/ vs. w/o CF):
$QM_{(df = 1)} = 2.53$, $p = 0.111$



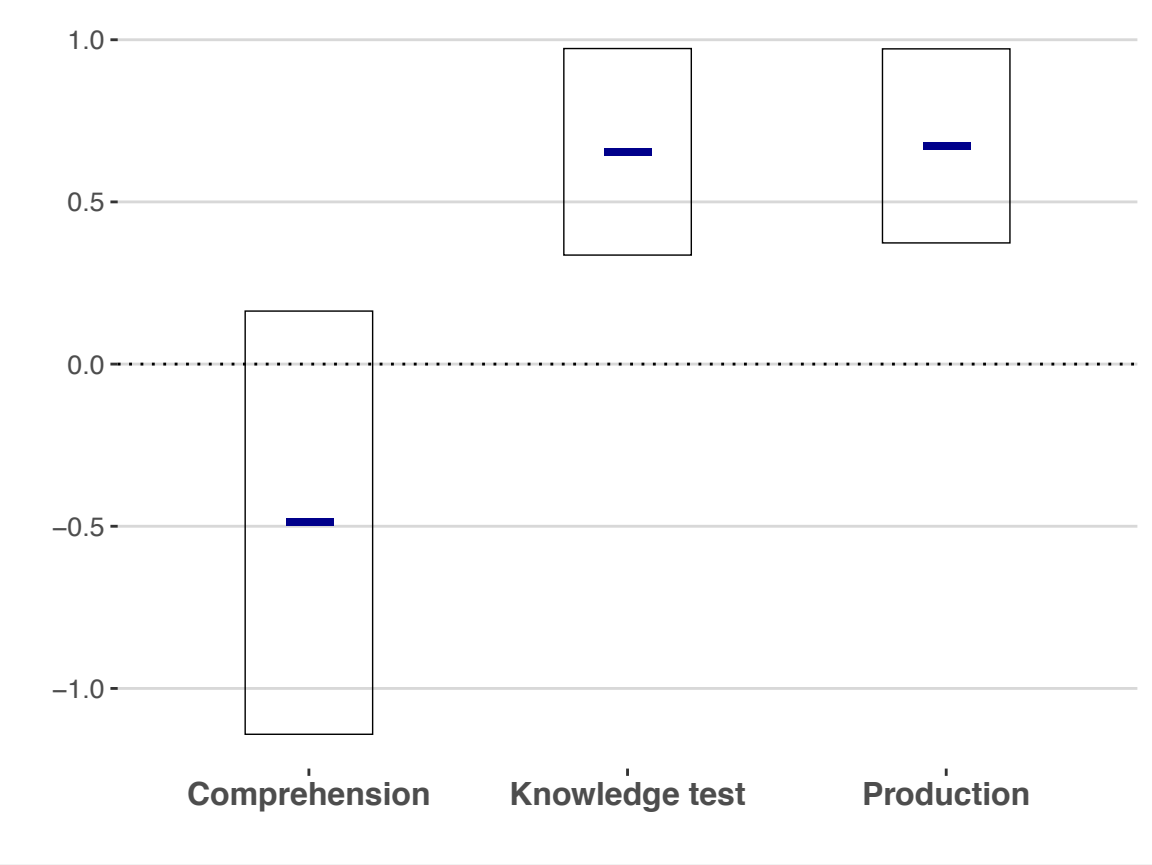
Meta-analysis: moderator analyses

Practice and outcome modality



Meta-analysis: moderator analyses

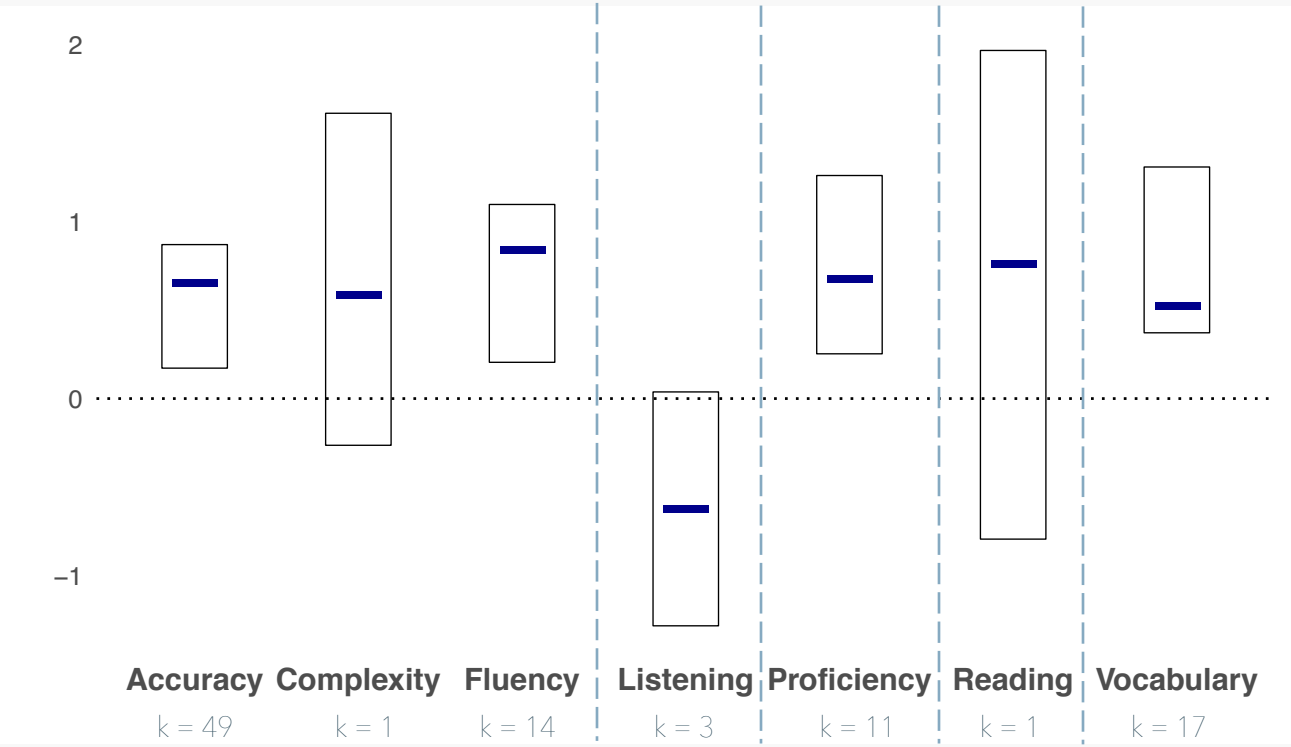
Outcome ▸ Dimensions



Meta-analysis: moderator analyses

Outcome ▸ Dimensions

More promising effects on **fluency** and possibly vocabulary



Meta-analysis: moderator analyses

Insights for future research and development

Global effectiveness of dialogue-based CALL,

but too few studies to determine significant differences between systems, interventions and outcomes.

