

Effects of interactivity of written practice on incidental vocabulary acquisition

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KU LEUVEN

UCLouvain



Effects of interactivity of written practice on incidental vocabulary acquisition

Interactive practice *with a dialogue system*, in this case, integrated within an educational video game.



Randomized controlled experiment with young Flemish learners of French (n=209)

Effects of interactivity of written practice on incidental vocabulary acquisition



Interaction-based vocabulary acquisition

How do output and interaction help lexical development?

Dialogue systems for SLA research

Definition, summarized typology, research questions

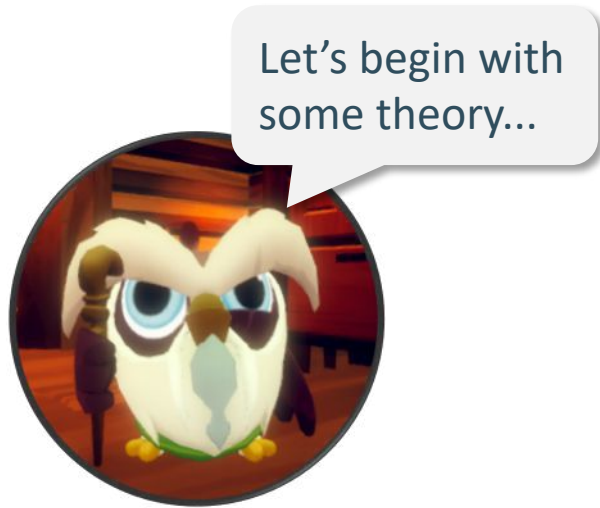
Randomized controlled experiment

Groups, learners' profiles, instruments, intervention

Results and discussion

Mixed-effects models, effects of encounters in input/output

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Theoretical background

Incidental vocabulary acquisition

Incidental vs. intentional learning (e.g. Eysenck, 1982)

exposure to material, no test announcement

Incidental vocabulary learning (Schmidt, 1994)

within a meaning-focused task

Contextual vocabulary learning (Elgort, Brysbaert, Stevens & Van Assche, 2018)

Theoretical background

Interactive tasks and vocabulary acquisition

Task-induced involvement (Laufer & Hulstijn, 2001)

factors for word retention in a task: *need, search, evaluation*

more effective tasks:

- Negotiation of meaning (+) (Newton, 1995)
- Word use for completing the task (++) (Newton, 1995)
- Interactionally modified output (++) (Ellis & He, 1999)

→ Many reasons to study incidental vocabulary learning beyond reading

Theoretical background

Effectiveness on vocabulary learning: experimental evidence

Meta-analysis of incidental word learning from spoken input

(de Vos, Schriefers, Nivard & Lemhöfer, 2018)

$d = 1.05$ (large effect)

interactive tasks ($d +0.73$) > non-interactive tasks ($d +0.10$) > input only

population: university ($d +0.92$) > high school ($d +0.74$) > elementary school

outcome: recognition ($d +0.42$) > recall

Theoretical background

Effectiveness on vocabulary learning: broader evidence

Studies of out-of-school exposure to English:

Peters, Noreillie, Heylen, Bulté & Desmet, 2019: **significant SEM parameters for vocabulary size (n=138):**

online/games ($\beta = .39^{*}$)**

n.s. parameters: use (friends/family), audiovisual input, written media

De Wilde, Brysbaert & Eyckmans, 2019: **best predictors of receptive vocabulary (n=747):**

using social medial in L2 ($\beta = .29^{*}$)**

playing games in L2 ($\beta = .18^{*}$)**

speaking L2 ($\beta = .13^{*}$)**

compare with watching TV ($\beta = -.07$ n.s.), music ($\beta = -.08^*$)

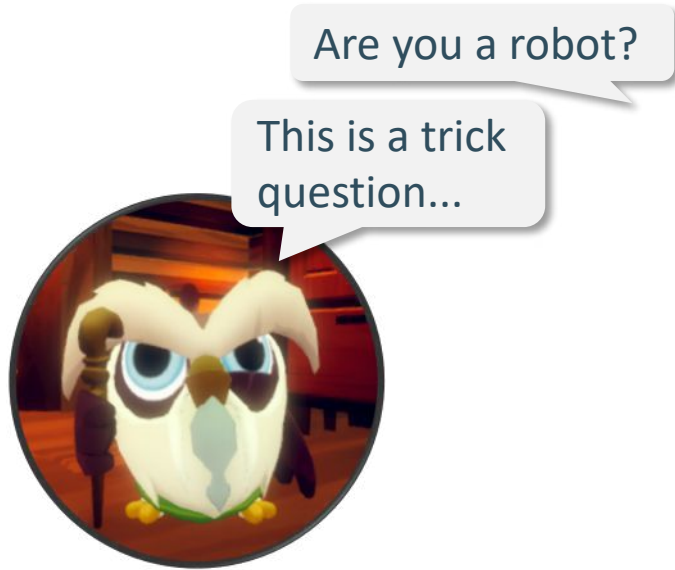
→ all profoundly interactive sources of exposure

Towards our research question...

