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Achieving epistemic alignment in a psycholinguistic experiment

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Abstract: A critical condition for obtaining valid data in a psycholinguistic experiment is that the participants understand how to perform the experimental tasks. Participants usually are not familiar with the organization and requirements of the experiment and are therefore given instruction and often practice opportunities prior to the actual test trials. Pre-experimental instruction is a regular component of the experimental set-up, yet no research exists on how the activity is organized with a view to its purpose in the research context and as the experimenter's and participant's joint interactional project. This case study is the first to begin to fill the gap. The instruction in focus aimed at preparing the participant to take part in a reaction time experiment designed to measure the implicit grammatical knowledge of L2 speakers of English. Building on ethnomethodological and conversation-analytic research on instruction delivery and understanding displays in different settings, the analysis reveals how in the course of the instruction the asymmetric epistemic statuses (Heritage 2012) of researcher and participant were incrementally aligned as they collaboratively accomplished explanation sequences and worked through practice items. It also shows how both participants selectively referenced the onscreen written instructions and how these became resources for the experimenter's explanations and the participant's evolving understanding of the experimental requirements. The main goal of this paper is to bring an unexamined but indispensable component of the experimental research process to applied linguists' attention and encourage further studies in this area. A further intention is to explore pre-experimental instruction practices in a larger archive of task instructions and eventually empirically test whether the interaction during instruction delivery is at all related to variation in the reaction times as measures to operationalize cognitive processes.

Keywords: conversation analysis, epistemics, instruction, reaction time, validity

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1 Introduction

There has been a steady increase in the use of experimental technologies to investigate how second languages are acquired implicitly, "without awareness of what is being learnt" (DeKeyser 2003: 314). Among these technologies are event related potential (ERP), eye tracking, and reaction time (RT) measurements. RT measurements are based on the premise that the interval between a stimulus and a response enables inferences to underlying phenomena such as linguistic competence and cognitive processes. In psycholinguistic experiments, the time to respond to the stimuli is the dependent variable of interest, and is measured and analyzed for hypothesis testing. Reaction times are measured in milliseconds from the onset of a presented stimulus to the onset of the response. In second language research, RT studies have investigated a wide range of phenomena, including bilingual representation and processing, L2 word recognition and sentence processing, and L2 phonological, lexical, and syntactic development (Jiang 2012).

RT experiments have provided important insights into L2 representation and processing, but their effectiveness is compromised when participants depart from experimental protocol. Potentially faulty data is generated when participants react to stimuli so fast or so slowly as to make their response times improbable. Even after pruning outliers from a response time data set, considerable measurement error often remains. In terms of measurement theory, it is now well established that what we observe, even with the most modern technology, can produce method of measurement artifacts that potentially cloud researchers' views of the constructs they intend to measure. To examine measurement consistency, the reliability of measurement instruments has to be estimated and reported in experimental studies. Psycholinguistic experiments are also expected to show such reliability (Fernández and Cairns 2010; Rákosi 2014). Yet RT studies that report the reliability of their measurements are the exception. With this lack of information, it is difficult to identify the magnitude and source of measurement error.

Because research participants are usually unfamiliar with the specialized technology of RT experiments, it is standard for experimental setups to give participants explicit task instructions to minimize the risk of measurement error. Instructions are typically delivered as written text and through interaction between experimenter and participant. While written instructions are prepared for all participants in advance, the experimenter does not know how much prior knowledge individual participants bring to the tasks they will be asked to perform. As each research participant is tested individually in a laboratory setting,

interactional instruction delivery allows the experimenter to gauge from the participant's contributions to the instruction talk how they understand the task requirements and how these understandings change as the instruction proceeds. The goal of the instruction is to gradually adjust the epistemic imbalance between experimenter and participant so that the participant's understanding eventually reaches the point where they are able to perform the required experimental tasks.

The rationale for the pre-experimental instructions, then, is that the participants' achieved understanding of the experimental protocol most likely reduces measurement error in the observed RT data. Yet the literature on L2 psycholinguistics has not attended to the *in situ* interactional delivery of pre-experimental instruction as a topic of empirical inquiry. This study begins to fill this gap. It aims to describe the interactional practices through which the participants in an RT experiment achieve epistemic alignment as the task instructions unfold. Specifically, we focus on how the experimenter provides instructions to a research participant in how to perform the experimental tasks and how the participant displays his changing understandings of how to carry out the tasks.

2 Instruction, understanding, and epistemic alignment

Our study builds on the extensive ethnomethodological and conversation-analytical literature on instructions in other social domains. The term "instruction", as Lindwell et al. (2015) comment, is used in several ways, two of which apply to the pre-experimental preparation of the participants in the RT experiments. Written instructions (e.g. manuals, guides, recipes) prescribe some course of action in textual format, with or without illustrations. As a procedural genre, they stipulate how, where, and when something should be done (operated, assembled etc.) as an ordered succession of actions to achieve a specified outcome. Interactional instructions are considered in speech act pragmatics and interaction analysis as a category of directive (Goodwin 2006; Searle 1975), issued by a (relative) expert to a (relative) novice, to do some action – sometimes a highly specialized action - in a particular way. Clearly there is functional overlap between the two kinds of instruction regardless of modality, but as Suchman (2007) points out, "where written instruction relies on generalizations about its recipient and the occasion of its use, the coach draws pedagogical strength from exploitation of the unique details of particular situations" (Suchman 2007: 45). In other words, written instructions

are designed once-and-for-all for a generalized imagined audience, whereas instructions-in-interaction are designed at particular moments *for* and, not least, together *with* a specific real recipient.

