A reception perspective on client-agent interactions in the DiaBiz corpus of spoken Polish

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Abstract

This paper introduces the DiaBiz corpus (Pęzik et al., 2022) – a spoken corpus of call-centre dialogues in Polish – and discusses the findings of a reception experiment (N=100) exploring some of the characteristics of the language data in the corpus. Given that the conversations were recorded specifically for the corpus rather than being authentic exchanges extracted from real-life business contexts, we first offer evidence on how the DiaBiz dialogues are experienced and evaluated by language users along a range of reception parameters: cognitive load, absorption, comprehension as well as naturalness. Our second main aim is to further nuance the account by comparing the experience of listening to the recordings of DiaBiz dialogues vs. reading their transcripts.

Keywords: Call-centre dialogues, phone-based client-agent interactions, Polish, reception experiment, spoken corpus.

Resumen

La recepción en las interacciones cliente-agente en el corpus de polaco hablado DiaBiz

En este artículo se presenta el corpus DiaBiz (Pęzik et al., 2022), un corpus hablado de diálogos en polaco en centros de atención telefónica, y se analizan los resultados de un experimento de recepción (N=100) que explora algunas de las características de los datos lingüísticos del corpus. Dado que las conversaciones se grabaron específicamente para el corpus en lugar de ser intercambios auténticos extraídos de contextos empresariales reales, ofrecemos, en primer lugar, pruebas de cómo los usuarios de la lengua experimentan y evalúan los diálogos de DiaBiz según una serie de parámetros de recepción: carga cognitiva,

ISSN: 1139-7241 / e-ISSN: 2340-2784
https://doi.org/10.17398/2340-2784.48.43

absorción, comprensión y naturalidad. Nuestro segundo objetivo principal es refinar el análisis comparando la experiencia de escuchar las grabaciones de los diálogos de DiaBiz frente a la de leer sus transcripciones.

Palabras clave: Diálogos en centros de atención telefónica, interacciones telefónicas cliente-agente, polaco, experimento de recepción, corpus hablado.

1. Introduction

The development of corpus linguistics has been primarily centred around the creation of increasingly large written corpora, many of which have exceeded the 1-billion-word threshold, though there are substantial differences between individual languages (e.g. The English Timestamped Corpus contains 73 billion words, while the size of the largest corpus of Polish, The Polish Web Corpus, plTenTen, is ca. 7 billion words). Spoken corpora, however, tend to be much smaller in size, which is natural considering the data collection challenges related to the acquisition and processing of spoken data. Nonetheless, their creation becomes an increasingly valuable solution which makes it possible to study spoken language, i.e. "the natural modality for the human species" (Raso & Mello, 2014, p. 2), on the basis of naturally occurring language samples.

In the case of Polish, existing spoken corpora are quite limited in size. The National Corpus of Polish (NKJP) as a referential corpus has a spoken component, but 27 out 30 million words of the spoken subcorpus are transcripts of parliamentary debates and committee meetings, and almost 1 million are transcripts of radio or television shows (Pęzik, 2012), which are not fully representative for natural speech. Spokes (Pęzik, 2015), which is the only Polish corpus of spontaneous conversations, contains ca. 2.2 million words, which makes it the largest corpus of this kind available for Polish, though its size is rather limited (e.g. the spoken component of the British National Corpus BNC2014 comprises 11.5 million words of conversations in informal settings). In addition, there is also the Hamburg Corpus of Polish in Germany (HamCoPoliG, Brehmer, 2011), covering (semi)-spontaneous speech recordings from Polish-German bilinguals and Polish monolinguals (ca. 38 hours, 300,000 words). In this context, the DiaBiz corpus is an important new tool, and the evaluation of the phone-based interactions it comprises is important for the proper assessment of its potential applications, both research-based and practical.

The study discussed in this paper also adds to the long-established body of research into the role of modality in communication, where parameters like persuasiveness and comprehensibility have received a fair amount of scholarly attention (Cantril & Allport, 1935; Chaiken & Eagly, 1976; Elbert & Ots, 2018; Harwood, 1951; Ischen et al., 2022) and links have been investigated to individuals' trust, cooperation and deception detection (Burgoon et al., 2003; Jensen et al., 2000). Notably, the implications of modality in communication have been the subject of inquiry across diverse settings with the medical domain being just one prominent case we could mention (e.g. Curtis et al., 2016).

2. The DiaBiz corpus

Considering the limitations of existing resources enabling the study of spoken Polish, the need to create and evaluate new spoken corpora of Polish seems natural, if not urgent. DiaBiz (Pęzik et al., 2022) and its sister corpus, SpokesBiz (Pęzik et al., 2023), both developed under the project "CLARIN – Common Language Resources and Technology Infrastructure", are an important addition to the set of available corpus tools. DiaBiz is a dialogue corpus comprising recordings and annotated transcriptions of phone-based customer-agent interactions from 9 different business domains, i.e. banking, energy services, telecommunications, insurance, medical care, debt collection, tourism, car rental and retail. Its size amounts to 4,036 dialogues, covering nearly 410 hours of recordings and over 3 million words of transcribed speech. The main aim of DiaBiz was "to boost the development of third-party speech recognition engines, dialog systems and conversational intelligence tools for Polish" (Pęzik et al., 2022, p. 723) by providing natural training data for Polish spoken in various business settings. Access to such recordings is naturally limited because of a number of legal aspects. Since naturally occurring business conversations cannot be shared by companies, the only possible solution was to create such data, building an environment enabling their proper and legal collection and further processing. To this end, the DiaBiz team set up a call centre and recruited professional agents to conduct a large number of conversations with "customers", who were the experiment participants. The interactions were scripted (ca. 250 scripts were prepared by the project team), but the scripts were not acted out. Instead, they would rather provide a set of guidelines for the agent and the customer (see Table 1 in the following section), listing the formal steps of the

procedure for the agent (for all sorts of situations covered by the dialogues, such as a lost credit card, problems with logging into a system, a complaint about an incorrect invoice, etc.) and providing necessary information for the customer (you cannot remember where and when you lost your card, you lost your password, you have never ordered the service listed in your invoice, etc.). The 5 agents who participated in DiaBiz recordings all had previous professional experience in call centre settings. The customers (191 participants in total) were asked to call the agent and perform the tasks indicated in the script, without any specific instructions about how to do it, which guaranteed a relatively high level of naturalness on the part of the callers. Participants relied on online personal data generators for customer identification purposes in order to avoid using real data. The scripts were based on samples of real-life data to reflect the natural flow of such dialogues, and we relied on the agents' profession expertise, asking them to verify the scripts before the sessions started.