Interactive tasks seem to be among the most beneficial for incidental vocabulary acquisition, but **what is it that makes them so effective?**

Attention to form within meaning-focused task? Need to use?
Negotiated input? Negotiated output? Multiple exposures?

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Dialogue systems for language learning

(Bibauw, Thomas & 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.

Dialogue systems for language learning

Types of systems (Bibauw, Thomas & Desmet, 2019)



Form-focused systems



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

Goal-oriented systems



SPELL (Morton, Gunson & Jack, 2012)

Dialogue systems for language learning

Types of systems (Bibauw, Thomas & Desmet, 2019)



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

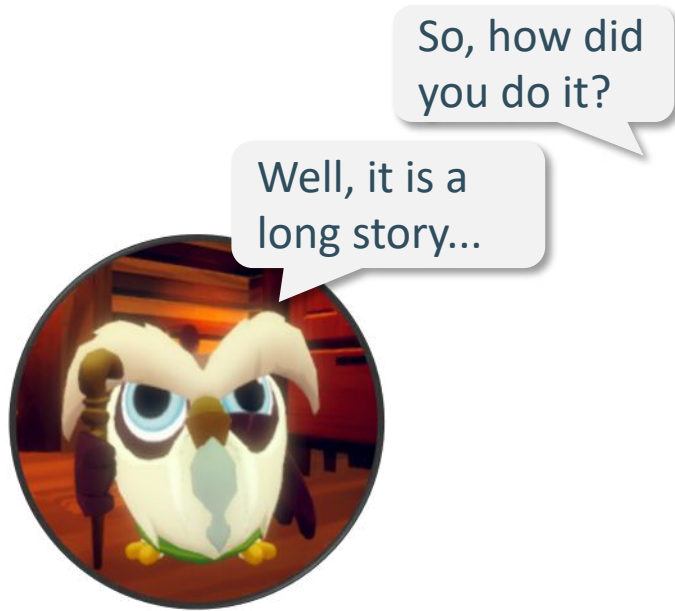
Advanced dialogue management:
→ high-level NLP required

Dialogue systems for SLA research

Research questions

1. Dialogue-based CALL systems exhibit large variation in terms of **interactivity and freedom** vs. **constraints** of the learner within the dialogue: what does it change?
2. Technologically, it is **considerably easier to “fake” the interaction** by restraining the learner: it is worth it pedagogically to implement advanced natural language understanding and dialogue management?
3. Traditionally, in large-classes school contexts, dialogue is often practiced through written “**Dialogue Completion Tasks**”: it is similar in terms of perception, performance and learning?

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Intervention · Dialogue system

LanguageHero, dialogue-based game for young learners

Developed by Leuven-based start-up *Linguineo*.

(Main) target audience: teenagers (10-14).

Prototype developed for French for Dutch-speaking learners.

Task-based free conversational written interaction.

Logged in as sbibauw

Logout

Target language:

fr

Tutor language:

en

Interface language:

Réglages

Language Hero

Conversations:

Structured around goal-oriented 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



Contextualization

Score: 405 ?
Friendship lvl0: Acquaintance

Gamification

Current task (2/30):
Say it is nice to meet them.

Microtasks to guide the conversation

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

You: bonjour je m'appelle 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: Comment tu t'appelle?

He does not seem to have heard you...