Promising design and target characteristics:

- task-based / goal-oriented
  but significantly different from form-focused ?
- with corrective feedback
- for beginner/low-intermediate learners
- for fluency and vocabulary development

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Dialogue systems for L2 research

Research question

Technologically, it is considerably easier to "fake" the interaction by restraining/ignoring the learner, rather than offering full interactivity, freedom and contextual task completion. Are these technological developments worth it?

1. **Do (more) interactive and emergent dialogue systems offer significantly better pedagogical opportunities for L2 development, in comparison with more constrained ones?**

Responding it would also answer questions regarding what aspects of interactivity in general are really promoting language learning.

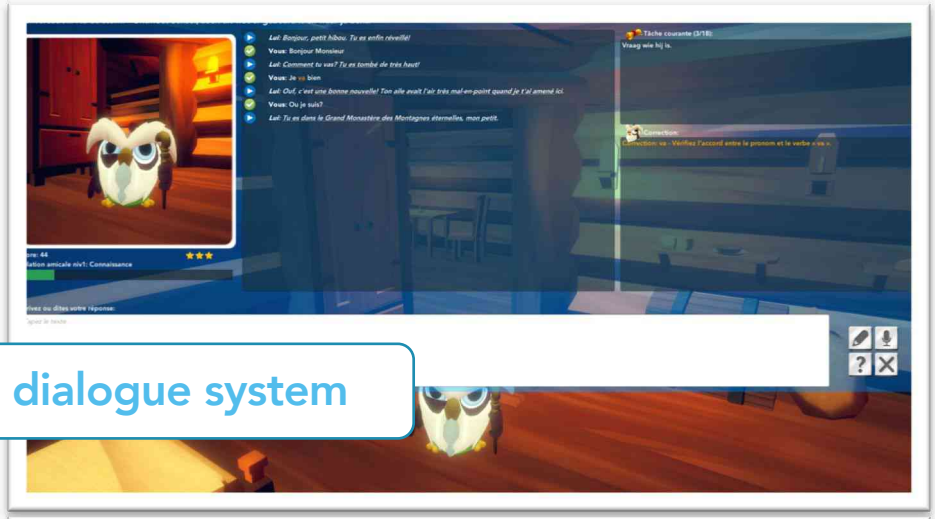
Intervention · Conditions
Interactive vs. static dialogue

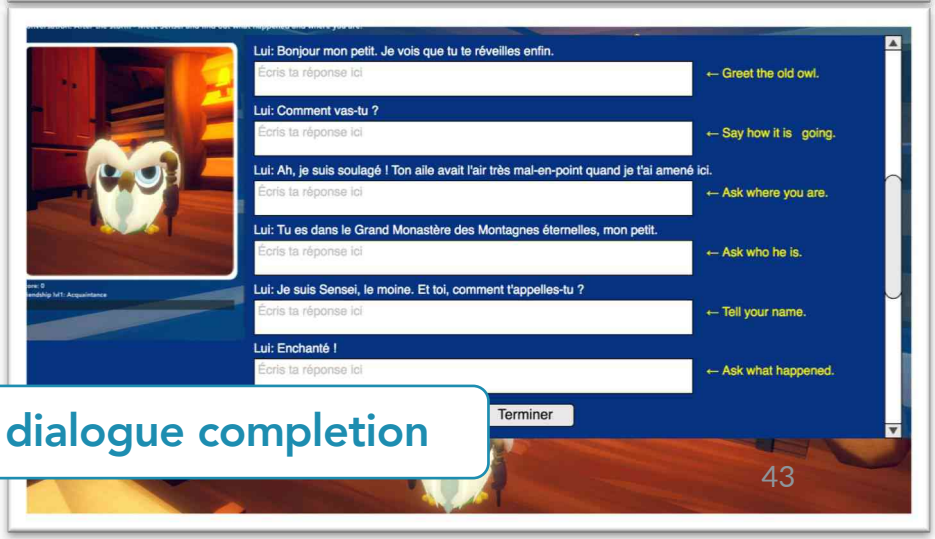
Compare:

(A) fully interactive, immediate/synchronous **dialogue system**

(B) classic, asynchronous **dialogue completion task**

Conditions with **identical tasks, input, output opportunities**, feedback and scaffolding.





Conversation: The snails - Vincent - Get to know the snails family

He: *Bien le bonjour! Comment t'appelles-tu?*

You: bonjour, je m'appelle Rinc

He: *Enchanté de faire ta connaissance, Rinc! Rinc. Rinc. Rinc. Ne t'en fais pas, je ne suis pas fou. C'est juste que je répète ton nom pour ne pas l'oublier.*

You: Coment tu t'apele?

He does not seem to have heard you...

Conversation: The snails - Vincent - Get to know the snails family

He: *Bien le bonjour ! Comment t'appelles-tu ?*

Je m'appelle Rinc

He: *Enchanté de faire ta connaissance, Rinc! Rinc. Rinc. Rinc. Ne t'en fais pas, je ne suis pas fou. C'est juste que je répète ton nom pour ne pas l'oublier.*

Coment tu t'apele?

He: *Moi, c'est Vincent. Elle, là-bas, c'est Angélique. Ça, c'est Delphine. Puis on a Georges dans le coin. Et évidemment, on ne peut pas oublier les triplées : Lisette, Claudette et Yvette. Oh! Et puis le petit là-bas, c'est Louis.*

Typ tekst..

Send your reply

Task: Say it is nice to meet them.

He: *Ah, vraiment? C'est aussi ce que l'ours a dit! Mais après, il oublie nos prénoms et nous traite de limaces! Des LIMACES!? Tu imagines? Si tu es si content de nous connaitre, alors tu peux me répéter nos prénoms? Ah! Tu vois! Tu t'en souviens pas, hein?! Désolé, c'est pas de ta faute, petit, mais personne ne fait jamais attention à nous.*

Typ tekst..

Send your reply

Quit

Methods
Population and group assignment

4 schools volunteered to participate, with 2-3 classes each:

$N_{clusters}$ = 11 $N_{participants}$ = 215 (208 complete cases)

Random assignment of classes to 3 conditions (distr. equally across schools):

- **Dialogue System** (experimental): $n_{D.Sys.}$ = 81
- **Dialogue Completion** ('baseline'): $n_{D.Compl}$ = 79
- **Control** ('business-as-usual') $n_{control}$ = 49

Flemish 2nd year secondary school learners of French (M_{age} = 13.4 y.o.)