How instructors design instructions and instruction-related actions in locally sensitive and recipient oriented ways is well documented in the research literature on interactional instruction delivery in such diverse settings as science class laboratories (Amerine and Bilmes 1988; Lindwall and Lymer 2011), clinical dental training (e.g., Hindmarsh et al. 2011), surgical training (Zemel and Koschmann 2014), prenatal examination (Nishizaka 2011), automobile sales (Mondada 2009), writing tutorials (Koshik 2002; Waring 2005), and dyadic teacher-student interaction in mathematics classes (Koole 2010; Koole and Elbers 2014). These studies also reveal how the instruction recipient's responses show the instructor how the recipient understands the instruction and in this way shape the instructor's subsequent action. For ethnomethodology and conversation analysis, "understanding" is an observable, contingent and consequential social action rather than an intrapsychological event (Koschmann 2011; Macbeth 2011). In fact, as a socio-interactional practice, understanding refers to several different displays of responsiveness. Sacks (1992) distinguished two *modes* of understanding, *claiming* understanding and *demonstrating* understanding. Koole (2010) draws from earlier conversation analytic work the distinction between *how* something – specifically, a prior turn (mostly *the* prior turn) – is understood, and *whether or not* something has been understood *adequately*. *An* understanding is what recipients of a prior turn display contingently through any kind of next turn that is responsive to that prior turn. *The* understanding is displayed in such actions as understanding checks, which ask the earlier speaker to confirm or disconfirm that the understanding is adequate. In his analysis of teacher's instructions to individual students who seek help to interpret and draw graphs in mathematics lessons, Koole (2010) locates the four understanding practices in distinct sequential environments. The framework is helpful for the analysis of the pre-experimental instruction in the RT tasks.

As noted above, the goal of the pre-experimental instruction is that the research participants achieve adequate understanding of the experimental tasks as a condition to perform the tasks according to protocol. Towards this end the experimenter's and participant's joint interactional work serves to align the participant's epistemic status with respect to the tasks with that of the experimenter. Epistemic status, according to Heritage, is

> an inherently relative and relational concept concerning the relative access to some domain of two (or more) persons at some point in time. The epistemic status of each person, relative to others, will of course tend to vary from domain to domain, as well as

> over time, and *can be altered from moment to moment as a result of specific interactional contributions*. (Heritage 2012: 4, our italics)

By 'epistemic alignment' we refer to the changes in epistemic status that the research participant displays in response to the written instructions and the experimenter's explanations and directions, and to the experimenter's uptake of the participant's understanding displays through such actions as confirmations and disconfirmations, corrections, and elaborations. The analysis will show how the participants gradually arrive convergent alignment through a series of sequences in which instructions presented by the experimenter are interpreted by the participant in ways that reveal incomplete or incorrect comprehension of the task instructions and how the experimenter not only resolves but also contributes to the misunderstandings. Through a series of clarification sequences and trials, the experimenter and participant eventually arrive at a point where the participant can begin the experiment in alignment with the experimenter's agenda.The main goal that we pursue in this paper is to uncover how pre-experimental task instructions are delivered as experimenter's and participant's joint accomplishment and to encourage further study of this indispensable phase in the research process. Beyond this immediate purpose, we also intend to frame a rationale for follow-up research on alignment to experimental tasks instruction, and to eventually empirically test whether the extent of experimental task negotiation is at all related to variation in the reaction times as measures to operationalize cognitive processes.

3 Participants and setting

The participants in the larger study were the experimenter and 18 research participants. The experimenter was an L2 speaker of English who spoke Farsi as his first language and had lived in the USA for four years. The research participants, also L2 speakers of English, spoke a range of first languages and had resided in the US for varying lengths of time. The participant in the single case study reported here spoke Mandarin Chinese as his first language and had resided in the US for two years. Experimenter and participants were graduate students who had met university requirements for admission, i.e. their TOEFL iBT scores were greater than 100, indicating they had advanced proficiency in English.

The RT experiment that the pre-experimental instruction prepared the research participants for was devised to measure second language speakers' implicit knowledge of English grammar. It comprised a word monitoring task

and a sentence comprehension task. The stimulus sentences in the word monitoring task were designed to be either grammatical or ungrammatical. Primed words in ungrammatical sentences are hypothesized to slow down processing speed and thus generate longer reaction times. The subsequent sentence comprehension task comprised a series of questions whose propositional content was either related to or different from the sentences used to test the word monitoring. The second task was devised to ensure that the participants actually processed the meaning of the test sentences. For the word monitoring task, the participants had to visually monitor the primed target word presented on a computer screen. Following the target word, the stimulus sentence was presented on the screen one word at a time. The participants had to press a 'yes' button on the keyboard as quickly as possible when the same target word appeared in a sentence shown immediately after the prime. If the sentence did not include the target word, the 'no' button was to be pressed. For the sentence comprehension task, which followed immediately after each word monitoring trial, the participants had to answer a question about whether or not the preceding sentence was true by pressing either the 'yes' button or the 'no' button as quickly as possible.

Prior to the experiment the pre-experimental instruction was conducted to ensure that the participants were ready to start the experiment. The instruction took place in front of the laptop computer set up for the experiment. Written instructions printed on paper or shown on the computer screen were also provided before the participants started several practice items.