You: Tu t'appelle 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

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

Intervention · Conditions

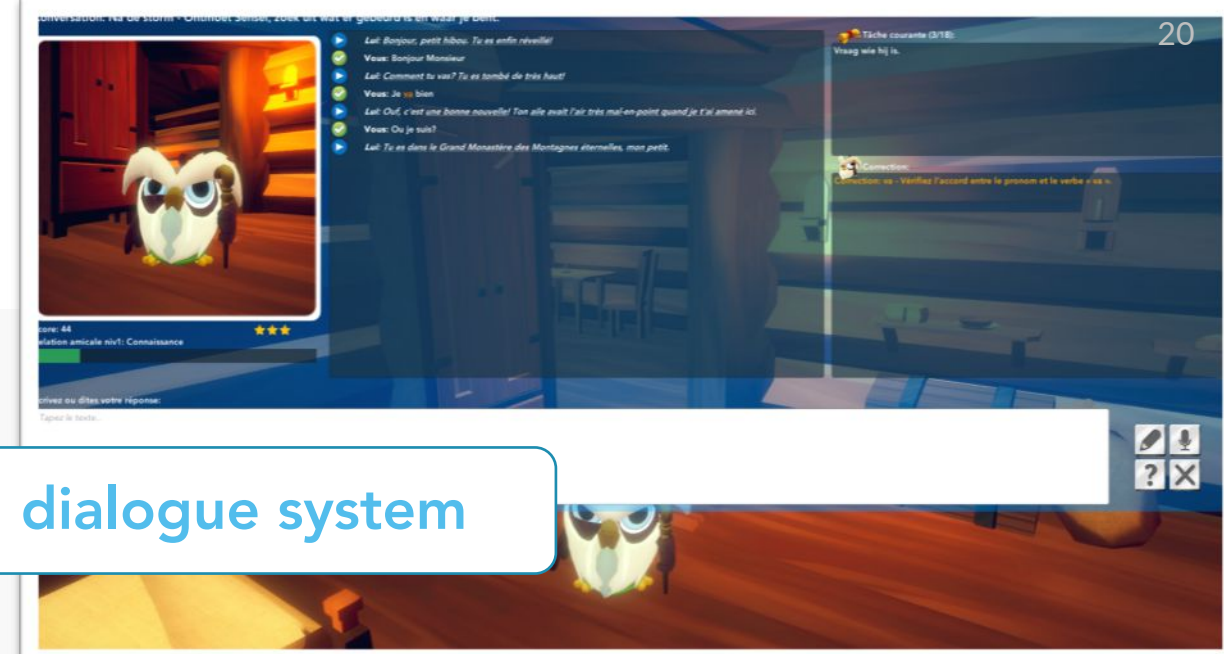
Interactive vs. static dialogue

Compare:

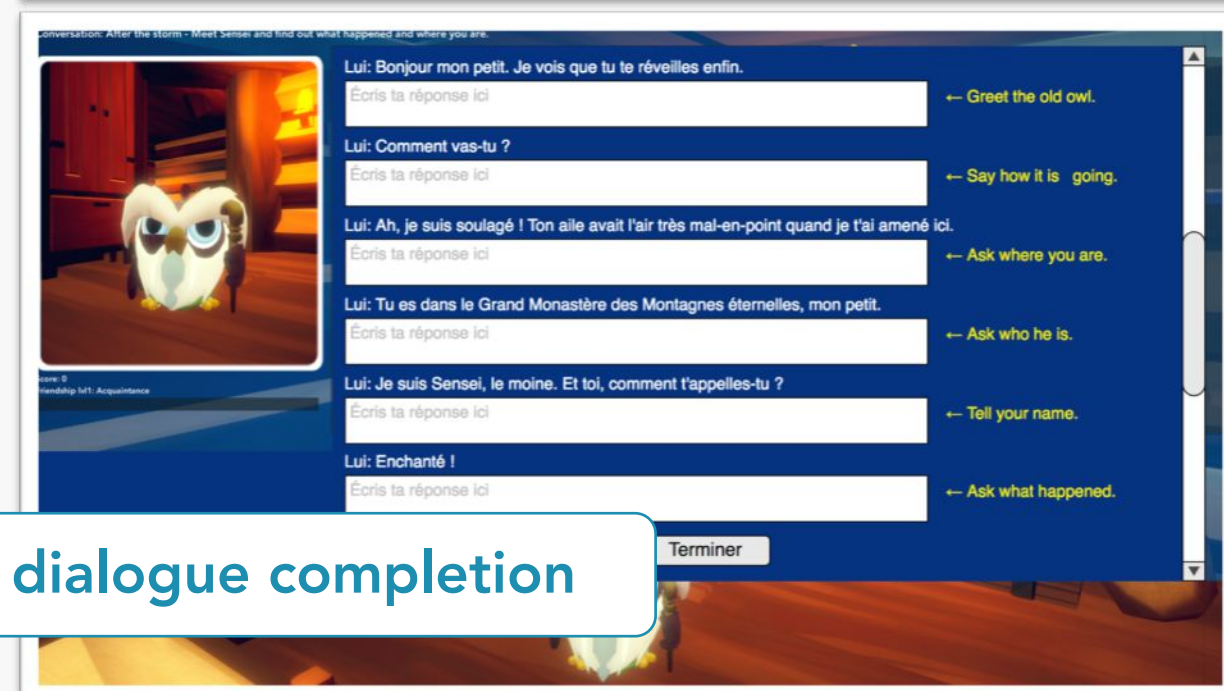
(A) fully interactive,
immediate/synchronous
dialogue system

