I wanna talk like you: Speaker Adaptation to Dialogue Style in L2 Practice Conversation

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Abstract. We present a novel method to analyse speaker alignment in second language practice dialogue. Our method represents utterances as Dialogue Acts and applies Epistemic Network Analysis to their use. ENA makes convergence between speakers visible, and enables us to confirm hypotheses that both initial similarity and final convergence increase with student ability; and that Dialogue Act use changes with ability, and over the course of an interaction. Our results can inform personalised automatic tutoring tools as well as formative assessment and feedback.

Keywords: Epistemic Network Analysis, Scaffolding, Dialogue, Natural Language Processing, Alignment, Zone of Proximal Development

1 Introduction

One-to-one spontaneous dialogue practice is important for Second Language (L2) learning in both classrooms and online learning platforms. It has been shown to provide greater opportunities for L2 learning [6, 1, 14, 2, 8] since learners improve from practice and from observation of their interlocutors. We use Dialogue Acts (DAs) [7] to label utterance roles and analyse alignment at this level. DAs are used to infer discourse structure, and for automatic understanding of spontaneous dialogue [18]. DAs provide a high level, topic-agnostic representation. We use Epistemic Network Analysis (ENA) [15] to model speaker DA usage within L2 dialogues at different levels, quantifying dialogic contribution. We investigate the following research questions: RQ1: *What is the relationship between DA symmetry and student ability?* and RQ2: *How does DA usage change over the course of a dialogue?* We hypothesise DA usage will be more similar as student ability improves, as speaker contributions become increasingly symmetric [4] and that speakers will converge within a single dialogue [17]. Alignment consists of interlocutor interaction adaptation, resulting in convergence, or in their sharing

⋆ We acknowledge useful input from Ed Fincham, Pablo Leon, Nicolas Collignon, Kate McCurdy, Clara Vania, Naomi Saphra, Toms Bergmanis, Sameer Bansal, Ida Szubert, Maria Corkery, Federico Fancellu and our anonymous reviewers.

Table 1: DA dialogue examples at Levels 1 (Highest) and 4 (Lowest) in BELC
P = Participant **DA** = Dialogue Act **SPA** = Code-switching in Spanish

P Level 1	DA	P Level 4	DA	DA key
T do you like the school ?	YNQ	T do you like this school ?	YNQ	**YNQ**: *yes-no-question*
T [- spa] m-entens ?	SPA	S yes .	YesA	**RespAck**: *response*
S 0 [= says nothing] .	SNA	T yes ?	RAck	*acknowledgement*
T do you like ?	YNQ	T what are you planning to do next year ?	WhQ	**decYNQ**: *declarative YNQ*
T do you like the school ?	YNQ	S I would like to study zoology .	Smt	**BackQ**: *backchannel-Q*
S xxx .	SNA	T what time did you arrive here this morning?	WhQ	**whQ**: *wh-question*
T no si t-agrada l-escola ?	SPA	S this morning ?	GenQ	**GenQ**: *General-Other-Q*
T do you like the school ?	YNQ	T yes .	YesA	**YesA**: *yes answers*
S yes .	YesA	S I ... I am here since eight o'clock .	Smt	**NoA**: *no answers*
T yes ok .	RAck	T uhhuh right quite early .	Smt	**NA**: *non-understanding*
T now what time do you	WhQ	T and when will you leave ?	WhQ	**Smt**: *statement*
begin in the morning?	SNA	S I ... I finish my time-table in half-past-two .	Smt	**repeat**: *repeat-phrase*
S 0 [= says nothing] .	SPA			**backAck**: *backchannel-*
T [- spa] m-entens ?	SPA			*acknowledge*

of the same concept space [11, 3]. Typically, alignment is measured at either a *lexical* (use of the same words [20, 16] or phrases [5] as each other) or a *syntactic* (parts of speech patterns e.g. similar noun-phrase constructions, or similar adjuncts [12, 13]) level. Measurement methods range from count statistics [5] to linear regression on prime-to-target distance[3] [19] to using general linear mixed models to account for the random effects present in dialogue [13, 16].

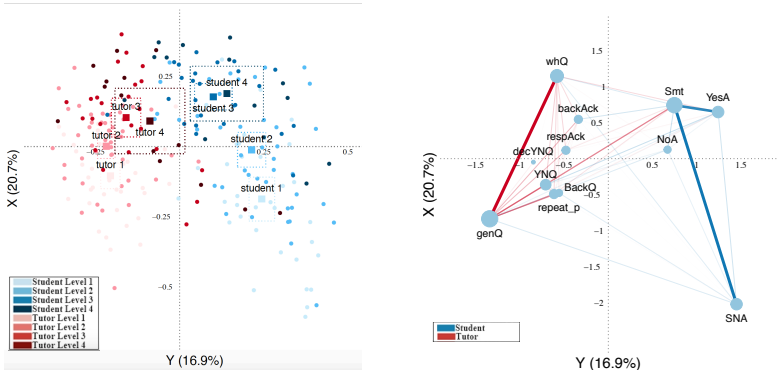
Our work contributes to the literature on speaker adaptation within L2 dialogue, providing evidence to support our hypothesis that alignment can be seen at the level of DAs both with increasing ability level and across dialogues. We present a novel method for modelling dialogue contribution by combining the descriptive powers of ENA with DAs. This has implications for formative assessment in an instructional setting, and continuous feedback for tutors and students. Our work also has implications for (i) design of learning analytic tools, (ii) informing tutoring strategy, and (iii) design of automatic tutoring systems.