The participants were tested one at a time in a computer lab with other participants present, who were performing the experiment individually on the provided laptop computers. When each participant arrived at the office, the experimenter led him or her to a specific computer. The computers were set apart from each other so that participants could not see others' computer screens. The experimenter turned on a palm-sized audio recorder before he began the instruction. The recorder was set in an unobtrusive spot right next to the computer. As the Institutional Review Board requirements called for all participants to agree to the recordings, it was determined by the researchers, who were not part of the main psycholinguistic experimental research team, to opt for audio recordings. The audio-recorded interactional data were transcribed according to CA conventions (Jefferson 2004).

Since no previous research on pre-experimental instruction delivery exists, we wanted to see how the overall activity is organized and how the experimenter and the research participants achieve epistemic alignment in the course of their interaction. Therefore we selected a single case from the corpus that allowed us to examine the interactional methods through which the parties progressed

through the instruction and that eventually enabled the participant to perform the practice trials correctly. It is important to note, however, that the interactional work that experimenter and research participants invested varied considerably among the participants. Some participants, similar to the case featured in this study, took frequent initiatives to clarify how to complete the tasks. Other participants only infrequently asked the researcher to explain the written instructions.

4 Analysis

The instruction is delivered in a written and an oral modality. The written instructions are divided into two parts, displayed as texts on two successive computer screens (Figures 1 and 2). The first instructional text, programmed in DMDX software for reaction time experiments (Forster and Forster 2003), describes the word monitoring task, the second the sentence comprehension task. The participants reference the written texts during the interactionally delivered instruction.

The instruction talk evolves through two major phases. In the first, the experimenter (R) explains to the research participant (P) the word monitoring task (Excerpt 1) and the sentence comprehension task (Excerpt 2). The first phase prepares P for the second, which is to perform a series of practice trials under R's monitoring and guidance (Excerpts 3–6).

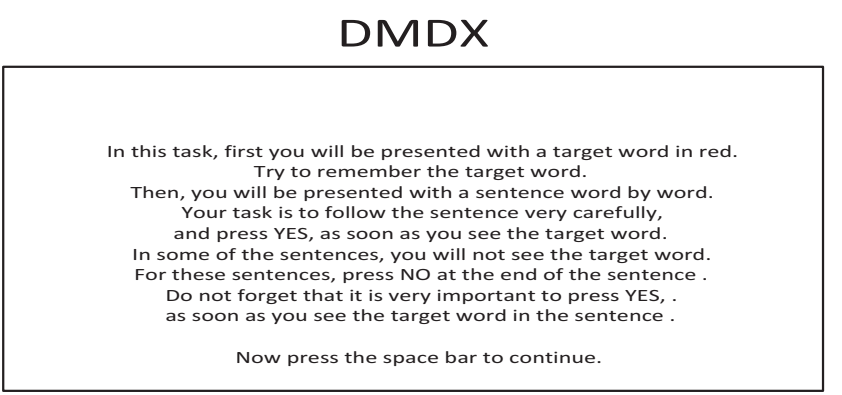

Figure 1: Instruction for word monitoring task displayed on computer screen.

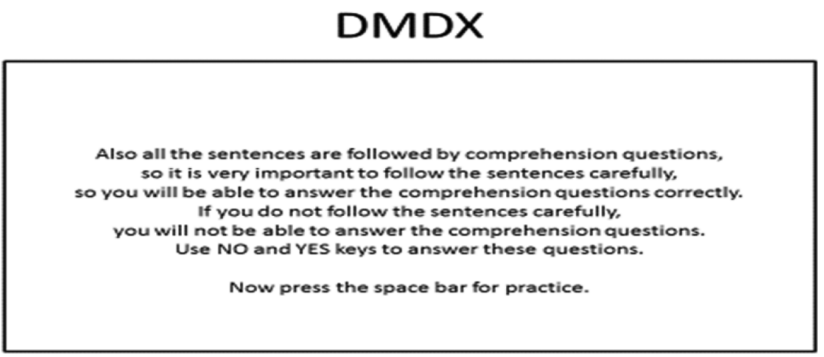

Figure 2: Instruction for sentence comprehension task displayed on computer screen.

4.1 Explaining the tasks

Excerpt 1 starts just after R has directed P to the computer and brought up the computer screen with the first written instruction (Figure 1). The talk in the excerpt develops in three phases. In the first phase R previews the two tasks that the experiment comprises. In phase two R explains the word monitoring task in some detail. In phase three P initiates a clarification sequence, which leads the participants to collaboratively conclude the instruction in the word monitoring task.

Excerpt 1 Word monitoring task

```
1  R Number sixty-four word-monitoring task. So this is
2    your first task,
3  P ye:ah=
4  R =and this is the sentence comprehension task,=
5  P =mm-hmm=
6  R =and then you will read sentences and answer
7    comprehension questions about that.
8  P [(alright)
9  R [However it is a little bit more complicated
10 P alright=
11 R =alright?=So first you see a word=
12 P =mm-hmm=
13 R =and then that word disappears,=
```

```
14 P  =mm-hmm=
15 R  =and a sentence starts appearing word by word.=
16 P  =so how how many word do I have to remember at one time.
17    (.)
18 R  you don't nee- need to remembering [any words=
19 P                                    [wha-
20 R  =You just saw one word=
21 P  =ah ah, only one word
22 R  yes.
23 P  and then whenever it (.) the word disappear on a
24    sentences, instead I click yes=
25 R  =as soon as you see that [word
26 P                          [ah, okay so that's
27    the only task for doing this one, right?
28    (.)
29 R  yes=
30 P  =[okay
```