(B) classic, asynchronous
dialogue completion task

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



dialogue system



dialogue completion

Methods

Population and group assignment

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

$$N_{\text{clusters}} = 11$$

$$N_{\text{participants}} = 215 \text{ (208 complete cases)}$$

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

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

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

L1 = 95,3 % Dutch

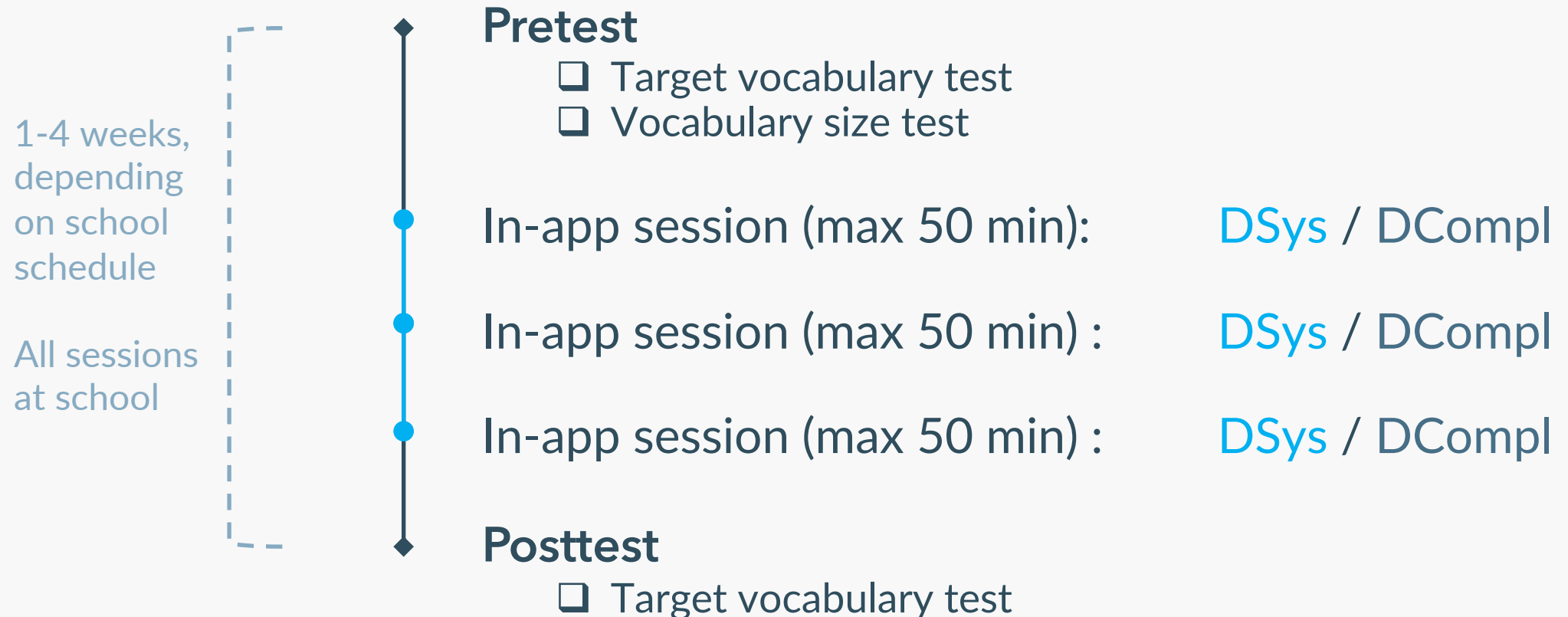
L2 = French = first L2, $M = 3,1$ years of instruction, mostly at **A1** level

(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



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, nor glossing, nor systematic presentation)
⇒ **Incidental learning only**

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

Methods · Instruments

Target Vocabulary Test (2)

- Receptive** part (meaning recognition): 25 items
 translation, as multiple choice
 e.g., Potager: ☐ soep ☐ moestuin ☐ vriend ☐ potaarde ☐ *Ik weet het niet*
 ☐ soup ☐ vegetable garden ☐ friend ☐ potting soil ☐ *I don't know*
- Productive** part (in-context form recall): 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 a lot of imagination: his books are really special!

Methods

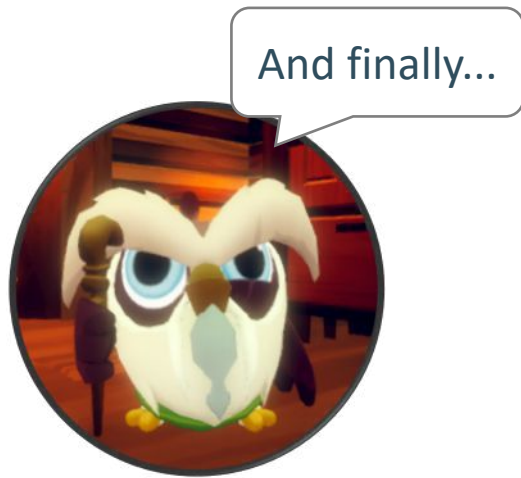
Advanced in-game logging

Full logging of all messages read and written in the system

Total: 48 353 messages, 577 494 tokens

Keystroke logging (in ms) for writing fluency measurement and repair behaviours analysis.