As reported in Pęzik et al. (2022), the interactions were recorded via the Genesys Pure-Cloud platform on two separate channels (one for the agent, the other one for the client), and then the audio files underwent a two-stage transcription process. First, the VoiceLab ASR engine (https://voicelab.ai) was employed to produce automatic transcriptions, which were relatively successful with the average word error rate of 14%. The transcripts were also punctuated automatically by means of a transformer-based sequential classification model trained on generally available records of spoken Polish. The decision to use punctuation in corpus transcripts was related to the needs of the target users. DiaBiz, apart from providing a large number of research opportunities, is a valuable tool which may be used for the development of new language processing tools for automating linguistic interactions such as voice bots and other dialogue systems which rely on punctuation marks. Therefore, providing punctuation in the transcripts was an important planned task. After the automatic procedures, the transcripts underwent manual correction by a team of annotators, whose task was not only to provide correct transcription in the places where ASR made a mistake, but also to modify the automatic punctuation so that it would follow the guidelines developed by the team for the purposes of this task. This proved to be quite a challenge, considering the fact that all the rules of Polish punctuation are based on written texts and they often fail to reflect the phenomena found in spoken data, but after a series of inter-rater agreement tests the final list of guidelines was implemented and followed in the process.

The fact that DiaBiz transcriptions are punctuated highly increases their legibility and makes it possible to conduct in-depth studies focused on their reception without the obvious hindrance produced by lack of any punctuation marks in a text. A fragment such as (1) is naturally much more difficult to process than (2).

(1) proszę pani yy bardzo mi przykro ale osoby które się z panią kontaktowały dokonały wyłudzenia kredytu i środków z pani konta z tego co widzę to autoryzowała pani wnioski kredytowe i przelewy właśnie w aplikacji mobilnej
ma'am I am very sorry but it appears that the person who contacted you committed a credit fraud against you it appears that you authorized loan applications and transfers through your mobile app

(2) Proszę pani, (yy) bardzo mi przykro, ale osoby, które się z panią kontaktowały, dokonały wyłudzenia kredytu i środków z pani konta. Z tego, co widzę, to autoryzowała pani wnioski kredytowe i przelewy, właśnie w aplikacji mobilnej.
Ma'am, I am very sorry, but it appears that the person who contacted you committed a credit fraud against you. It appears that you authorized loan applications and transfers through your mobile app.

One of the aims of our study is to analyse whether the data in the form of punctuated transcriptions of speech such as (2) are close enough to spoken language to prove meaningful for the purposes of various (also functional) analyses of speech. This aim is embedded within the current study's overall objective which is essentially two-pronged. First, we seek to offer insights into the reception of dialogues that make up the DiaBiz corpus. To that end we use a selection of well-established reception constructs (see Section 3.1. below) that can give us a first, yet already relatively comprehensive, account. As a second key objective, we intend to capture the possible effect of modality (aural vs. visual) on reception.

3. The study

3.1. Participants, materials and procedure

The study was conducted online and involved 100 participants who received non-monetary compensation in the form of a shopping voucher and were randomly assigned to one of two experimental conditions. In both

conditions participants were required to get acquainted with two dialogues but in one of the conditions the conversation was presented in the form of a text (the "reading" condition) and in the other condition it was accessed as recorded speech (the "listening" condition). The participants were all L1 speakers of Polish – the language of the dialogues. As they were recruited online, the selection was not limited to users with specific educational or professional profiles to ensure diversity, thus making it possible for our participant pool to be largely representative of the general user who engages in call-centre conversations on a daily basis. Within the pool 57 were female, 41 were male, one person was non-binary and one individual chose not to disclose their gender. Participant age varied from 19 to 54 with M(SD)=25.23(6.54). Both dialogues (cf. Appendix) were domain-specific and explicitly related to banking. In Dialogue 1 a bank customer calls to report a problem logging into his account and receives assistance from an agent representing the bank. Dialogue 2 is largely analogous in that a bank client reports a specific matter – in this case receiving a phone call from an individual who, as it becomes clear in the course of the dialogue, swindled the customer out of a considerable amount of money by deceiving her into believing he was the bank's security officer. Table 1 illustrates the tasks in the form presented to the callers (the original instructions were in Polish).

Dialogue 1: information for the client
You're calling because you cannot log into your Internet account.
The agent will need to verify your identity. Provide the data but remember they cannot be real.
You don't know your customer password.
You confirm the email address registered in the system but you would like to change it because you haven't used it for a long time.
Dialogue 2: information for the client
You're calling your bank because you have received a strange call regarding the security of your account. You wish to get more information.
The agent will need to verify your identity. Provide the data but remember they cannot be real.
After positive identification, describe the phone call. Say that the security officer had a strange Eastern accent and said something about unauthorised transfers from your account. He asked for your personal data (PESEL number, names of parents, mother's maiden name), login, credit card information etc. You cannot remember his name.
Inform the agent that you have confirmed some logins and operations in your mobile app during the call. After getting information about the total sum of the fraud, start panicking, ask for help and try to have the operations cancelled. Inform that you will call back after reporting the fraud to the police.

Table 1. Tasks for the clients during the DiaBiz recording sessions.