L1 = 95,3 % Dutch

L2 = French = first L2, *M* = 3,1 years of instruction, mostly at **A1** level

(M_{score} in productive vocabulary size test = 3.6/30 in 1K frequency band)

10 (near-)native speakers of French excluded (final N = 198)

Methods
Procedure

1-4 weeks, depending on school schedule

All sessions at school

Pretest
- ❑ Computer-delivered spoken interview
- ❑ Target vocabulary test
- ❑ Vocabulary size test

In-app session (max 50 min): DSys / DCompl

In-app session (max 50 min) : DSys / DCompl

In-app session (max 50 min) : DSys / DCompl

Posttest
- ❑ Computer-delivered spoken interview
- ❑ Perceptions questionnaire
- ❑ Target vocabulary test

Perceptions questionnaire (post)

Construct	Subdimensions	Items	α	Source/Theoretical framework
Perceived **ease-of-use**	Corrective feedback, Comprehensibility, Interface, Tasks	5 (7)	.67	Technology Acceptance Model (Davis 1989), partially from Cornillie et al (2013)'s translation (adapted)
Perceived **usefulness**	General usefulness, Corrective feedback, Hints, Tasks	11	.89	
Perceived **interactivity**	Immediacy, Control, Mutuality	11 (13)	.79	New scale developed
Perceived **authenticity**	General Academic Personal	6 (7)	.84	Perceived Authenticity of Writing Scale (Behizadeh & Engelhard 2014) (adapted)

e.g., PERCEIVED INTERACTIVITY: "Through my answers, I could really have an impact on the game."
PERCEIVED USEFULNESS: "I am less afraid to speak French now than I was before playing the game."

Target Vocabulary Test *(1)*

"Target" words and sequences seen and potentially produced inside the intervention: based on **frequency of exposure** across whole available content, selecting the most frequent lemmas and the most frequent formulaic sequences.

But no explicit target of instruction (no specific feedback, no glossing, no systematic presentation)
⇒ **Incidental learning** only

At pre- and post-test (identical, randomized order)

Target Vocabulary Test *(2)*

- **Receptive** part (**meaning <u>recognition</u>**):
  25 items
  translation, as multiple choice

  e.g., Potager: □ soep □ moestuin □ vriend □ potaarde □ *Ik weet het niet*
  □ *soup* □ *<u>vegetable garden</u>* □ *friend* □ *potting soil* □ *I don't know*

- **Productive** part (**in-context form <u>recall</u>**):
  25 items
  gap-filling (L2 only) on formulaic sequences

  e.g., Cet auteur a vraiment _ _ _ _ _ _ _ _ d'imagination : ses livres sont très originaux !
  This author really has <u>a lot</u> of imagination: his books are really special!

Computer-delivered speaking interview

Automatized simultaneous speaking test

Individual, in-class & simultaneous,
with headset, in front of computer

24 questions

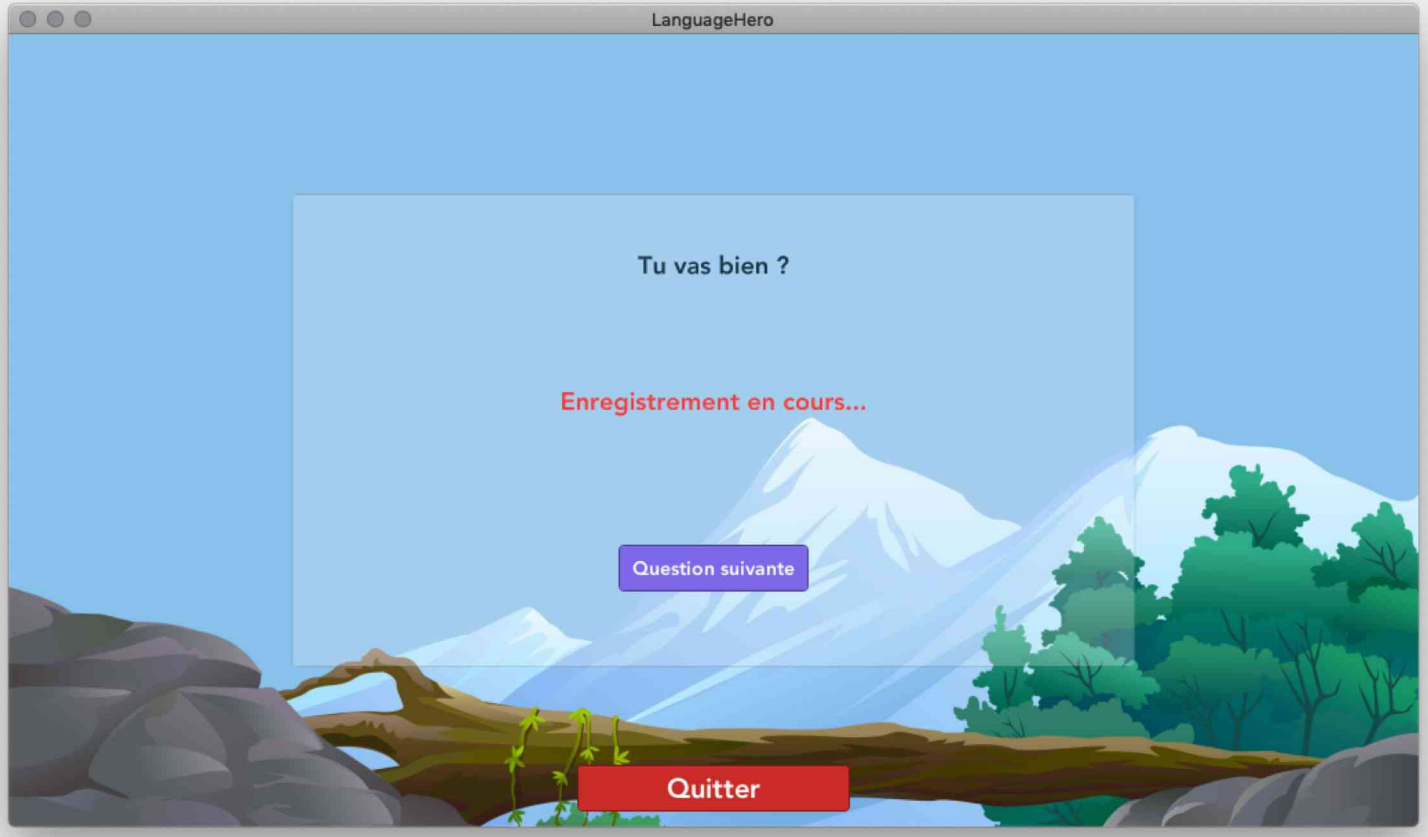
from basic (“How are you?”) to questions targeting specific communicative functions (“Can you describe your French teacher?”)