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Results

Receptive vocabulary

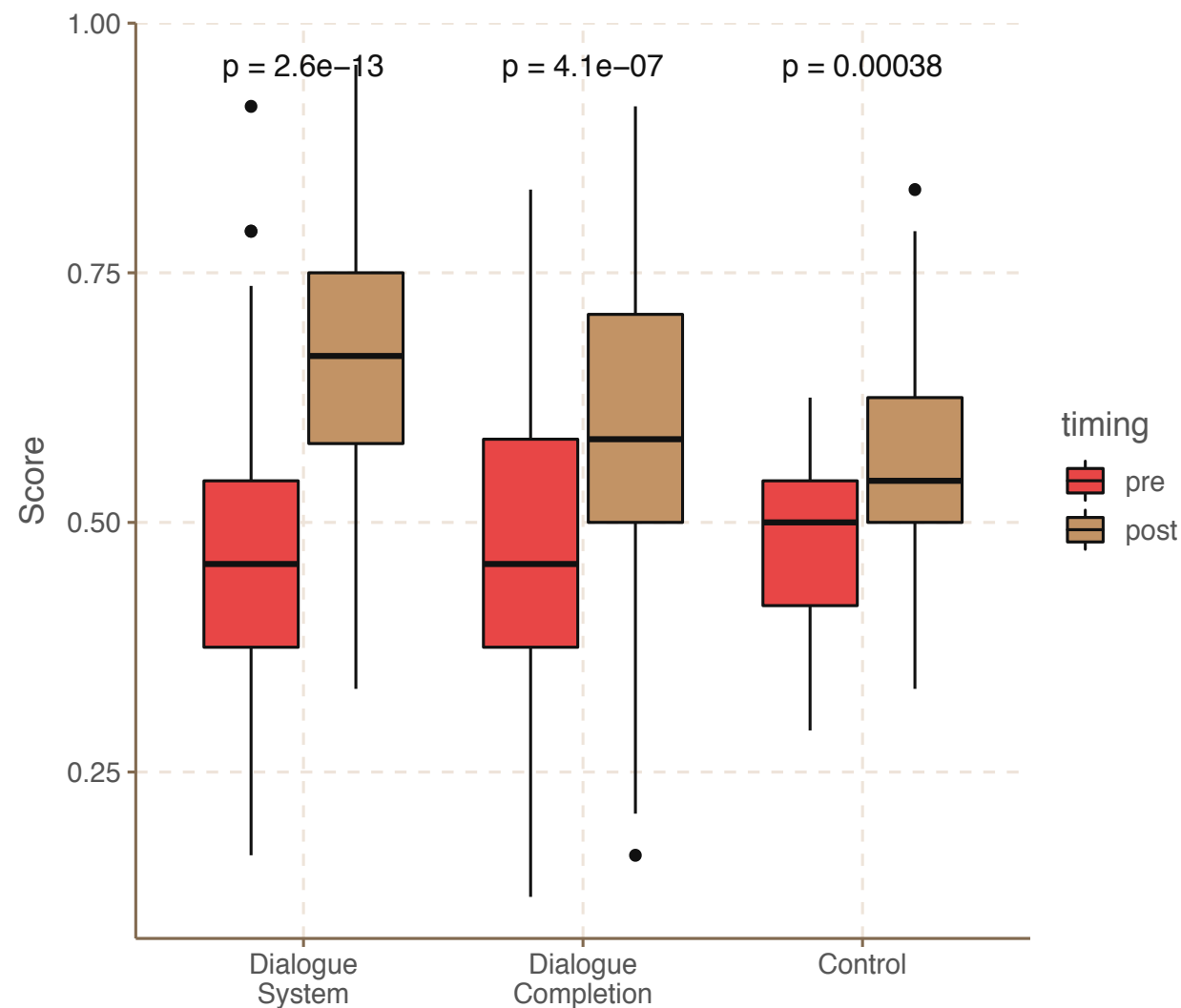
Very significant increase.