Regarding Dialogue 1, 59 participants stated they had conducted a similar conversation at some point in their lives, 39 denied ever having had such a conversation, 1 individual observed she once had a conversation that was exactly

like the one in question, and 1 individual remarked that he had "once worked at a call centre at which it was similar". When it comes to Dialogue 2, as many as 82 participants denied ever having had a similar exchange, 17 stated they had had a similar conversation at some point, and 1 individual commented that she had never conducted a conversation like the one in the experiment but she "has heard of" situations like the one discussed in the recording. The questionnaire first collected basic demographic data as well as information on our participants' prior experience relevant to the task. The main component of the questionnaire elicited self-report data on different facets of experience, performance data on dialogue comprehension (cf. Perego et al. 2015) as well as feedback on how readers and listeners perceive the conversations, with special emphasis on naturalness. The self-report questions examined the participants' cognitive load and absorption. For cognitive load we adapted the indicators of difficulty, effort and frustration which were already used in reception research (Kruger et al., 2014; Szarkowska & Gerber-Morón, 2018). Absorption was tested using the scale developed by Kuijpers et. al. (2014). The original story world absorption scale was adapted to match the stimuli, which entailed referring to "the dialogue" rather than "the story", and "the client" or "the participants" instead of "the main character" as well considering the modality, either reading or listening.

3.2. Results

3.2.1. Cognitive load

When it comes to the first construct under scrutiny, as can be seen in Table 2, the cross-condition differences are statistically significant for all the three indicators: difficulty, effort and annoyance. These results are consistent across indicators as estimations of difficulty – reverse-coded compared to the other two indicators, with higher values indicating lower estimated difficulty – effort and annoyance are higher in the reading condition.

Indicator	Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
Was it difficult for you to read/listen to the dialogue? [difficulty]	4.91(1.67)	6.45(1.28)	Z = -5.2666, p < .00001
Did you have to put a lot of effort into reading/listening to the dialogue? [effort]	3.36(1.86)	1.80(1.34)	Z = 4.4624, p < .00001
Did you feel annoyed when reading/listening to the dialogue? [annoyance]	3.05(1.85)	1.57(0.93)	Z = 4.2782, p < .00001

Table 2. Mean scores and statistical results for indicators of cognitive load.

In the case of Dialogue 2 (cf. Table 3) the difference across conditions is statistically significant for effort – where the direction of effect is consistent with what we identified for this indicator in Dialogue 1 – while it is not statistically corroborated for difficulty or annoyance.

Indicator	Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
Was it difficult for you to read/listen to the dialogue? [difficulty]	5.66(1.47)	5.82(1.78)	Z = -1.0831, p = 0.2787
Did you have to put a lot of effort into reading/listening to the dialogue? [effort]	2.86(1.80)	2.18(1.65)	Z = 2.1262, p = 0.03349
Did you feel annoyed when reading/listening to the dialogue? [annoyance]	3.43(2.01)	3.59(1.93)	Z = -0.4618, p = 0.6443

Table 3. Mean scores and statistical results for indicators of cognitive load.

3.2.2. Absorption

Dialogue 1

As can be seen in Table 4 below, a comparison of composite scores clearly indicates that listening was more conducive to absorption than reading as far as Dialogue 1 goes.

Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
-0.59(1.92)	0.12(2.03)	Z= -7.3644 P< .00001

Table 4. Composite absorption for Dialogue 1.

What we see when absorption is broken down into subconstructs (cf. Table 5) is that all items within Attention produce statistically significant differences between conditions and in the case of Transportation these are four out of five. The proportion becomes smaller for Emotional Engagement, where two out of five items yield statistically significant differences, and no statistically significant differences are found for items within Mental Imagery.

Items	Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
Attention			
When I finished reading/listening to the dialogue I was surprised to see that time had gone by so fast.	-0.41(1.65)	0.98(1.85)	Z=-3.8573 P=0.0001
When I was reading/listening to the dialogue I was focused on what happened in the story.	0.73(1.59)	1.73(1.28)	Z= -3.1824 P= 0.0014
I felt absorbed in the dialogue.	0.13(1.95)	1.23(1.51)	Z=-2.8452 P= 0.0044
The dialogue gripped me in such a way that I could close myself off for things that were happening around me.	-1.11(1.72)	0.11(1.82)	Z=-3.2003 P= 0.0014
I was concentrating so hard on the dialogue that I had forgotten the world around me.	-1.79(1.42)	-0.73(1.76)	Z= -3.1138 P= 0.0018
Transportation			
When I was reading/listening to the dialogue it sometimes seemed as if I were in the story world too.	-1.34(1.64)	-0.39(2.04)	Z= -2.2763 P= 0.0228
When reading/listening to the dialogue there were moments in which I felt that the story world overlapped with my own world.	-1.16(1.99)	-0.5(1.96)	Z= -1.7484 P= 0.080
The world of the dialogue sometimes felt closer to me than the world around me.	-1.84(1.46)	-0.84(1.66)	Z=-3.1273 P= 0.0018
When I was finished with reading/listening to the dialogue it felt like I had taken a trip to the world where the dialogue took place.	-1.73(1.57)	-0.75(1.92)	Z= -2.6096 P= 0.009
Because all of my attention went into the dialogue, I sometimes felt as if I could not exist separate from the described situation.	-2.14(1.20)	-1.20(1.64)	Z=-2.9979 P=0.0027
Emotional Engagement			
When I read/listened to the story I could imagine what it must be like to be in the shoes of the main character.	-0.25(1.92)	0.05(1.93)	Z=-0.7381 P=0.4605
I felt sympathy for the client.	0.11(1.87)	0.57(1.81)	Z=-1.2039 P=0.2286
I felt connected to the client.	-0.77(1.67)	-0.32(1.99)	Z=-1.206 P=0.2278
I felt how the client was feeling.	0.38(1.77)	1.25(1.78)	Z=-2.5428 P=0.011
I wanted the client's problem to be solved.	0.55(1.85)	1.75(1.50)	Z=-3.3459 P=0.00082
Mental Imagery			
When I was reading/listening to the dialogue I had an image of the participants.	0.14(1.81)	-0.25(2.15)	Z=0.9036 P=0.3662
When I was reading/listening to the dialogue I could see the entire situation being played out before my eyes.	0.38(1.71)	0.02(2.28)	Z=0.6715 P=0.5019
I could imagine what the world in which the dialogue took place looked like.	-0.45(1.87)	-0.52(2.04)	Z=0.3062 P=0.7595

Table 5. Absorption for Dialogue 1.