Question oral + written presentation,

then automatically starts recording,
30 sec limits or “*Next question*” button

Methods · Instruments

Computer-delivered speaking interview



Methods

Automated fluency metrics computation

±10 000 single audio files (N=208 * 24 questions * pre+post)

- Automated speech recognition (Google Cloud Speech-to-text) for transcription
- Manual correction of transcriptions + annotation of filled pauses, L1/LF use, meta-discourse, etc.
- Automated detection of pauses (Praat syllable nuclei detection script, de Jong & Wempe, 2009)
- Automated computation of syllables from transcript, with variations in pruning, and selection of measures that best predict proficiency level.

Methods

Fluency metrics

Speaking fluency (Segalowitz, 2010)

- ~~Cognitive fluency~~
- ~~Perceived fluency~~
- Utterance fluency (temporal/performance)
  - Speed fluency
    - speech rate, articulation rate, syllable duration, length of runs (syllables), duration of runs (sec)… (Bosker et al, 2013; Hilton, 2014; Kormos & Denes, 2004; Götz, 2013…)
  - Breakdown/Pauses
    - silent pause rate, silent pause duration… (Bosker et al, 2013; de Jong & Bosker, 2013; Kahng, 2014; Hilton, 2014…)
    - ~~filled pauses~~: not good differentiator (Cucchiarini et al, 2002…), unrelated to other fluency measures (Segalowitz et al 2017)
  - ~~Repair fluency~~: not good differentiator of proficiency (Cucchiarini et al, 2002; Revesz et al 2016; Saito et al 2018; Dumont, 2017…)

Combined metric via Principal Component Analysis

Using a silent pause threshold of 250ms (de Jong & Bosker, 2013; Préfontaine et al, 2016)

Differences of learners' behaviours

Pilot (2 classes in first school): "Discourse Completion Task" even more limited (no explicit validation of responses, no feedback, no scaffolding), to reflect the paper version of such a task

→ Strong attitudinal influence (DCT condition):

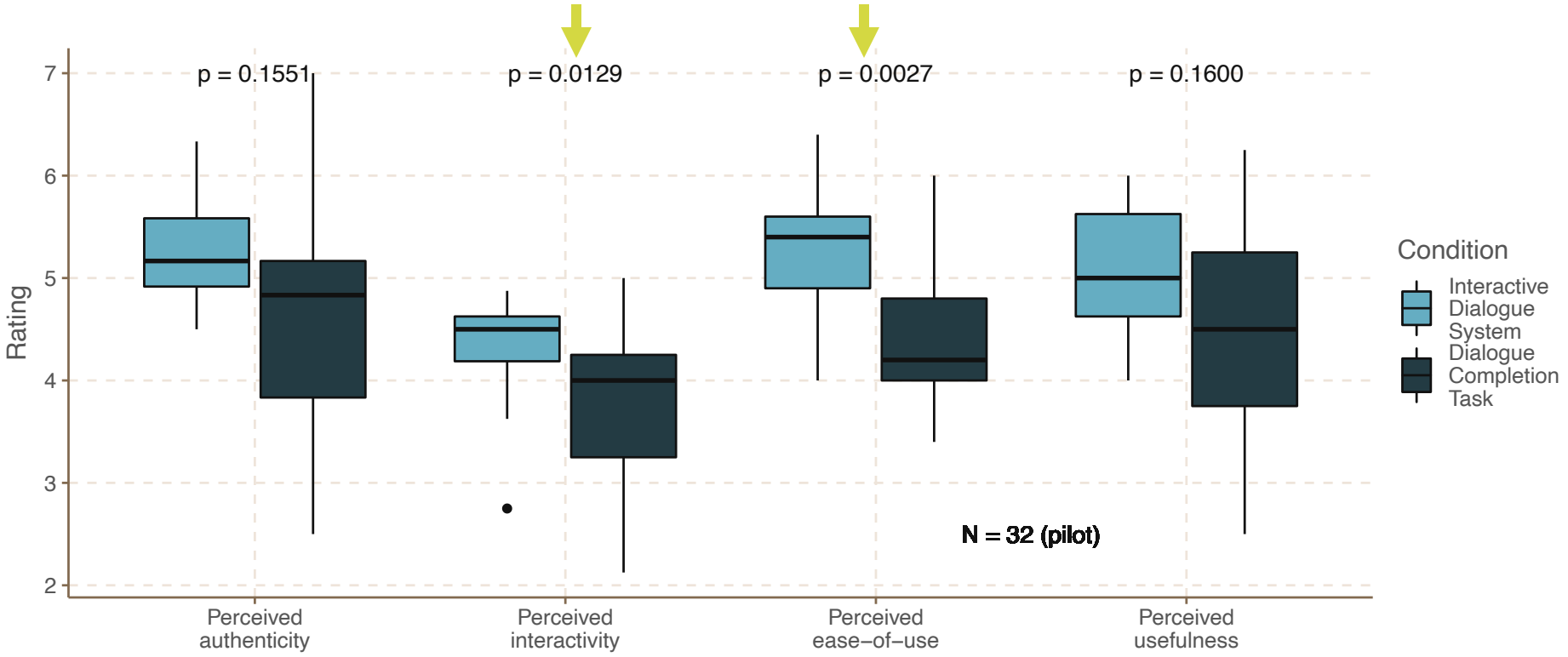
- at session 2, a few learners asked "why are we doing this?"
- at mid-session 3, multiple pupils stopped trying/working altogether
- 23.7% of messages containing "voluntary noise"

→ Raised ethical issues

⇒ Added **basic "correct/not" feedback** and **writing support** afterwards ➔ essentially solved the issue