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

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

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

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



Results

Productive vocabulary

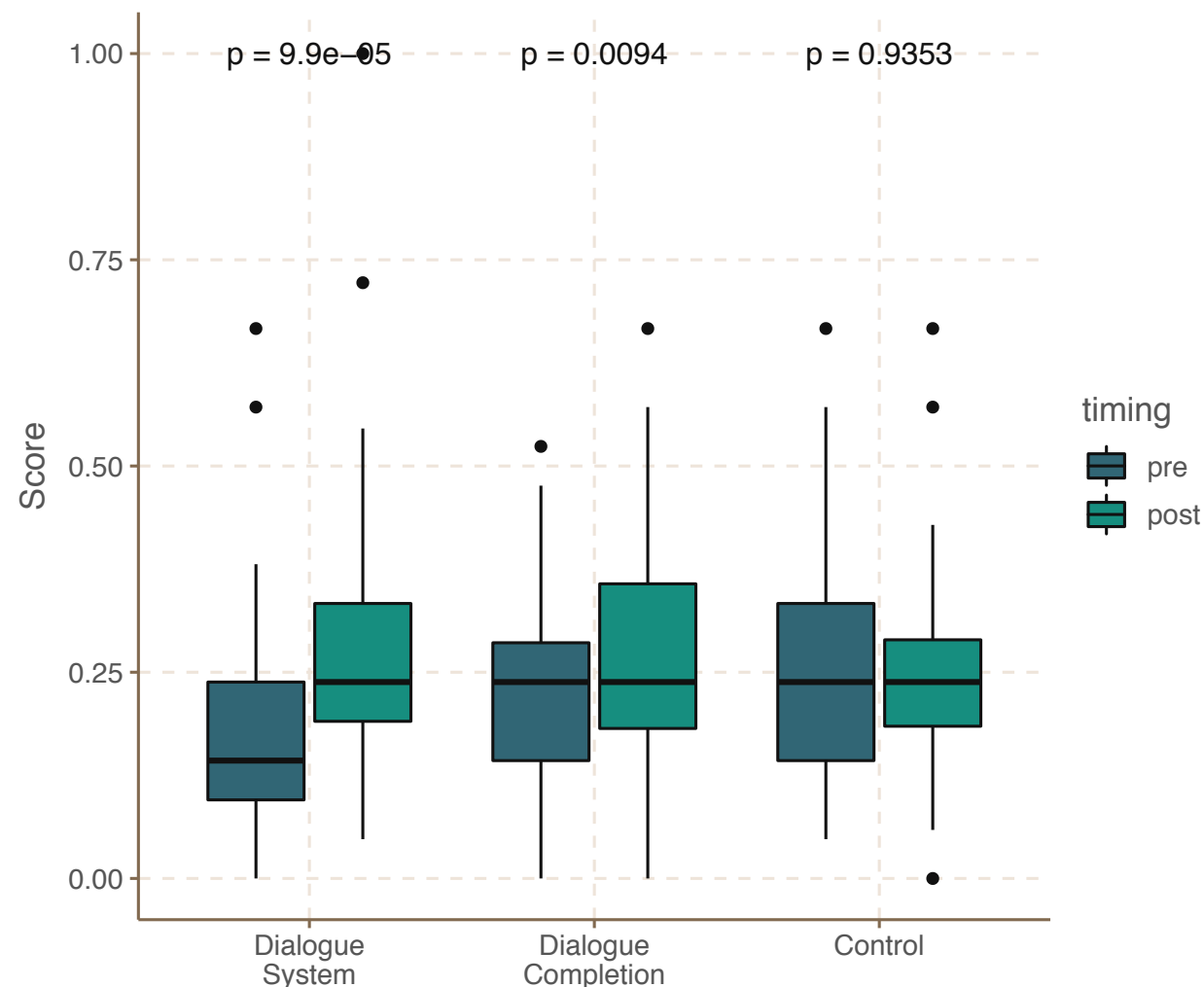
Less marked increase,
and much more difficult test.

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

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

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

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



Results

Linear regression with mixed effects modelling

	β	SE	F	df	p
(Intercept) ***	-0.36	0.08	-4.54	72	0.000
Dialogue System <i>n.s.</i>	-0.03	0.04	-0.77	366	0.440
Dialogue (vs. Control) <i>n.s.</i>	0.05	0.05	1.19	328	0.234
Score at pretest ***	0.39	0.01	35.87	7195	0.000
Vocabulary Size Score ***	0.10	0.01	7.10	171	0.000
Test: Receptive (vs. Productive) ***	0.41	0.10	4.14	54	0.000
Gender: F °	0.05	0.03	1.91	171	0.058
Dialogue × Receptive °	0.08	0.05	1.66	7191	0.098
Dialogue System × Receptive **	0.12	0.04	3.28	7212	0.001
(1 Subject)	0.14				
(1 Item)	0.31				
(Residual)	0.70				

$R^2 = 0.45$

Results & discussion

Effects on vocabulary acquisition

Effect is, obviously defined by pretest score and voc. size, and higher for receptive vocabulary.

No direct distinction of effect between Dial.System and Dial.Completion, because it does not affect recall results that much:

sig. differentiated effect on receptive voc. acquisition:

Dial. system > Dial. completion > 'business-as-usual'

Results

Modelling number of encounters with words

Frequency counts (lemma) of

- Potential encounters:
 - probable **input** (from bot's utterances)
 - opportunities for **output** (computed from model responses)
- Actual encounters
 - **input**: bot's utterances (but noticing?)
 - **output**: user's messages

Results

Modelling actual and potential encounters with words

	β	SE	F	df	p
(Intercept)	-0,53	0,21	-2,53	721	0,012
Dialogue System ***	-0,27	0,07	-3,86	424	0,000
Dialogue (vs. Control) *	0,45	0,21	2,18	1083	0,030
Score at pretest	0,36	0,02	16,58	1442	0,000
Vocabuly size score	0,11	0,03	3,90	141	0,000
Test: Receptive (vs. Productive)	0,30	0,32	0,94	1240	0,348
Gender: F	0,01	0,05	0,25	121	0,804
Potential Encounters: Input *	0,12	0,06	2,11	24	0,045
Potential Encounters: Output	-0,03	0,07	-0,39	28	0,699
Actual Encounters: Input	-0,03	0,02	-1,59	1356	0,112
Actual Encounters: Output ***	0,10	0,02	4,15	1614	0,000
Dialogue × Receptive	0,24	0,31	0,78	1782	0,435
Dialogue System × Receptive **	0,23	0,08	2,97	1727	0,003
(1 Participant)	0,19				
(1 Item)	0,20				
(Residual)	0,73				

$R^2 = 0.46$

Results

Modelling actual and potential encounters with words

Major predictor of incidental vocabulary learning is not input, but **output** (actual number of uses).