Similarly to what was observed in the case of Dialogue 1, the comparison of composite absorption scores from Dialogue 2 (cf. Table 6) gives a statistically significant difference, with the auditory stimuli again resulting in higher self-reported absorption.

Reading condition (N=55*) M(SD)	Listening condition (N=44) M(SD)	Statistical results
-0.006 (1.97)	0.32 (2.12)	Z= -3.6525 P=0.0003

** Due to a technical glitch (possibly related to an unreliable Internet connection) answers by one participant in the reading condition were not recorded by the online form for the questionnaire items on absorption in Dialogue 2. The number of responses is therefore 55, not 56 as in the remainder of cases discussed throughout the paper.*

Table 6. Composite absorption for Dialogue 2.

What we then see in the sub-constructs that comprise absorption (cf. Table 7) could be described as a more pronounced version of what we observed in the case of Dialogue 1, suggesting a pattern. In parallel, here the highest proportion of items with statistically significant differences is found for the sub-construct of Attention (three out of five), and then only one such item (out of five, with one more being marginally statistically significant) is identified for Transportation but no such items are identified within Emotional Engagement or Mental Imagery.

Items	Reading condition (N=55) M(SD)	Listening condition (N=44) M(SD)	Statistical results
Attention			
When I finished reading/listening to the dialogue I was surprised to see that time had gone by so fast.	0.11(1.77)	0.27(1.85)	Z=-0.5257 P=0.5991
When I was reading/listening to the dialogue I was focused on what happened in the story.	1.16(1.60)	2.11(1.33)	z-3.5196 P=0.0004
I felt absorbed in the dialogue.	0.8(1.83)	1.77(1.38)	Z=-2.8428 P=0.0045
The dialogue gripped me in such a way that I could close myself off for things that were happening around me.	-0.67(1.45)	0.14(1.86)	Z=-2.5538 P=0.01066
I was concentrating so hard on the dialogue that I had forgotten the world around me.	-1.16 (1.33)	-0.57(1.70)	Z=-1.729 P=0.08381
Transportation			
When I was reading/listening to the dialogue it sometimes seemed as if I were in the story world too.	-0.82(1.59)	-0.52(1.85)	Z=-0.7217 P=0.4705
When reading/listening to the dialogue there were moments in which I felt that the story world overlapped with my own world.	-0.84(1.78)	-0.45(1.84)	Z=-1.1045 P=0.2694
The world of the dialogue sometimes felt closer to me than the world around me.	-1.75(1.36)	-1(1.83)	Z=-1.9674 P=0.04913
When I was finished with reading/listening to the dialogue it felt like I had taken a trip to the world where the dialogue took place.	-1.44(1.40)	-0.70(1.95)	Z=-1.7733 P=0.07618
Because all of my attention went into the dialogue, I sometimes felt as if I could not exist separate from the described situation.	-1.82(1.42)	-1.18(1.67)	Z=-1.8365 P=0.06629
Emotional Engagement			
When I read/listened to the story I could imagine what it must be like to be in the shoes of the main character.	0.16(1.88)	0.30(2.13)	Z=-0.5071 P=0.6121
I felt sympathy for the client.	1.47(1.56)	1.82(1.72)	Z=-1.7169 P=0.08599
I felt connected to the client.	0.09(1.68)	-0.02(2.12)	Z=0.132 P=0.895
I felt how the client was feeling.	1.67(1.60)	2.05(1.52)	Z=-1.7977 P=0.07222
I wanted the client's problem to be solved.	1.65(1.54)	2.0(1.45)	Z=-1.489 P=0.1365
Mental Imagery			
When I was reading/listening to the dialogue I had an image of the participants.	0.71(1.94)	0.11(2.28)	Z=1.1859 P=0.2357
When I was reading/listening to the dialogue I could see the entire situation being played out before my eyes.	0.71(1.72)	0.07(2.14)	Z=1.4414 P=0.1495
I could imagine what the world in which the dialogue took place looked like.	-0.16(1.88)	-0.36(2.17)	Z=0.5345 P=0.593

Table 7. Absorption for Dialogue 2.

3.2.3. Comprehension

In general, participants from both conditions showed a relatively high level of comprehension in both dialogues, well above 90% (cf. Table 8).

	Reading condition (% correct, N=56)	Listening condition (% correct, N=44)
Dialogue 1	92.5%	95.9%
Dialogue 2	91.6%	94.8%

Table 8. Composite comprehension of both dialogues in both conditions.

Interestingly, general comprehension did not improve in Dialogue 2, even though it was already clear what type of questions to expect and theoretically the participants could have paid more attention to such elements when reading or listening. Nonetheless, either due to fatigue or the more complex nature of the problem discussed in Dialogue 2, both groups show a small drop in comprehension compared to Dialogue 1. Another interesting observation is related to the fact that even though the level of comprehension is consistently higher for the listening group, this practically never translates into a significant difference between individual questions, as discussed below.

In the case of Dialogue 1, both groups fully understood the topic of the conversation and almost all the questions related to the most important elements of the client's story (cf. Table 9) such as the problem described (Q2) or further course of action (Q7), as well as all yes-no question (Q3, Q4, Q6, Q9 and Q10) were answered correctly. Details such as the agent's name (Q1) or the information used for the client's verification (Q5), unless they really stand out because of the association with James Bond (Q8), are the only elements missed by a more substantial number of participants. All in all, it is important to note that the results are practically the same in both conditions and while listeners show a slightly higher level of comprehension in all the questions except Q10, no difference proves statistically significant.