After tagging the recording with identifying information (line 1) R begins the instruction with a preview of the entire experimental task, produced in a multi-unit turn. The preliminary sequence is organized as a three part list (Jefferson 1990) with temporally ordered components: "your first task," (l. 2), "and this is the sentence comprehension task," (l. 4), "and then you will ... ." (l. 6-7). The deictic pronoun "this" (lines 1 and 4) suggests that both participants are simultaneously reading the first instructional text, which describes the word monitoring task (Figure 1), in line 2 and the second text, which describes the sentence comprehension task (Figure 2), in line 4. It is also likely that R is pointing to the corresponding text box. P marks receipt of each list item with acknowledgement tokens of different strength ("ye:ah", l. 3; "mm-hmm", l. 5). When the list is hearably complete, indexed with turn-final falling intonation, P responds with what sounds like "alright" (l. 8). Used at this sequential juncture, "alright" signals that P recognizes the end of the preceding activity and his readiness to move on (Beach 1993), and that the participants' "shared epistemic store" (Gardner 2007: 323) has been advanced. With all three response tokens P claims but does not exhibit understanding. Koole (2010) finds that in "discourse unit explanations" in which "the teacher shows the student how to go about doing

this assignment" (p. 187), students' claims (rather than demonstrations) of understanding are treated by the teacher as sufficient ground to proceed and are in fact the preferred response option, perhaps because they are less intrusive. Here we see just the same orientation to the progressivity of the instruction talk.

In overlap with P's response R moves to the next phase in the explanation. He initiates the transition with a contrast marker ("however") and an assessment ("it is a little bit more complicated") that links back to the preview and at the same time projects the upcoming detailing of the "first" task (lines 9). In this way the assessment works as a pivotal boundary marker between the activities (Drew and Holt 2005; Jefferson 1984). The following exchange of "alright" tokens (lines 10–11) indicates that both participants orient to the assessment as shift implicative and collaboratively proceed with the activity transition.

In the next phase of the explanation R gives a version of the on-screen word monitoring task in which he describes what P will be seeing on the screen but not what he is supposed to do, suggesting R's understanding that P has read the written instructions at this stage. As R selectively operates on the written instructions, he refers to "the target word in red" and "the target word" (Figure 1) as "the word". As will be seen, the less specific reference becomes problematic for P's understanding of the task. For the step-by-step description R uses the same three point list format as before (lines 11–15). P claims understanding of the first two steps ("mm-hmm", l. 12 and 14). In response to the last step ("and a sentence starts appearing word by word.") P asks a clarification question that shows his understanding that he has to remember some of the words in the sentence but is unsure how many (l. 16). The experimenter corrects that understanding saying that P does not need to remember "any words" (line 18). The correction conflicts with the written instruction, but the discrepancy remains inconsequential as P begins and abandons another question in transitional overlap (Jefferson 1986) and so may not register the potential trouble source. Instead P responds to R's reminder "You just saw <u>one</u> word" (l. 20) with an immediate and emphatic claim of changed understanding ("=ah ah, only one word"), which R confirms.

P continues to exhibit his understanding of the instruction on the screen and R's version (l. 23–24), which prompts further specification from R as to when P has to "click yes". Following a claim of changed understanding P's next action is to step up from ascertaining the specifics of the task to an upshot formulation (Heritage and Watson 1979) that he offers up for confirmation, "okay so that's the only task for doing this one, right?" (l. 26–27). With the declarative syntax and the tag P's utterance conveys high certainty that his

understanding is correct (Heritage 2013) and strongly projects a confirming response. This is what R provides, but (in contrast to his latched earlier confirmation) only after a micropause. With the hesitation R may be orienting to the ambiguity of "this one", which can be heard to reference the word monitoring task or the entire experiment. Yet P does not register the gap and produces a sequence closing third ("okay", l. 30; Schegloff 2007) that closes the confirmation sequence and informs R that P is ready to move on to the next phase in the instruction.

The excerpt shows how P engages in achieving a correct understanding of the instruction with different practices, used in different sequential contexts. While R is explaining the task(s), P limits his contributions to listener responses that claim understanding and thus indicate to R that he should proceed with the explanation. Once R has reached the end of his explanation of the word monitoring task (the last step in the second three-point list, l. 15), P no longer treats R as primary speaker (Hauser 2009). Rather he now initiates sequences through requests for clarification (l. 16) and confirmation (l. 23–24, 26–27) that not only claim but demonstrate his understanding and probe into whether that understanding is correct. R contributes to this project by correcting, expanding upon and confirming P's understandings. The shift from understanding claims to demonstrations echoes Koole's (2010) observation that students more commonly demonstrate their understanding at the end of the teacher's "discourse unit" instruction.

Excerpt 2 is occupied with the explanation of the sentence comprehension task. As P reads the written instruction on the screen, he registers a major problem with his previous understanding. R repeats segments from the on-screen instruction, which prompts P to revise his understanding of the number of tasks he has to do and results in a joint conclusion of the entire task explanation activity.