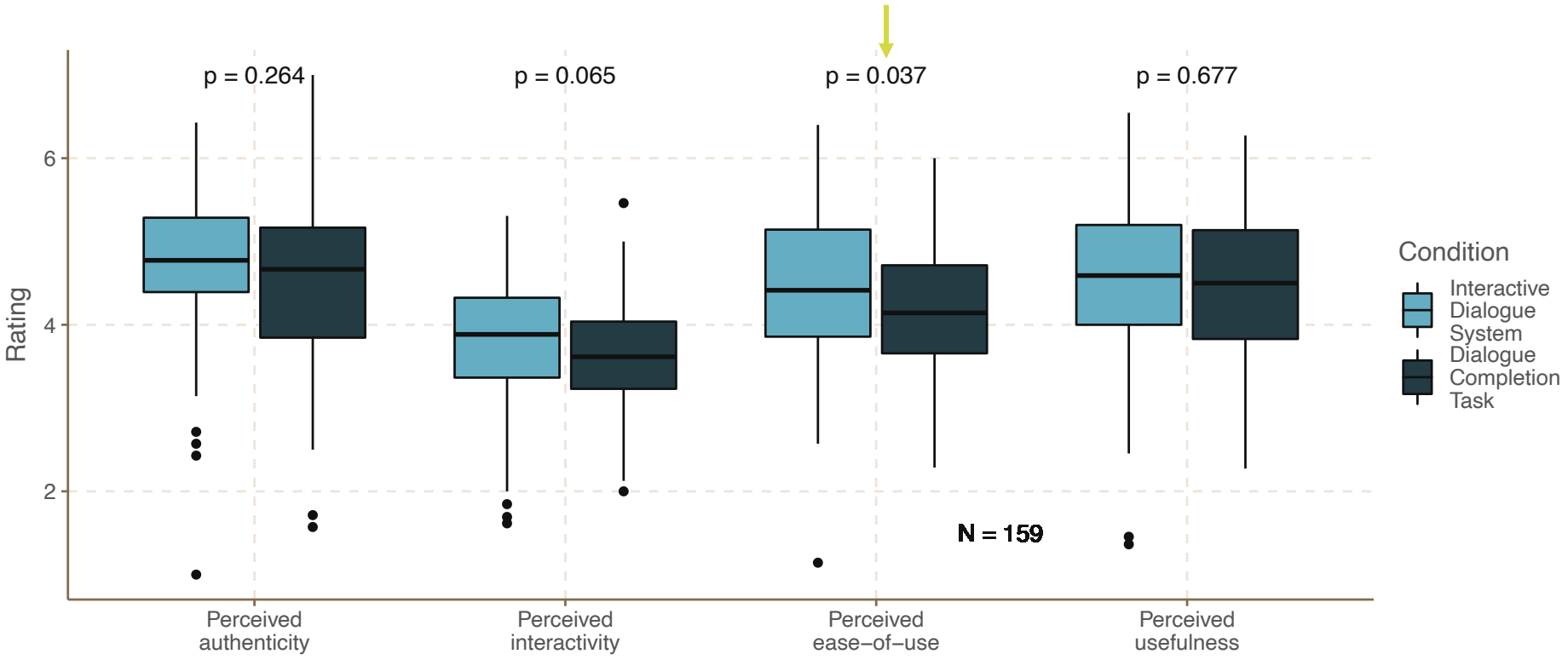
Experimental results

Differences of learners' perceptions (pilot only)



Experimental results

Differences of learners' perceptions



Differences of learners' perceptions

Feeling of interactivity within dialogue-based CALL game seem to be majorly influenced by the **basic feedback** received.

Goal vs. form-orientation

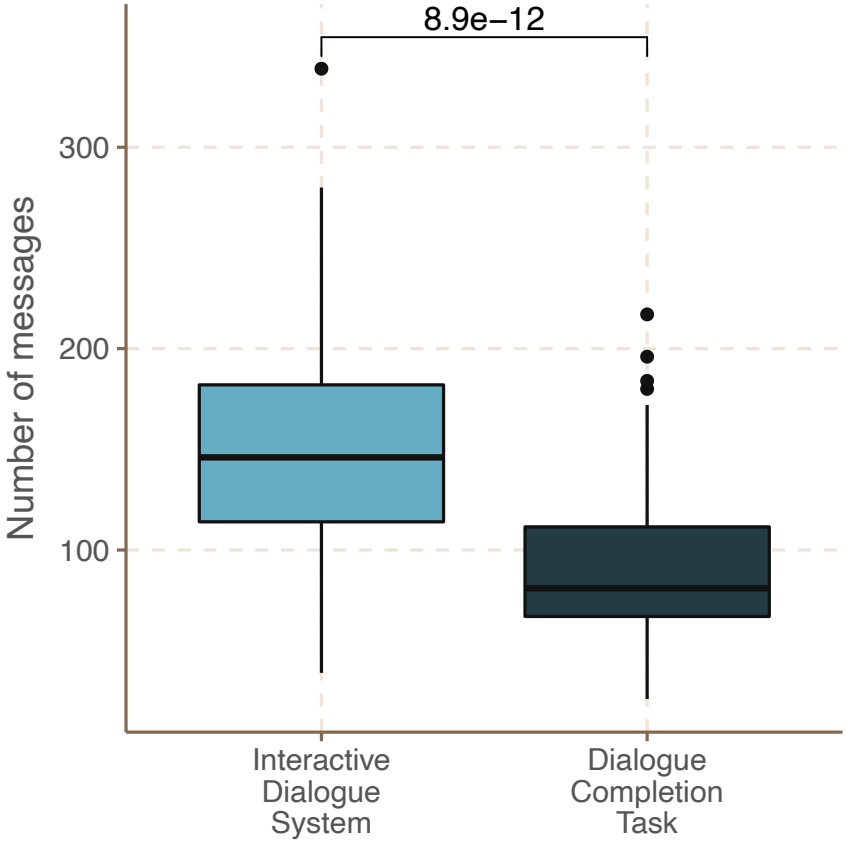
form-orientation behaviour/'exercise mindset' among many participants from both conditions:

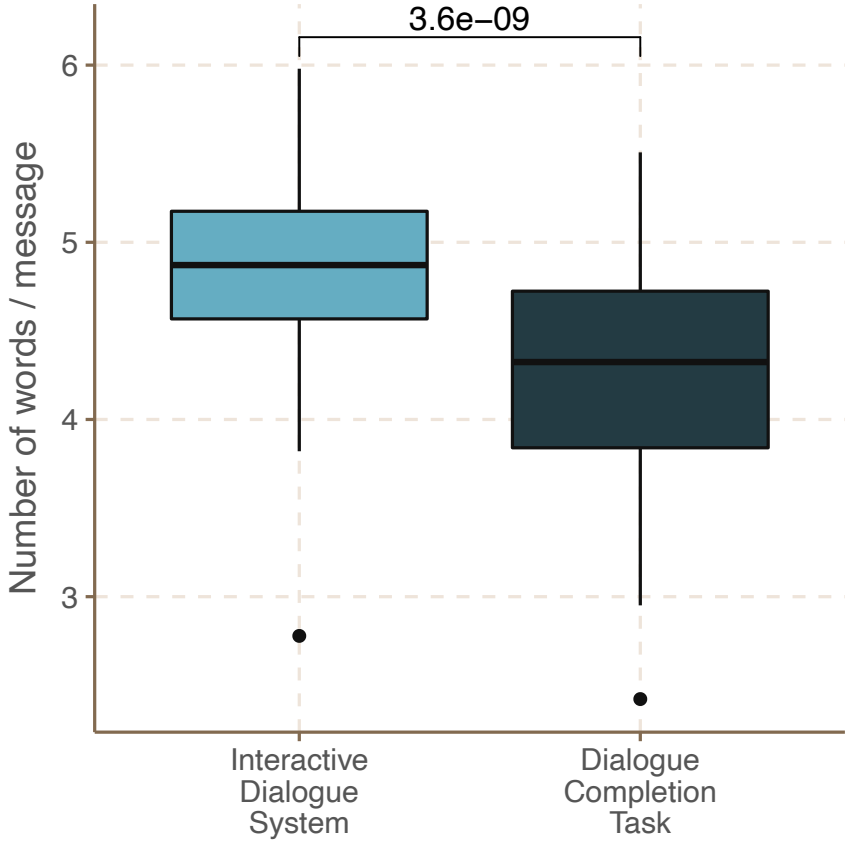
due to in-school experiment? age factor? presentation of the instructions?

→ lack of perception of task goals as meaningful

Experimental results

Quantity of in-task production





Results

Receptive vocabulary

Very significant increase.

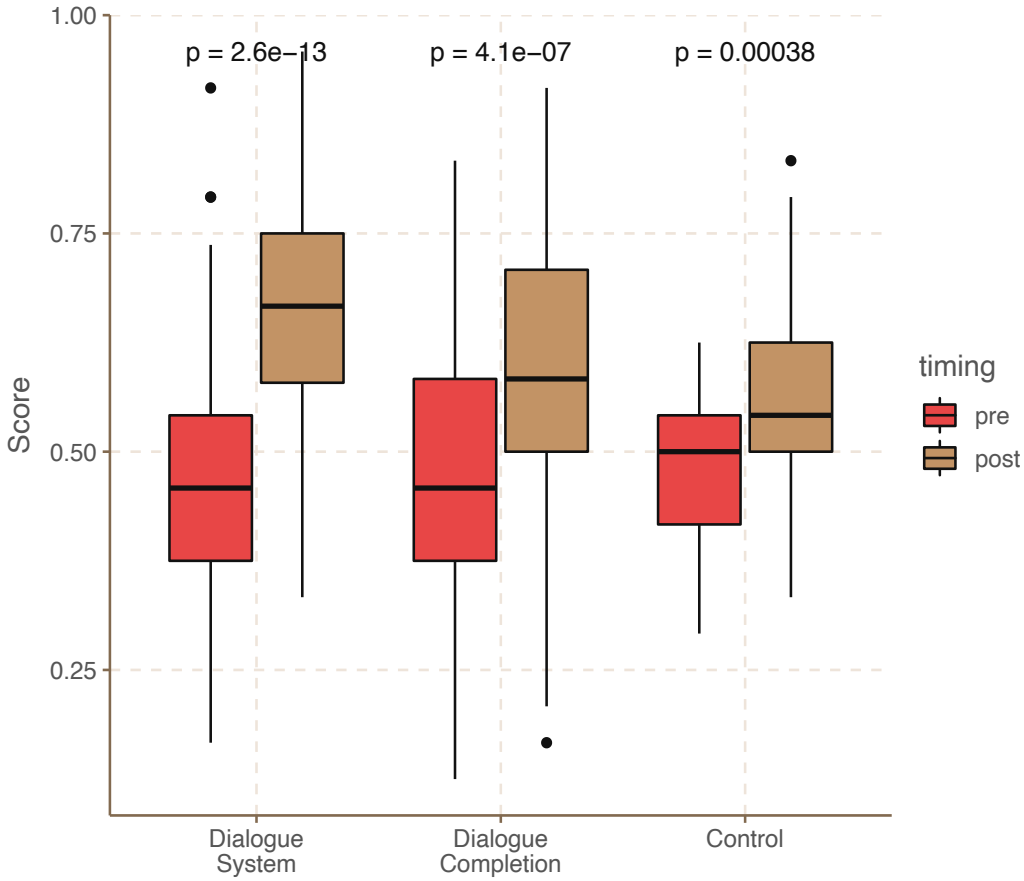
$d_{\text{DSystem}} = 1.17^{***}$

$d_{\text{DCompletion}} = 0.80^{***}$

$d_{\text{DControl}} = 0.67^{***}$

Considering the short treatment (2h), clear difference between conditions.

$d_{\text{DSys vs DCompl}} = 0.25^{*}$



Results

Productive vocabulary

Less marked increase,
and much more difficult test.