No.	Question	Reading condition (correct answers, N=56)	Listening condition (correct answers, N=44)	Statistical results
1	What is the agent's name?	45 (80.4%)	36 (81.8%)	X^2 (1, N = 100) = 0.0342, p = 0.853332
2	What is the caller's problem?	56 (100%)	44 (100%)	X^2 (1, N = 100) = 0
3	Does the caller remember his password?	52 (92.9%)	41 (93.2%)	X^2 (1, N = 100) = 0.004, p = 0.949635
4	Does the caller remember his PESEL number?	54 (96.4%)	44 (100%)	X^2 (1, N = 100) = 1.603, p = 0.2055
5	What kind of information does the agent ask for?	45 (80.4%)	40 (90.9%)	X^2 (1, N = 100) = 2.152, p = 0.1424
6	Is the caller a new client?	55 (98.2%)	44 (100%)	X^2 (1, N = 100) = 0.793, p = 0.3732
7	What should the client do according to the agent's instructions?	50 (89.3%)	43 (97.7%)	X^2 (1, N = 100) = 0.793, p = 0.3732
8	Which famous person is the client's email address related to?	54 (96.4%)	44 (100%)	X^2 (1, N = 100) = 1.603, p = 0.2055
9	Will the client receive an activation link?	52 (92.9%)	43 (97.7%)	X^2 (1, N = 100) = 1.23, p = 0.2674
10	Will the client have access to the account's history?	55 (98.2%)	43 (97.7%)	X^2 (1, N = 100) = 0.029, p = 0.8648

Table 9. Comprehension of Dialogue 1.

The picture emerging from the analysis in Table 10 is generally similar, though some subtle differences do surface. First of all, listeners are no longer as consistent in their advantage over readers as in Dialogue 1. Their success rate is slightly lower in questions related to less relevant details (Q1, Q2, Q3, Q4, Q6), but higher for general comprehension and more substantial elements such as the nature of the problem (Q5) and further steps that the client is advised to take (Q7, Q8, Q9 and Q10). Nevertheless, only Q10 shows a significantly different result for the investigated groups, with a clearly better comprehension displayed by listeners.

No.	Question	Reading condition (correct answers, N=56)	Listening condition (correct answers, N=44)	Statistical results
1	What is the agent's name?	50 (89.3%)	39 (88.6%)	X^2 (1, N = 100) = 0.011, p = 0.9165
2	How did the client describe the voice of the caller?	55 (98.2%)	42 (95.5%)	X^2 (1, N = 100) = 0.654, p = 0.4219
3	Was the client asked for her PESEL number during the call discussed with the agent?	50 (89.3%)	39 (88.6%)	X^2 (1, N = 100) = 0.011, p = 0.9165
4	What name was given by the man who called the client earlier?	55 (98.2%)	42 (95.5%)	X^2 (1, N = 100) = 0.654, p = 0.4219
5	Did the client accept any credit applications during the discussed call?	46 (82.1%)	40 (90.9%)	X^2 (1, N = 100) = 1.572, p = 0.2099
6	What is the total amount of loans disbursed by the client?	51 (91.1%)	40 (90.9%)	X^2 (1, N = 100) = 0.001, p = 0.9775
7	Will the client be able to transfer money from her account after the call with the agent is finished?	53 (94.6%)	44 (100%)	X^2 (1, N = 100) = 2.43, p = 0.1190
8	Whom should the client contact according to the agent's instructions?	55 (98.2%)	44 (100%)	X^2 (1, N = 100) = 0.793, p = 0.3732
9	Does the client know the locations of the nearest bank agency?	52 (92.9%)	44 (100%)	X^2 (1, N = 100) = 3.274, p = 0.0704
10	Has the agent asked the client to call again?	46 (82.1%)	43 (97.7%)	**X^2 (1, N = 100) = 6.114, p = 0.0134**

Table 10. Comprehension of Dialogue 2.

3.2.4. Naturalness

When it comes to Dialogue 1, processing the interaction in an auditory form was conducive to higher naturalness estimations than processing it in a written form (cf. Table 8). At the same time, we would argue that the estimations are generally high, with the lower of the two still being 4.96 on a 1-7 scale. With the items that inquired specifically about the linguistic layer, we see analogous statistically significant differences between reading and listening for the one focusing on the agent's output as well as the one focusing on the client's output. The final item, eliciting a relatively direct judgment of the dialogue, uncovers no statistically significant difference between conditions, indicating that readers and listeners considered the material to be authentic to a comparable – and relatively high – degree.

Dialogue 1			
Items	Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
To what is extent was the dialogue natural?	4.96(1.45)	5.52(1.81)	Z= -2.3125 P= 0.02075
To what extent was the language used by the agent suitable for the situation?	4.02(1.62)	5.36(1.48)	Z= -3.9965 P= 0.00006429
To what extent was the language used by the individual talking to the agent suitable for the situation?	3.96(1.49)	4.73(1.59)	Z= -2.3036 P= 0.02124
The dialogue I read/listened to is a transcript/recording of an authentic conversation that took place.	4.73(1.58)	5.05(1.90)	Z= -1.1564 P= 0.2475

Table 8. Naturalness for Dialogue 1.

As far as Dialogue 2 is concerned (cf. Table 9), contrary to what we saw in the case of Dialogue 1, there is no statistically significant difference between conditions when it comes to the general evaluation of the dialogue's naturalness. At the same time the evaluation is clearly positive, as it was for Dialogue 1. We identify a statistically confirmed cross-condition difference in the evaluation of the agent's language, with the listening condition yielding higher scores on average as it did in Dialogue 1, but no such difference was found as far as the client's language is concerned – which is in turn disanalogous to the findings from Dialogue 1. When it comes to how much participants tended to agree the conversation was one that actually took place, similarly to Dialogue 1, the scores are high and display no cross-condition difference, suggesting that the modality played no traceable role in this respect.