Excerpt 2 Sentence comprehension task

```
30 P  =[okay
31 R   [but it is also important,
32    (0.2) ((R presses space bar))
33    read this page,
34    (2.0)
35 P  hmmm.
36    (1.0)
37    okay
38    (2.0)
```

```
39     °ohh°
40  R  >°because (when) as that word appears in the
41     sentence it is important to follow the sentence
42     very carefully°<
43     (.)
44  R  It >°is very important to follow the sentences
45     carefully°<, =
46  P  =mm-hmm=
47  R  =so you should (.) to be able to (.) answer this
48     comprehension questions=
49  P  =so two task, answer the comprehension question,
50     and then press yes or no.
51  R  exactly=
52  P  =alright
```

In overlap with P's sequence closing third R transitions the instruction to the sentence comprehension task. For that he uses the same method as previously, an assessment prefaced by a contrast marker ("but it is also important," l. 31). Here the pivotal device retrospectively weakens R's confirmation of P's upshot formulation and so suggests a problem with P's understanding. The projected explanation of the sentence completion task begins when R brings up the next computer screen with the written instruction (Figure 2) and directs P to read it. As P is reading through the text he acknowledges what he is reading ("hmm." l. 35), claims understanding of what he needs to do ("okay" l. 37), and professes a change in his understanding ("°ohh°" l. 39). The production of the change of state token (Heritage 1984) – spoken with lower volume and elongation – conveys a stance of surprise (Wilkinson and Kitzinger 2006), suggesting that P has recognized some aspect of the experimental procedure that had not been clear to him up to that point.

R appears to be taking the surprise token to indicate that P has finished reading but does not engage with the possible recognition that it conveys. Instead he partially reads aloud (indexed by faster production speed and lower volume) a directive from the written instruction and so brings that directive to P's special attention (l. 40–42). When P gives no response R repeats the directive with modified emphasis (l. 44–45), which P acknowledges. Continuing his selective repetition of the written instruction, R gives an account for why the careful reading of the sentences is important, namely so that P can answer the comprehension questions. In response P formulates his understanding that there are two tasks and specifies these consecutive tasks ("answer the comprehension

question, and then press yes or no." l. 49–50). Although P's understanding only partly aligns with the written instruction, it gets a strong confirmation from R ("exactly") and so is treated by R as sufficient for the moment. P responds with a latched sequence-closing third ("alright") that has both epistemic and sequence-organizational import: it proposes that P has progressed in aligning his epistemic store with R's and completes not only the immediately preceding confirmation sequence but the entire instruction in the sentence comprehension task (Gardner 2007).

4.2 Practice

Building on the epistemic alignment that the participants have achieved in the explanation phase, the experimenter moves his instructional agenda forward to the practice phase. The entire practice comprises six trials. We analyze the first four of these because they document how the participants jointly and incrementally succeed in aligning P's practical understanding of the tasks with the requirements of the RT experiment.

The first practice session aims at the word monitoring task. A prime concern for the participants is the time constraints imposed by the experimental design and how P needs to handle them.

Excerpt 3 Practice 1: word monitoring

```
53 R so let's do some practices >it is important to
54   keep your fingers close to yes and no button< =
55 P  =ah okay =
56 R  =especially yes button so you can press yes
57   so okay are you ready? = If you are ready to practice,
58   press the space bar for some practice?
59 P Does it have a time limit?
60   (.)
61   <like (.) ah, one or two minute> to finish the
62   comprehension question or =
63 R  =yeah (.) ah, I don't know the exact time, but
64   yeah. =
65 P  =Alright I (should) =
66 R  =if you don't answer it will go away =
67 P  =but which button I should press, =
68 R  =°th[is one°
69 P       [this one right? =
```

```
70 R  =Yes.
71    (1.0)
72 R beautiful=
73 P  =okay.
74    (.)
75 R <New Zealand is more beautiful than other
76    countries.> Okay so this was the senten[ce=
77 P                                          [ooh=
78 R  =you press yes
79 P  =ss>so that means< as as as soon as I watch
80    the target word I should quickly press the yes=
81 R  =°yes°
82 P as quickly as possible.=
83 R  =°ye[s°
84 P      [okay. I I got you.
```

Following announcement of the practice trials, R's first action is to bring a procedural detail to P's attention that had not been addressed in the written instruction or R's preceding task explanation, namely how P has to position his fingers relative to the yes and no keys on the keyboard (l. 53–56). With the informing R orients to the RT technology and its underlying logic, whereby delays in pressing the response keys increase the reaction time metric and so could introduce measurement error. As the informing comes before the first trial, it can be understood to extend to the entire experiment. Since the participants are sitting in front of the computer it is likely that R points to the respective key as he refers to each and that P visually locates the keys as he acknowledges the information as new and agrees to do as instructed (l. 55).

R's next action is another preliminary, "so okay are you ready?" (l. 57) However R does not relinquish the turn to give P a chance to respond. In continuation of his turn, R directs P to press the space bar contingent on his readiness to practice (l. 57–58). As the next 11 lines show this contingency is not met. P puts the projected embodied action on hold (l. 59) and initiates two successive pre-second insert expansions[1] (Schegloff 2007), both of which

1 Pre-second insert expansions are initiated by the speaker of a second pair part and designed to produce information that enables the speaker to respond to a first pair part.

solicit procedural information that P needs to conduct the practice: whether there is a "time limit" (l. 59–65) and which key to press (l. 66–69). P's general question about the time limit is followed by examples of specific timeframes ("one or two minute") for answering the comprehension question. R's affirming answer (l. 62–63) could be taken to extend to both the general and the specific question, and so the possibility of taking "one or two minute" to answer the comprehension question stays uncorrected. R's further informing that the comprehension question "will go away" (l. 66) if no answer from P is forthcoming remains inconsequential. P had already treated the time limit issue as clarified (l. 64) and initiates another procedural information sequence regarding which key to press. R confirms P's candidate selection (l. 69), which closes the second insert expansion. With his next action P shows himself "ready to practice" as he is presumably pressing the space bar (l. 69) and so responds to R's directive in line 57–58.