Is it different for receptive vs. productive learning?

Results

Exposure to words $\Rightarrow$ Receptive test

	β	SE	F	df	p
(Intercept)	-0,38	0,28	-1,35	476	0,178
Dialogue System	-0,05	0,08	-0,63	207	0,529
Dialogue (vs. Ctrl) *	0,65	0,28	2,28	469	0,023
Score at pretest ***	0,37	0,03	12,19	692	0,000
Vocabuly size score ***	0,12	0,04	3,34	141	0,001
Potential Encounters: Input <i>n.s.</i>	0,10	0,09	1,17	16	0,257
Potential Encounters: Output <i>n.s.</i>	-0,03	0,08	-0,33	14	0,748
Actual Encounters: Input <i>n.s.</i>	0,02	0,04	0,53	919	0,594
Actua Encounters: Output **	0,08	0,03	3,07	936	0,002
(1 Participant)	0,24				
(1 Item)	0,22				
(Residual)	0,75				

$R^2 = 0.33$

Results

Exposure to words $\Rightarrow$ Productive test

	β	SE	F	df	p
(Intercept)	-0,34	0,23	-1,46	362	0,144
Dialogue System ***	-0,32	0,08	-4,13	163	0,000
Dialogue (vs. Ctrl) *	0,55	0,23	2,42	496	0,016
Score at pretest ***	0,37	0,03	11,39	765	0,000
Vocabuly size score **	0,11	0,04	2,73	141	0,007
Potential Encounters: Input °	0,17	0,09	1,98	8	0,081
Potential Encounters: Output n.s.	-0,03	0,12	-0,20	11	0,842
Actual Encounters: Input *	-0,07	0,03	-1,98	631	0,048
Actual Encounters: Output ***	0,14	0,04	3,38	730	0,001
(1 Participant)	0,19				
(1 Item)	0,21				
(Residual)	0,82				