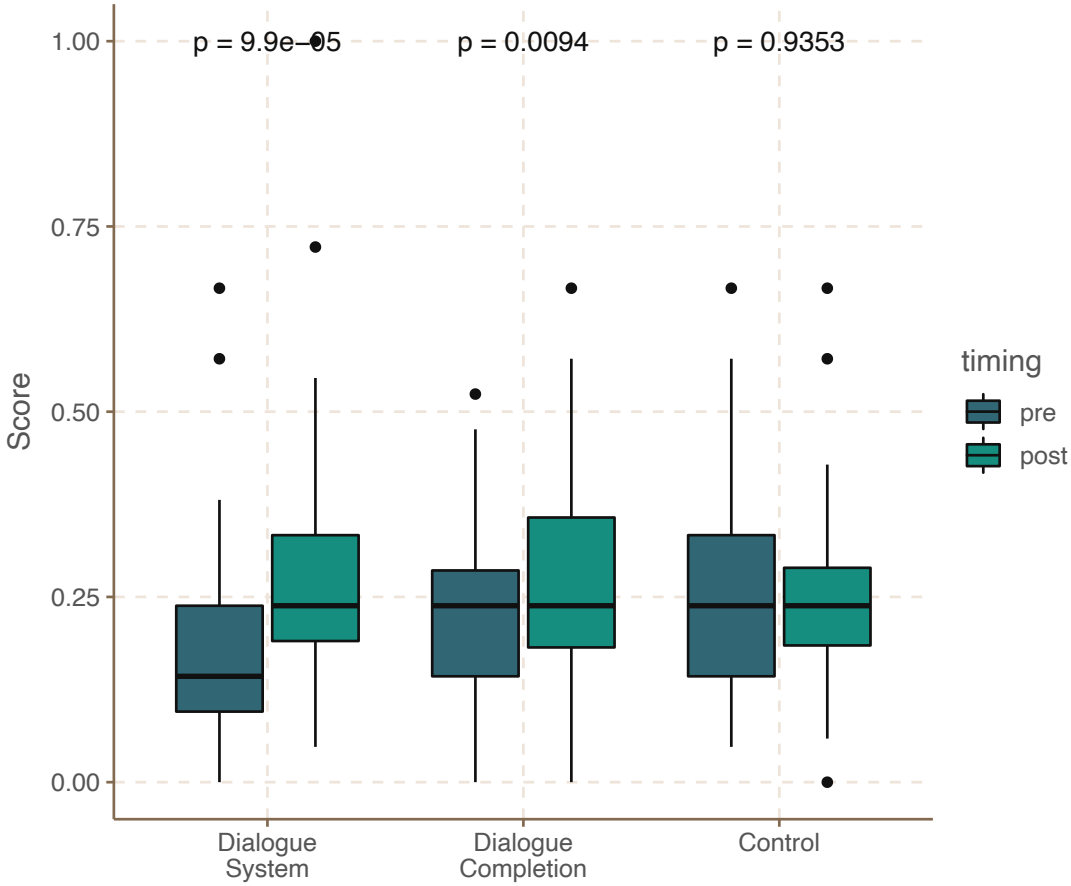
$d_{\text{DSystem}} = 0.56^{***}$

$d_{\text{DCompletion}} = 0.39^{***}$

$d_{\text{DControl}} = 0.02$ *n.s.*

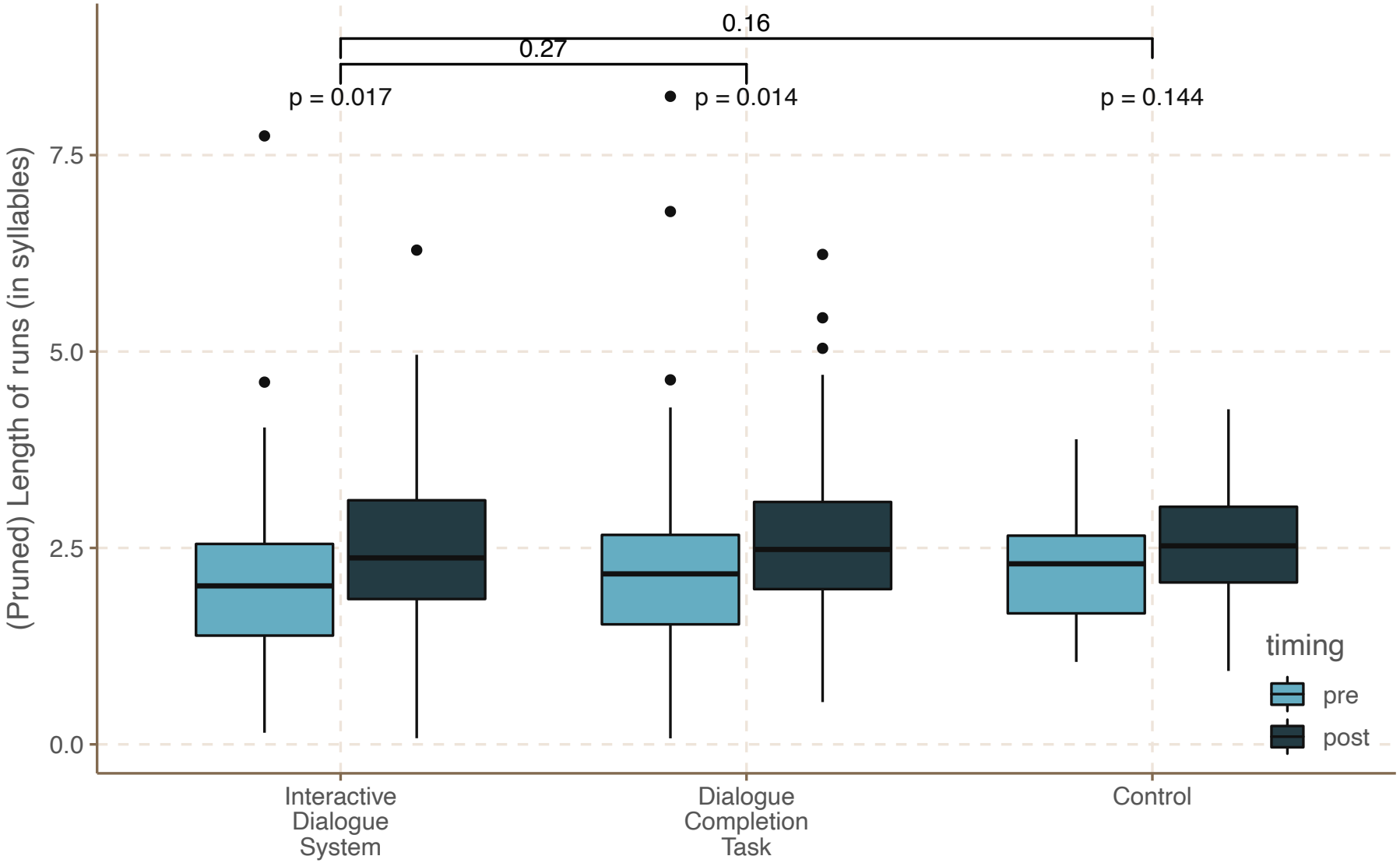
But here, no improvement in control group and benefits of practice are much clearer.