Pressing the space bar activates the first practice trial on the computer screen. The target word "beautiful" is shown for 3 seconds, after which the sentence "New Zealand is more beautiful than other countries" appears one word at a time, with 600-millisecond intervals between words (Figure 3).

R reads the target word "beautiful" and the sentence aloud as they appear on the screen (l. 72, 75–76). P registers the target word with "okay." (l. 73) and so treats its appearance as expected. However when R categorizes the just-read sentence as "the sentence" and instructs P to press the yes key upon its appearance, P first claims (l. 77) and then demonstrates (l. 79–80, 82) that he has revised his earlier understanding of the time he may take to respond (l. 61). Prefaced by "so that means" he formulates his new understanding by using, for the first time, the technical term "target word" (l. 80) and several temporal expressions, "as soon as," "should *quickly* press," and "as quickly as possible" (lines 79, 80, and 82). The temporal formulations can be taken to show P's realization that the time he has to respond is substantially shorter than what he previously assumed. R confirms P's revised understanding and P closes the sequence with a minimal post-expansion (Schegloff 2007) in which he acknowledges and accepts P's confirmation ("okay.") and upgrades it with an explicit claim of understanding ("I I got you.") Lindwell and Lymer (2011) show in the context of instruction in science labs that such understanding formulations serve to close the instruction sequence or, as is the case here, a phase within the larger instruction.

In the same vein as the science teachers, R treats P's understanding as he has claimed and demonstrated it up to this point as sufficient ground for advancing the instruction to the next phase in the practice, which is seen in Excerpt 4.

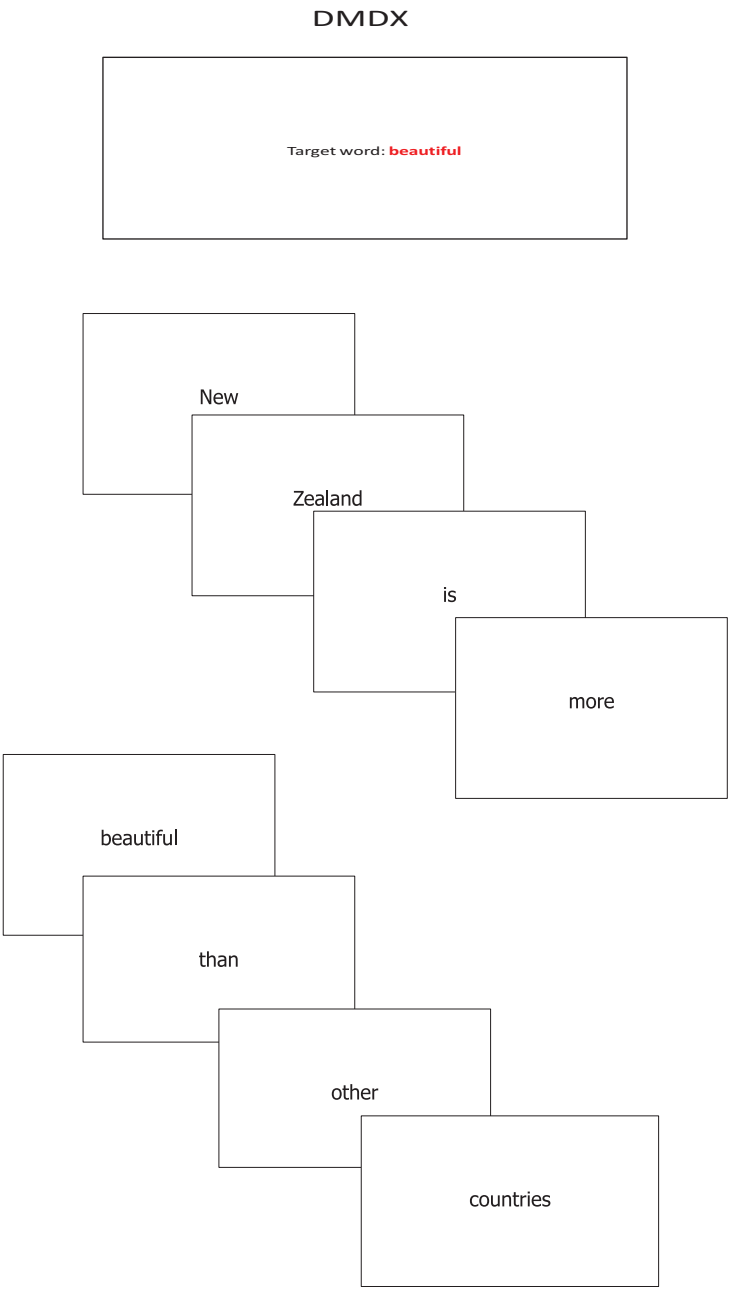

Figure 3: Practice item 1: word monitoring task.