$R^2 = 0.33$

Results & discussion

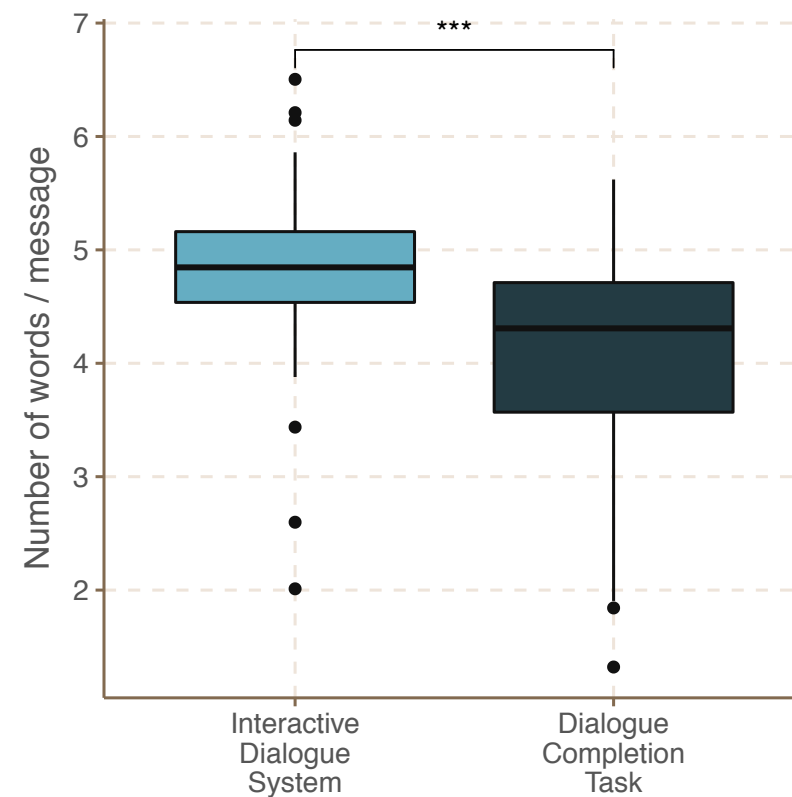
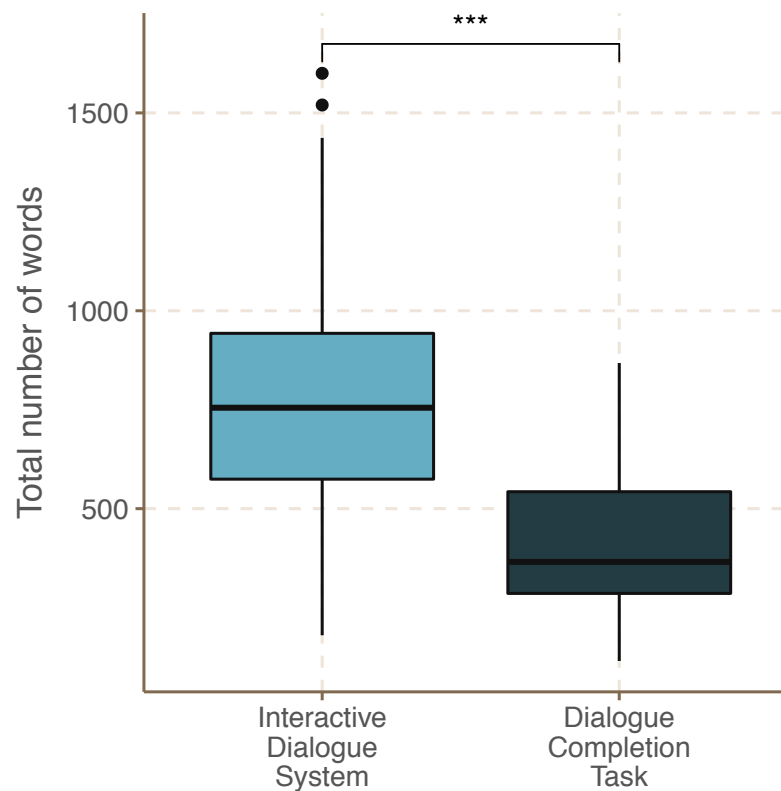
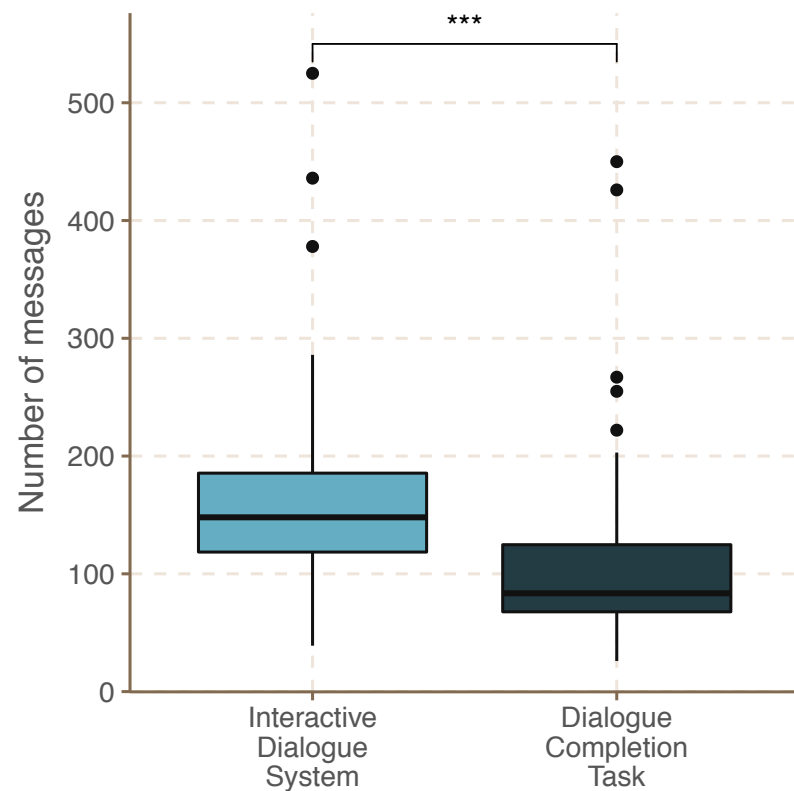
Output encounters with words

It confirms the actual uses/output encounters influence both receptive and productive acquisition.

When accounting for output encounters, other coefficients go negative (e.g. Dialogue system) because their specificity is 'absorbed' by the number of uses.

Results

Quantity of in-task production



Discussion

Limitations

- Somewhat coarse automated processing for detection of encounters: can be refined substantially: include formulaic sequences that are tested in productive part.
- Suboptimal items, esp. in productive test, with very low or very high facility scores.
- Very “unadventurous/passive” behaviour in many participants from both conditions (fulfilling the microtasks like exercises):

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

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

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Conclusions

Interactivity and incidental vocabulary acquisition

- Effectiveness, in particular for **receptive acquisition**:
Dialogue system > Dial. completion > Business-as-usual
- But effectiveness differences between *Dial. system* and *Dial. completion* not as strong as expected (worth the technological effort?), although it could be explained by the limited involvement of the participants, which could be due to a series of contextual and instructional factors.
- Actual number of uses (encounters) in production are a highly **significant predictor of word learning**, much higher than number of input encounters.

Perspectives

Dialogue systems as an SLA 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! Dank u!
Merci! ¡Gracias!

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Any questions?
Suggestions?
Ideas?

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