$d_{\text{DSys vs DCompl}} = 0.23$ *n.s.*



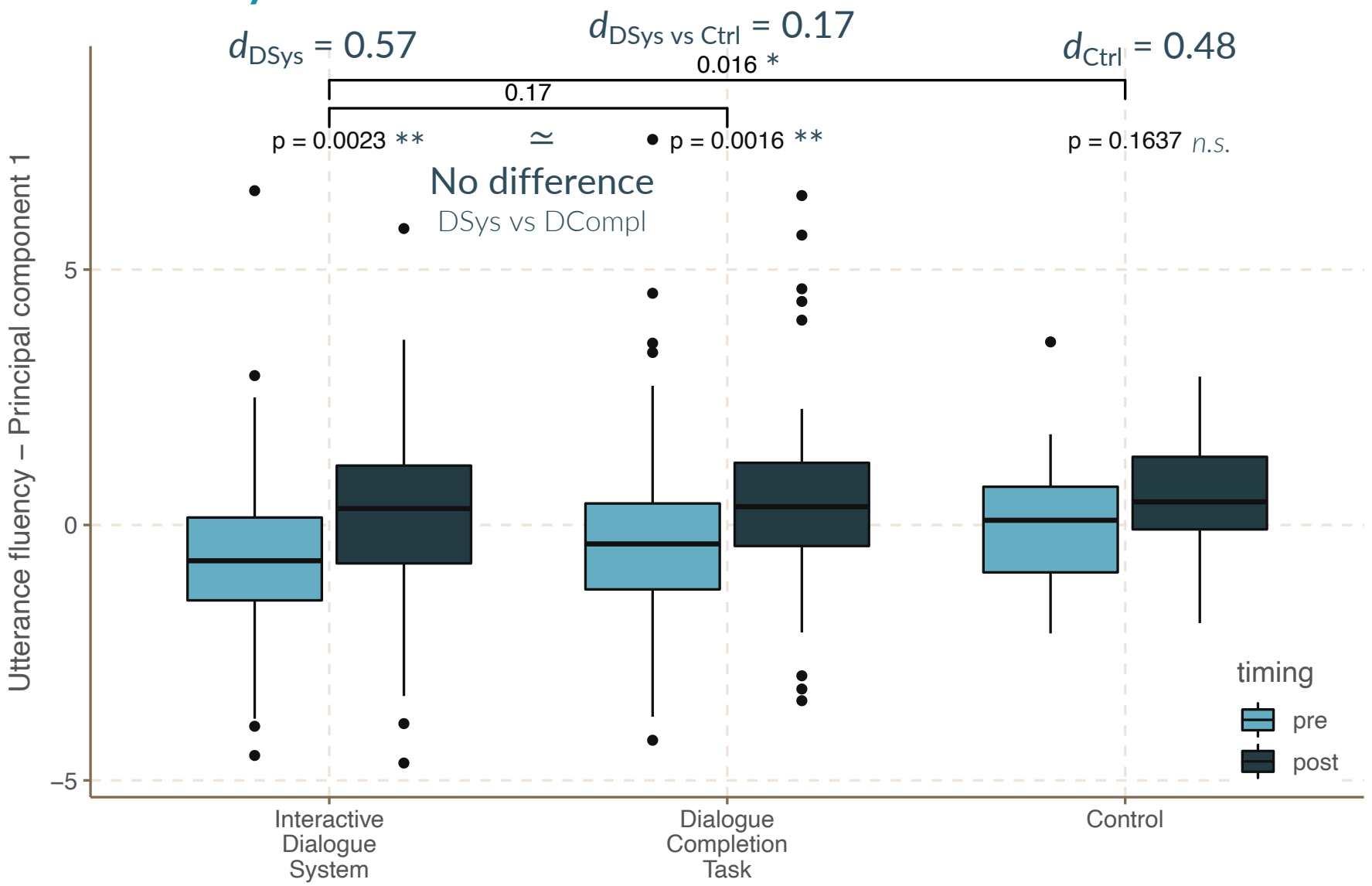
Results

Fluency



Results

Fluency



Discussion

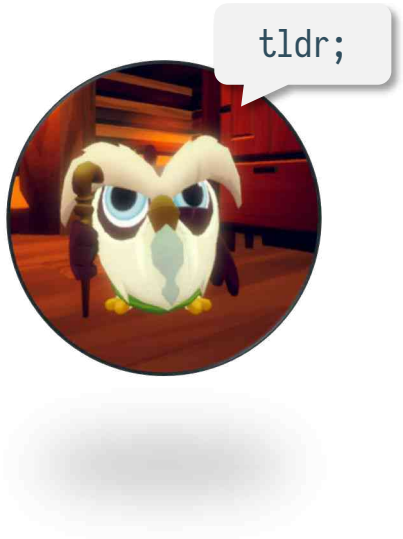
Fluency

Very small effect ($d_{\text{DSys vs Ctrl}} = 0.17$), when controlled for "base development" and training to the test effect,

but very **short treatment** (2h) → expected (effect on general L2 speaking proficiency by *written* practice)

No difference between DSys and DCompl
⇒ In line with observations of form-orientation

Dialogue systems for language learning: typology of systems and measurement of effects



Dialogue systems for language learning
Terms, fields and definition
Rationale

Typology of systems
Types of dialogue-based CALL systems
Technological approaches in research and industry

Past effectiveness
Meta-analysis of previous effectiveness studies

Evaluation of *LanguageHero*
Measuring effects on L2 development
- Challenges and opportunities

Conclusions

Effects of dialogue-based CALL

Clear effect of dialogue-based CALL practice on L2 development, especially on **vocabulary** acquisition.

Very small effect on **fluency**

Still quite promising that possible to observe an effect on fluency on such a small timeframe.

+ Fine-grained evaluation of fluency metrics via automated comparison

⇒ Methodological innovation

Conclusions

Relative effects of interactivity

Limitation: Strong form-orientation/"exercise mindset" in many participants from both conditions:

Due to school context? age factor? presentation of the instructions?

→ Probably reduced the "interactivity" of the Dialogue system condition a lot.

Limited differences in perception

Small differences in receptive vocabulary learning

No difference in prod. vocabulary and fluency dev.

Perspectives
Dialogue systems for language learning

The question of interactivity and freedom vs. constraints remains open:

- uncertainty regarding the pedagogical and motivational advantage of a goal-oriented, fully interactive dialogue system.
- well possible that more beneficial to invest more time in pedagogical content and instructional design, and less in complex AI/NLP development
  (Bibauw, Van den Noortgate, François & Desmet, *under review*)
- → **Trade-off** technological/instructional development

Perspectives
Dialogue systems for language learning

Dialogue has yet to see the breakthroughs other NLP tasks have witnessed from deep learning. → Still much room for improvement (dialogue management, response generation/selection, evaluation…)

For language learning:

- To **compensate for the lack of human-human interaction** (native, teacher and peer interlocutors remain preferable)
- '**Constrained by design**' route seems the most manageable (e.g., Duolingo Bots)
- Prefer it for **well-defined, signposted, conventional interactions** (not open-ended social chat)
- Needs extensive **corrective feedback** and **scaffolding**

Perspectives
Dialogue systems as an L2 research environment

Dialogue systems offer
fully controllable and reproducible interaction:
opportunities to monitor and to alter infinity of details.

Experimental testing (A/B testing) with different types of tasks, instructions, feedback, exposure, reactions…

Thank you!
Merci !
Dank u!
¡Gracias!

Serge Bibauw
serge.bibauw@uclouvain.be

More info: https://serge.bibauw.be