2 Data & Methods

The Barcelona English Language Corpus (BELC) [10] consists of 118 transcripts (of length 60-140 utterances) from English learner conversational practice. Tutors' instructions were to elicit as much naturalistic conversation as possible, following a similar script. It is divided into four general levels of student ability, from beginner to intermediate. We use DA annotations [17], chosen from [18] for their relevance to the corpus. Table 1 shows DA labels and example dialogues from the highest and lowest level students, demonstrating differences in DA use.

Epistemic Network Analysis (ENA) [15] is a graph-based analysis method which captures relationships between different concepts (*codes*, in our case DAs) within an *analysis unit* (speakers at each level) in textual datasets. Codes are considered related if they appear in the same *stanza*: full dialogue (RQ1), or dialogue quarters divided by number of utterances (RQ2). Each utterance is

[3] The item being aligned to in this context is known as the *prime*, and the subsequent usage of this prime by the other speaker is known as the *target*, or sign of alignment.



(a) Scatter plot: average dialogue patterns across levels.

(b) Subtraction: edges=speaker with strongest code co-ocurrence.

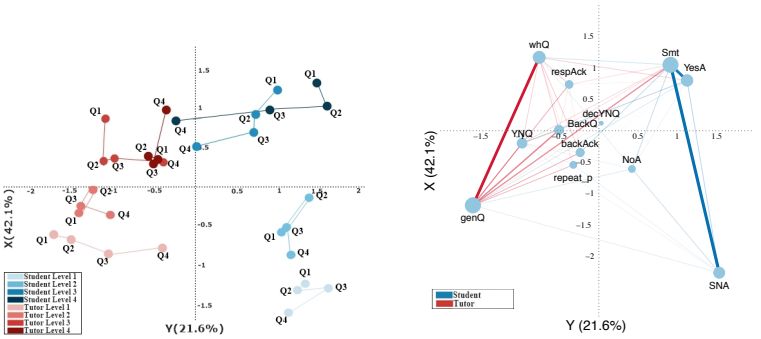
Fig. 1: ENA projection graph: Students and tutors at Higher levels are closer to DAs such as *WH-questions*, and *Statements*; whereas at lower levels, DAs such as *general questions*, and *Signal-non-understanding (SNA)*.

represented as a vector of the presence (1) or absence (0) of each code. A co-occurrence matrix is derived for each dialogue from these code vectors. Dimensionality reduction is performed using Singular Value Decomposition (SVD) [9] representing the projection graph in a two dimensional space [svd1, svd2].

3 Results & Discussion

To answer RQ1, stanza is the *full dialogue*, the unit of analysis *speaker* and *ability level*. Figure 1(a) shows individual speakers' networks at different abilities. Interlocutor means are closest at higher student ability levels. We see evidence of tutor movement within DA space (t-tests reveal significant difference between Tutor Level 1 (T1) and Tutor Level 4 (T4): ($D = 1.26$ $p < 0.001$) , which we interpret as tutors' adapting their strategy to learner ability. Students show *more* movement across ability level than tutors (t-tests reveal significant difference between S1 and S4: ($D = 1.79$ $p < 0.001$)), indicating that ability influences the sorts of DAs produced, with a more active role (*Wh-Questions (whQ), Response-Acknowledgements (RespAck)* and *Statements (Smt)*) being taken by higher level students. Figure 1(b) shows students have more connections between *statements, signal-non-understanding* and *yes-answers* than tutors, who have more connections in general, specifically between *questions, back-channeling* and *repetition.*

To answer RQ2, stanzas are *dialogue quartiles* and unit of analysis *speaker* and *ability level*. Figure 2(a) shows trajectories over the four quartiles, points represent mean speaker position in the same DA space as Figure 2(b). Figure 2(a) shows greater speaker DA similarity at Q4 than at Q1 for all levels, supporting our hypothesis of DA convergence over an interaction. This is most pronounced at high ability levels. High level students show most convergence (greater distance between Q1 and Q4). We can interpret this as indication that



(a) Trajectories: Q1: dialogue start, Q4: dialogue end.

(b) Subtraction: difference between student and tutor.

Fig. 2: ENA trajectory. t-tests show sig. diff. between Q1 & Q4 for each trajectory except L1 Students ($x(D = 0.28\ p = 0.26), y(D = 0.08\ p = 0.74)$). Highest effect sizes: Tutor L1 ($D = 1.49\ p = 0.001$) and Student L4 ($D = 1.46\ p = 0.001$).

their ability allows them to align more, or that DA usage becomes more diverse with ability. Tutors show less movement, except to converge with L1 students. We interpret this as evidence of tutor strategy: converging when the student cannot, and adapting less when they are capable. Higher ability dialogues have been shown to become more symmetric [17], mirroring native speakers. Here, we are able to see that this is the case for interlocutors' use of DAs. While evidence of alignment at a lexical level has been found in BELC [16], our work shows this at a more abstract level in terms of the conversational dynamics via DAs.

4 Contributions & Conclusions

We contribute a novel method for analysis of L2 dialogue, combining DA labels with ENA. Our findings support the hypothesis that L2 speakers in dialogue practice exhibit a degree of convergence, both as ability level increases and over the course of a dialogue. This better understanding of tutor adaptation can inform the design of tutoring dialogue systems. This method can be used by practitioners in learning analytics for the design of new tools across different dialogue modalities. The corpus used is not large or diverse enough for us to make generalisations about particular dialogue characteristics at certain levels thus we limit our interpretation to high-level adaptation phenomena. Next we plan to explore particular DA functions and difficulty in context. The shift of speaker DA position suggests different DA patterns are used to better suit student ability. We hypothesise certain DA sequences may be more indicative of learner support, and others of conversational symmetry.

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