Dialogue 2			
Items	Reading condition (N=56) M(SD)	Listening condition (N=44) M(SD)	Statistical results
To what is extent was the dialogue natural?	6.02(1.09)	5.98(1.30)	Z= -0.177
To what extent was the language used by the agent suitable for the situation?	P= 0.8595		
To what extent was the language used by the individual talking to the agent suitable for the situation?	5.88(0.95)	6.52(0.82)	Z= -3.6886
The dialogue I read/listened to is a transcript/recording of an authentic conversation that took place.	P= 0.0002255		

Table 9. Naturalness for Dialogue 2.

4. Discussion

Call-centre interactions have already received scholarly attention from the vantage point of language, especially drawing on English input (e.g. Cameron, 2008; Cowie, 2007; Friginal, 2008, 2009; Lockwood, 2012; Presbitero, 2017). A critical barrier for this type of work is the availability of call-centre data, especially when it comes to larger datasets or covering several business domains, some of which may draw on sensitive information more than others. In this paper we present evidence to argue that the DiaBiz corpus offers valuable data that display a high degree of authenticity despite being a result of a data collection procedure that was more controlled than would have been the case if the conversations had been obtained from commercial sources. This is especially pertinent when we acknowledge that call-centre interactions vary across languages (Antonopoulou & Sifianou, 2003; Economidou-Kogetsidis, 2005; Sifianou, 1989) and therefore the problem of certain languages being under-resourced needs to be continually addressed.

While the range of instruments and experiential parameters can be extended in future studies testing corpus data, we believe the current account successfully captures some of the key aspects. Our findings point to some modality-based reception patterns and offer insights into the experience of receptors in a broader sense regarding naturalness. The first construct that we examined – cognitive load – provides some evidence for a listening advantage, i.e. lower cognitive effort in the listening condition, as the indicators of difficulty, effort and annoyance scored significantly higher among readers in the case of Dialogue 1, and for Dialogue 2 an analogous statistically significant difference was found for effort (but not for the remaining two indicators).

Analogous statistically significant differences are found in the case of absorption, with listening once more producing significantly higher composite scores for both dialogues. At the same time, we see an interesting pattern when it comes to differences between the sub-constructs of absorption, with Attention contributing most to the overall differences, both in Dialogue 1 and Dialogue 2.

The analysis of comprehension shows that some simple procedural effects may have impacted the results. Since both groups already knew what kind of comprehension questions to expect, they could (consciously or not) try to prepare for the second round by paying more attention to detail. This is naturally much simpler when you are a reader since it is possible to go back

to some elements of the dialogue before you move on to the questions. Thus, the fact that readers were more successful with detailed questions in Dialogue 2 may have stemmed from this behaviour. Listeners, on the other hand, retained a higher level of comprehension for the questions related to general understanding, which makes this a consistent and tangible result. All in all, it seems that comprehension is indeed slightly better when you process the recording, but if you work with transcripts, the loss is largely insignificant.

At this point it should be noted that even though transcripts are a written form, they still bear close resemblance to speech and they do differ from the typical specimens of written Polish our participants are used to. The basic unit of text organization is not a well-formed and complex sentence but rather a short utterance, often containing repetitions, mistakes and hesitations. As a result, even when punctuation is provided, the cognitive load incurred by such a text may prove relatively high, general comprehension may be hindered and attention may suffer.

Nonetheless, an important finding is that the client-agent interactions were generally evaluated to be natural irrespective of the modality in which they were processed by our participants. A statistically significant modality-based difference was found in the case of naturalness estimations for Dialogue 1, where listening was conducive to higher scores for the overall naturalness of the conversation, as well as the naturalness of language used by both the client and the agent. An analogous effect was identified in Dialogue 2 when it came to the evaluation of the agent's linguistic output only. What we could conceive of as a "weakened listening advantage" between Dialogue 1 and Dialogue 2 might be explained by our participants' growing exposure, matching the procedural effect we mentioned with respect to comprehension above, but it might also have to do with the very content of the respective dialogues, with valence, or emotionality more generally, as a parameter to be further investigated.

5. Conclusions

While spoken corpora of Polish are slowly developing, access to recordings of business communication is seriously restricted. Even though such data are extremely valuable from the point of view of conversational analytics and automation solutions, call centre interactions contain sensitive

information and personal data which cannot be released for legal and ethical reasons. Under the current EU legislation, such recordings cannot be publicly shared or even analysed without explicit consent from the customers. In practice, this means that real-life recordings from most business domains are unavailable to NLP specialists. Thus, in order to acquire meaningful data for the creation and training of automated solutions and linguistic analyses of Polish used in various commercial domains, it is necessary to create such datasets, and DiaBiz is the first large-scale attempt at this endeavor.

Despite careful design and great attention to detail, the risk of basing a spoken corpus on scripted data was that the level of naturalness of such conversations may turn out not to be high enough. Therefore, our study aimed to check the reception of the dialogues by Polish native speakers, whose task was to evaluate the data along a range of parameters. The results presented in the preceding sections prove that DiaBiz serves its purpose, containing relatively natural spoken data which do not strike our participants as acted out or in any way artificial. We based our experiment on two dialogues which were not mechanical exchanges between the agent and the customer (one is rather informal in character, while the other contains some extremely emotional reactions of the caller), so the risk of their potential unnaturalness was rather high. That is why the results yielded by the experiment (limited as it is in its scope) prove very optimistic in this respect.