Excerpt 4 Practice 1: sentence comprehension

```
85  R Now could you press the space bar to get the
86    question?
87    (2.0) ((sound of pressed key))
88  P uh-huh, an- and then (.)
89    do I [have to answer?
90  R      [is it yes or no? yes
91    (.)
92  P well, I'm not sure because the reason why
93    I press yes because the beautiful is appear
94    this sentence OR I have to do the judgment
95  R .hhh you press the yes once=
96  P =mm-hm[m
97  R       [cause you saw the word=
98  P =yeah
99    (.)
100 R that is over
101 P Okay
102 R Now you have a question. Is the answer
103   to this question yes or no.
104   (.)
105 P well, it depends it depends on my judgment or it
106   depends on whether this word has appeared or not.
107 R hhh (.) it doesn't depend if the word appears
108   or [not it depends on what the sentence says
109 P    [OHh ohh alright alright okay
110   I gotchu [so I should do the judgment call right?
111 R          [so (let's do another practice)
112 R °let's do another practice°
```

As directed by R, P presses the space bar, upon which a screen with the comprehension question "Is New Zealand the most beautiful? " appears. The recipient token ("uh-huh," l. 88) suggests that P has read the question, but he shows uncertainty of what he is required to do with it. Both participants' next actions address P's uncertainty with overlapping questions that put the practice

activity on hold (l. 88 and 89). The intervening instruction talk[2] (l. 90–110) is organized in the form of two successive IRF sequences (initiation-response-feedback, Sinclair and Coulthard 1975) in which R checks P's understanding of how he has to respond to the word monitoring task and the sentence comprehension task. The IRF sequences are organized in a parallel fashion. Both start with a known-information question[3] (Mehan 1979), that is a question to which R has the answer and that probes into whether P has the knowledge or understanding that the question addresses (l. 90 and 102–103). We also note that the questions are formatted as alternative questions, a polar question format that constrains the response to a choice between two candidate answers (Sadock 2012). Similar to its use in other instructional contexts (Koole 2010; Margutti 2006), the alternative question format narrows the scope of P's immediate task and so assists P in producing the correct answer. However following the first alternative question (l. 90), R models the answer in same turn, so that now an agreement by P becomes relevant. Yet P does not respond as projected by either initiation (l. 92–94, 105–106). His response turns come after interturn delays and are prefaced by *well*. Heritage notes that in response to polar questions, "well-prefacing may function as a harbinger of non-straightforward or expanded responses" (Heritage 2015: 91, also Schegloff and Lerner 2009). P's responses disalign with their questions and are both non-straightforward and expanded.[4] Echoing R's question format, each response formulates two alternative criteria on which to base his decision for a yes or no response to the stimulus, his "judgment" or whether "the word" has appeared on the screen, and his uncertainty which of the two to adopt. The possibility to use his judgment conflicts with P's own formulation from just seconds earlier (l. 79–84) and shows that even understandings that are demonstrated (and not only claimed) do not necessarily extend beyond their local occasion. The alignment of the participants' epistemic stores has suffered a setback.

R responds in third position with delayed turn starts that treat P's continued uncertainty about the task requirements as problematic. In his uptake of P's first response R selects and ratifies the first alternative ("You press the yes once [...] because you saw the word [...] that is over", l. 95–100), which P acknowledges after each TCU and accepts with a sequence-closing "okay" (l. 101). In his uptake

2 The interpolated instruction sequence is prompted by P's difficulty in proceeding with the task.

3 Also called display or test questions, known-answer questions reverse the epistemic asymmetry between questioner (as information seeker) and answerer (as information provider).

4 Structurally P's responses are dispreferred and type-nonconforming since they subvert the progression of the sequence as projected by the first pair part (Raymond 2003).

of P's second response, which addressed P's handling of the comprehension question, R selects and rejects the second alternative and contrasts it with a correct alternative that P did not propose ("it doesn't depend if the word appears or not it depends on what the sentence says", l. 107–108). However, fatal to the participants' prospect to realign their disjoint epistemic positions, the correction gets produced in overlap with P's claim of changed understanding (l. 109) so that P may not have caught the correction. After P formulates his understanding with "I gotchu" in the clear, R treats the intervention as completed (cf. l. 82–83) and proceeds to the next practice trial (l. 111). However, his directive overlaps with P's inference "so I should do the judgment call right?" (l. 110), which expands the sequence post-completion and projects a response. At this point the talk is both epistemically and sequentially misaligned. When R repeats his directive in low volume he sequentially deletes P's confirmation request.

The last two excerpts show how P progresses in the practice trials. In Excerpt 5 he successfully completes the word monitoring task but continues to display uncertainty about the sentence comprehension task and produces an incorrect answer. In Excerpt 6 he completes another trial correctly and formulates his revised understanding of how to answer the comprehension questions.

Excerpt 5 Half-way there

```
113 P  =°report°
114      (3.0) ((sound of keyboard: presses YES key))
115 R    °mm-hmm°
116       (.)
117 R    °get the question°?
118 P    press [this one?
119 R          [mm-hmm
120      (0.3) ((sound of keyboard: presses space bar))
121 P    yeah ((sound of keyboard: presses YES key))
122      ((screen displaying WRONG appears))
123 R    The sentence said the police and the question was
124      about the fireman.
125 P    OHH
126 R    °see? Sentences should be read very carefully°
127 P    °okay okay°
```

While R is repeating his directive he launches the next test sentence ("People should report stolen money to the police"). P gets as far as registering the target word (l. 113) and pressing the correct answer key, as R's confirmation (l. 115) indicates. This moment represents an important milestone in the practice phase

of the instruction as P has now successfully completed the word monitoring task without R's assistance. However the subsequent sentence comprehension task remains problematic for P, as seen in his continued uncertainty about the required key board action and how to answer the comprehension question. When P does not proceed, R directs him to obtain the comprehension question ("°get the question?°", l. 117). It takes another confirmation sequence (l. 118–119) before P presses the space bar as directed (l. 120). In response to the comprehension sentence ("Should people report the fireman stolen money?"[5]), P says "yeah" and immediately presses the yes key (l. 121). His keystroke triggers a screen with the message WRONG.