What is more, the analysis shows that the dialogues may quite safely be analysed on the basis of transcripts (without reference to the recordings), with no significant loss in the level of comprehension and naturalness (though higher cognitive load and lower absorption). We believe that this result is at least to some extent related to the fact that DiaBiz transcripts contain punctuation, which makes it much easier for the corpus user to process the dialogue. This is an important finding since most spoken corpora do not contain any punctuation marks. Naturally, the decision depends on the range of target users and applications, but in the case of corpora aimed at training automated language processing tools, it should be an option worth considering.

Acknowledgement

This research received support from the Faculty of Philology Scientific Development Fund (University of Lodz) as part of the project "Reception of translated domain-specific dialogues: cognitive and methodological implications" awarded to Anna Cichosz.

Article history:
Received 22 December 2023
Received in revised form 11 March 2024
Accepted 12 March 2024

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APPENDIX

DIALOGUE 1 – translation into English

AGENT Hello, this is Sarah Kennedy from BT. How can I help you?

CLIENT Hello.

AGENT Hello.

CLIENT My name is Anthony Shepherd. I don't know why, but I can't log in to my online account.

AGENT I don't know that yet either. What do you see on the screen, any errors?

CLIENT (erm)

AGENT Or, I don't know, maybe the website just goes blank? What do....

CLIENT No, it just says that the password is incorrect and that some activation link has been sent to the e-mail address I gave at some point when logging in, but to be honest, I haven't the faintest idea which one it was - completely slipped my mind. I'm taking a butchers at my inbox, the one I'm using on a daily basis, and there's nothing there, there's no password reminder or any activation links.

AGENT OK.

CLIENT And I'm calling to ask you to fix it, because I need to log in.

AGENT Alright, I'll try to sort it out. Please tell me, is this online account linked with the phone number that you're calling from now?

CLIENT Listen, it was ages ago, but I guess so. I'm wondering, I was probably using a different e-mail address back then.

AGENT But no.

CLIENT And I don't know if...

AGENT I meant the phone number.

CLIENT Oh, it is, then.

AGENT Is your online account linked with this phone number?

CLIENT I think so, yeah.

AGENT Alright, then please give me your customer password.

CLIENT But what's the password?

AGENT Alright, if you don't remember your customer password, I'll verify your identity in a different way. Please give me your full name again, please.

CLIENT Anthony Shepherd.

AGENT Thank you very much. Now, your national insurance number, please.

CLIENT Zero, one, zero, three, eight, four, double one, double two, five.

AGENT Thank you very much. And now your home address that you provided for the contract, please.

CLIENT Sure. My home address is 4 Willesborough, 17306 Ashford.

AGENT Thank you very much and please bear with me for a moment. The system is loading.

CLIENT Yeah, this system, damn. Oh well.

AGENT From what I see, you've tried to log in. But what happened here? Listen, your online account linked to your phone number seems not to exist. I'll check what might've happened. Something's gone awry.

CLIENT It seems...

CLIENT Listen, I've been your client for a long time and I suppose that the e-mail address that I gave you back then is not...

AGENT No, it's not even about the e-mail address, it's something strange.

CLIENT OK.

AGENT You have an account created in 2007, there are some attempts to log in and now I have a message saying that the account doesn't exist. But you created it and you haven't deleted it in the meantime, from what I see, so it should be somewhere. Please give me a sec, alright?

CLIENT Sure.

AGENT I'll look into that.

CLIENT Go on, please. Please save me from the abyss, at all costs.

AGENT At all costs you say?

CLIENT Yes.

AGENT You don't know how much it could be and you're already in.

CLIENT Oh, damn. I think that you're so kind that you won't charge me as much. But it may be my wishful thinking.

AGENT No, I'm not that cheeky to charge you anything extra for it. You have all the helpdesk service included in your subscription fee.

CLIENT Ah, lovely jubbly.

AGENT We're obliged to help you, since you're our client. Alright, what do we have here? I have nothing left to say but to apologize, because it seems that your customer account has been deleted by mistake during maintenance works on our websites and servers, around two weeks ago. Due to a mistake, it has been deactivated.

AGENT But of course you'll be able to...

CLIENT What now?

AGENT Let me explain.

CLIENT OK.

AGENT You'll be able to create it again and you'll be able to access everything that you had on the previous account before it got deleted.

CLIENT OK.

AGENT So it works like that...

CLIENT So everything will be brought back.

AGENT Yes. It will be the same account, but you'd have to come up with a new password and click on the

link. But please tell me, you mentioned that the e-mail address you provided was inactive. We have to update the e-mail address in the first place, then. Please give me your current e-mail address.

CLIENT Sure. Ant007.

AGENT OK. Like the agent. Go on, please.

CLIENT James Bond, yeah. At gmail, dot, com.

AGENT Thank you very much, Agent 007. Alright.

CLIENT Agent Anthony. It's just that I needed to create an e-mail address on the spot and it stuck. It's not very official, but well.

AGENT And it stuck.

CLIENT Yes.

AGENT Alright, I'll send the activation link to this e-mail address, then. What are the next steps. Alright, I've sent it. You should receive it in a moment. If it's not in your inbox, please check the spam folder. Now, you'll find a link in this e-mail. Please click on the link, our website will pop up with the log in box, but it'll look different than it usually does, because instead of the phone number, log in and password there'll be the New Password and Repeat New Password boxes. So you type in your phone number in the Log in box and in the Password box you type in your new password.

CLIENT Okey dokey, sure.

AGENT The password should have at least eight characters, but no more than twenty. The password safety policy says that it has to include some lower case letters, capital letters, a digit and a special sign to ensure diversity.

CLIENT Sure.

AGENT In the second box.

CLIENT A dot and so on.

AGENT Exactly. In the second box, please type in the same password. After you click on OK, you'll receive a text message with the authorization code that will confirm the password change and the reactivation of your account. You'll have to type in this authorization code. And that's basically it. You'll be logged in to your account, you'll have access to all the invoices, packages that you activated or that you want to activate. Basically everything what you had before will be there. Nothing dating twenty-four months back will disappear, that's for sure.

CLIENT (...)

AGENT Alright, that'd be it.

CLIENT Oh, that's great.

AGENT Unless you have any more questions.

CLIENT No.

CLIENT No, my dear. Thank you. I'm logging in to my e-mail and trying to get my account back.

AGENT Alright.

CLIENT If I get stuck, I'll turn to my missus.

AGENT If anything is wrong, please call us.

AGENT We're available around the clock.

CLIENT Great, thank you very much for your help.

AGENT Thank you very much as well.

CLIENT Have a nice day at work.

AGENT Thank you. Goodbye.

CLIENT Cheers.

AGENT Take care.

CLIENT Thanks. Goodbye.

DIALOGUE 2 – translation into English

AGENT National Bank, this is Caroline Adams, how can I help you?

CLIENT Hi. I received a dodgy call regarding the security of my account, and I'd like to find out more about it, because I'm very concerned.

AGENT Certainly. But before I can access your account, I need to ask you a couple of security questions, alright?

CLIENT Please.

AGENT Thank you. Let's have your personal identification number first, please.

CLIENT It's double four.

AGENT Yes?

CLIENT Oh, four.

AGENT Yes?

CLIENT Two, seven, six, four, one, two, oh.

AGENT Thank you. Now I need your seven-digit customer number. It's the one you use to log in to our online banking services.

CLIENT Just a moment, I have to dig it out.

AGENT Take your time.

CLIENT How many digits, again?

AGENT Seven digits.

CLIENT Alright, the customer number. It's seven, eight.

AGENT Yes?

CLIENT Five, four.

AGENT Yes?

CLIENT Six, two.

AGENT Yes?

CLIENT That's seven, is that it?

AGENT Yes, thank you. I'm also going to need the first, fourth, and eighth digit of your telephone service password.

CLIENT Give me a mo, I have to check it.

CLIENT I scribbled it down somewhere.

AGENT Of course.

CLIENT What was it, again?

CLIENT The first one?

CLIENT Right?

AGENT The first, fourth, and eighth one.

CLIENT The first one is two.

AGENT Yes?

CLIENT Now the fourth one?

AGENT Yes.

CLIENT Five.

AGENT Yes?

CLIENT And now the eighth?

AGENT Yes.

CLIENT Eight.

AGENT Alright.

CLIENT One more?

AGENT Just the first, fourth, and eighth one.

CLIENT Right, so that's that.

CLIENT OK.

AGENT Thank you.

CLIENT Good.

AGENT The identity verification process has been successful. Now, I would like you to tell me what happened exactly and what you would like me to do for you. What caused your concern?

CLIENT The thing is, a bloke called and identified himself as an employee of your security department, but he sounded dodgy. He went on about some unauthorized transactions in my account and asked me for my personal details, just like you did, such as my personal identification number.

AGENT I see.

CLIENT And also the names of my parents, my mother's maiden name, and then my login credentials. And also the details of my card.

AGENT Ma'am, the employees of our bank never ask for such information.

CLIENT I haven't got the faintest idea who it was.

CLIENT He did introduce himself, but…

AGENT So you don't remember this person's name?

CLIENT I don't, that's the problem. He did introduce himself, of course, but whoever remembers a random name. And I didn't jot it down.

AGENT I understand.

CLIENT Right.

AGENT Ma'am, I'm afraid you may have fallen victim to a scam.

CLIENT Good lord!

AGENT Our employees never ask for such sensitive data.

CLIENT I see.

AGENT We don't normally call you about this information. Now, I would like you to tell me if you authorized anything through your mobile app when you were speaking to the person who claimed to be an employee of our bank. Any transfers or applications?

CLIENT Yes, I did. There were some applications, and they told me to download the mobile app. I thought it was safe and I simply authorized it during the call.

AGENT I see.

CLIENT Yes.

AGENT Alright, give me a moment, please. I'll check the status of your account.

CLIENT Alright.

AGENT Ma'am, I am very sorry, but it appears that the person who contacted you committed a credit fraud against you. It appears that you authorized loan applications and transfers through your mobile app.

CLIENT Oh, God.

AGENT The sum total of the active loans is twenty-five thousand pounds, and the outgoing transfers amount to twelve and a half thousand pounds.

CLIENT Sweet Jesus!

AGENT I am very sorry.

CLIENT What am I supposed to do now? Can you help me somehow? Can it be fixed?

AGENT First of all, I am going to place a safety lock on your account, in case there is further unauthorized activity. From now on, no outgoing transfers will be permitted from your account. Second, you should immediately contact the police and report it. As soon as your case has been assigned a reference number, please call our helpline again. We will record your complaint, and of course we are happy to cooperate with law enforcement authorities. Unfortunately, there is little we can do until the police are involved.

CLIENT Are you sure?

CLIENT Can't you somehow check who did this?

AGENT Let me explain.

AGENT Unfortunately, we can't do this without the help from the police. For the time being, I have placed a security lock on your account, and nobody can now make any transfers from your account, so if you would like to use your assets, you are going to have to visit one of our branches and present a

valid ID document.

CLIENT Alright.

AGENT Then you can withdraw whatever the amount you may need.

CLIENT Alright.

AGENT Would you like me to direct you to our nearest branch?

CLIENT I know where it is, I live nearby.

AGENT Alright.

CLIENT Right, I'm calling the cops now.

AGENT Please do.

CLIENT Perhaps they can help me.

AGENT Like I said, please speak to the police first, and once your case has been assigned a reference number, please call us again.

CLIENT Sure, I'll buzz you as soon as I have reported it. Thank you for your help.

AGENT You're welcome.

CLIENT Good bye.

CLIENT Right.

AGENT We'll be expecting your call. I hope this matter is resolved as soon as possible.

CLIENT Right, I'm calling you first thing once I've spoken to the fuzz. Cheers.

AGENT Alright.

CLIENT Good bye.

AGENT Thank you for your call.

CLIENT Good bye.