P's incorrect answer prompts R to explain the rejection to P pointing out the difference in propositional content between the stimulus sentence and the associated comprehension question (l. 123–124). P registers the explanation with a free-standing "OHH", a surprise-marked claim of having achieved a new understanding (possibly while gazing at the WRONG message on the screen) that proposes to close the sequence (Koole 2010). However, R extends the sequence with an admonition that formulates the general implication ("see?") from P's incorrect response. For that he produces a version of his earlier directive to carefully read the sentences as a general requirement for answering the comprehension questions (l. 41–42, 44–45). In the present sequential context, where the directive is prompted by P's preceding wrong answer, the utterance can also be understood to implement a reprimand (cf. Mandelbaum 2014 on requests that perform other actions besides requesting). It bears pointing out that R produces the turn in a format that offsets its disaffiliative stance, namely in low volume and with a passive construction ("Sentences should be read very carefully"). Lastly, with the generalization R carries out a new closing-relevant action (Schegloff and Sacks 1973). P's response shows that he registers the actions and stances conveyed through R's turn. With repeated *okay* tokens, spoken in low volume, he recognizes and accepts the directive and the reprimand, conveys a matching stance (Couper-Kuhlen 2012) of contrition, and aligns with the proposed sequence closing. Thus R and P exit the practice episode with the mutual understanding that "reading the sentences very carefully" is not only a practical requirement but a moral obligation that comes with participating in the RT experiment (Stivers et al. 2011 on the "morality of knowledge").

In the immediately following trial P progresses from demonstrated non-understanding and claimed understanding to demonstrating his understanding of the sentence comprehension task through his practical action and by formulating his newly gained understanding.

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5 The incorrect grammar appears to be unintended and unnoticed by the participants.

Excerpt 6 Achieving epistemic alignment

```
128 R Next practice.
129 P right back, pick
130   (5.0) ((sound of keyboard))
131 R mm-hmm
132   (.)
133 R °question?°
134   (5.0) ((sound of keyboard))
135 R mm-hmm
136   (.)
137 R °next practice?°
138 P ooh: I un- understand. So,(.) tseh the answer
139   for the question at the last is just the
140   sentences I read, righ[t?
141 R                       [always
142 P always[:
143 R       [you answer only based on the sentence
144   [not based on your [own information
145 P [ah: okay         [alright, I gotcha
```

The "next practice" in the trial series is the first in which P successfully responds to both the word recognition and sentence comprehension component, as R's acknowledgements (l. 131 and 135) indicate. When prompted for another practice (l. 137), P again puts the practice activity on hold by initiating a confirmation sequence. He starts his multi-unit turn (l. 138–140) with an explicit understanding claim prefaced by a surprise-marked *oh*. Following his understanding *claim* is a *demonstration* of his new understanding (Koole 2010) that P achieves by formulating how the answer to the comprehension question has to be determined. As P offers his understanding up for R to confirm, he orients to the continued epistemic imbalance between him and the experimenter, but with the same design features as in Excerpt 1 (l. 26–27) the utterance format shows P's confidence in his understanding and an expectation for confirmation. The expectation bears out, as R responds with a strong confirmation ("always"). P's third-turn repeat invites further elaboration (Schegloff 1997) from R, who reworks and sharpens P's understanding formulation by contrasting the correct source with the incorrect source for P's answer ("you answer only based on the sentence not based on your own information"). With this contrast formulation R also corrects P's earlier understanding in Excerpt 4 that he should "do the judgment call" (l. 111) when answering the comprehension question. It is not

clear how much of the negative component of R's explanation P registers since most of it overlaps with his understanding claims, but coming after P's successful trial and confirmed formulation of his revised understanding, the sequence-closing sequence suggests that the participants have now accomplished epistemic alignment about how P has to answer the comprehension questions.

5 Discussion and Implications

Potter and Edwards (2013) suggested that one area where conversation analysis can contribute to understanding how procedural knowledge evolves is the organization of conduct in psychological research methods. The analysis in this study examined how a research participant changed his understanding of the experimental task as a result of his interaction with the experimenter during the instruction delivery phase of the psycholinguistic experiment. The instruction progressed through two ordered phases, an explanation phase followed by a practice phase. In both phases incongruent understandings of the on-screen instructions and the experimenter's explanations surfaced and were eventually resolved through clarification and confirmation sequences, prompted by the participant's claims and displays of understanding. While epistemic alignment remained fragile throughout most of the instruction, the participant finally demonstrated through successful practice trials that he had achieved the necessary practical understanding of the task to begin the experiment. Beyond the immediate interest of illuminating how instruction in preparation for a psycholinguistic experiment in second language acquisition is delivered as the participants' joint interactional accomplishment, the analysis also contributes to the broader conversation-analytic literature on the practices of instruction delivery and understanding displays in instructional contexts.

A secondary goal of the present study is to link the interactions about task instructions to the results of the psycholinguistic experiment. Heritage and Robinson (2011) provide an illustrative example of how CA analyses of diagnostic primary care interviews can generate empirically testable hypotheses about interventions designed to modify conventional diagnostic questioning. The analysis of the case featured in this study also suggests some derivative research questions. As there were many other study participants, the question arises how the interactional work to achieve epistemic alignment may differ between these participants and the experimenter. A further question, which takes us beyond the domain of social interaction, is whether the extent and range of interactional practices that participants engaged to align their epistemic stores in the pre-

experimental instructions are at all related to the reaction times obtained in the experiment. A quantitative follow-up study will address this question.

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