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English Native Speakers' Pronunciation of Selected Polish Consonant Clusters

The present paper is concerned with articulation of selected Polish consonant clusters by native speakers of English and is situated within the scope of Polish phonetics. The analyses that became the basis of this paper were conducted for the purpose of the master's thesis. They originated from the emerging need of researching the notions of phonetics in the context of teaching Polish as a foreign language. The aim of the study was to determine which consonant clusters present in the research material are pronounced inconsistently with the norm. Those investigations were accompanied with an attempt of detecting some typical phenomena appearing in English native speakers' articulation of Polish consonant clusters and some causes of such realisations among the selected respondents. The mentioned claims were accomplished. In her investigations the author took into consideration also language biography (e.g. other languages spoken by the students), the ability to differentiate Polish sounds (individual and geminate sounds) and the notion of transfer (also phonetic interference) related to various differences between the composition of consonant clusters in Polish and English. The qualitative analysis was based mainly on the transcription of the recordings of the students' performances (readings of the prepared text) and the author's subjective auditory impressions. In order to examine sound perception, Kwiatkowska's test (2015) was applied. Based on the analysis of the performances of five speakers the author determined which Polish consonants appeared as most difficult to differentiate and which clusters turned out to be the most problematic to pronounce. It was determined that incorrect articulation concerned both consonant clusters inside words (word-initial, word-medial, word-final) and across word boundaries, especially modifications of the place of articulation, mistakes in voicing and devoicing were noticed, also simplifications of clusters (vowel insertions or consonant deletions). Moreover, a number of mistakes concerned incorrect pronunciation of the sounds: [ʃ̟], [ʒ̟], [t͡ʃ̟], [d͡ʒ̟] and [ɕ], [ʑ], [t͡ɕ], [d͡ʑ]. The conclusions of the analyses may help in formulation of some adequate pronunciation exercises addressed to the native speakers of English studying Polish as a second language (some exemplary ones, not included in the present paper, were proposed by the author in her other publication, see Derych 2021).

Keywords: consonant clusters, Polish phonetics, Polish as a foreign language

Aussprache ausgewählter polnischer Konsonantencluster durch Muttersprachler des Englischen

Der folgende Beitrag befasst sich mit der Aussprache polnischer Konsonantensequenzen durch Muttersprachler des Englischen und gehört zum Bereich der polnischen Phonetik und Phonodidaktik. Die dem Text zugrunde liegenden Analysen wurden im Rahmen der Masterarbeit durchgeführt. Sie resultierten aus dem wachsenden Bedarf der Phonetik die besondere Aufmerksamkeit im Kontext der Glottodidaktik der polnischen Sprache zu schenken. Ziel der Studie war es herauszufinden, welche Konsonantensequenzen in der polnischen Sprache mit dem Referenzstandard nicht konform ausgesprochen werden. Begleitet wurden diese Befunde von dem Versuch, typische Phänomene bei der Aussprache von Konsonantenclustern durch englischsprachige Personen und die Gründe für eine fehlerhafte Umsetzung in der Gruppe der Befragten zu ermitteln. Die angedeuteten Ziele wurden im Laufe der Untersuchung erreicht. In ihren Überlegungen berücksichtigte die Autorin auch die sog. sprachliche Biographie (andere den Befragten bekannte Sprachen), die Fähigkeit zur Unterscheidung polnischer Laute (inkl. Geminate) und das Problem der Übertragung (auch phonetische Interferenzen) in Bezug auf das Auftreten

von vielen Unterschieden in der Zusammensetzung der Konsonantensequenzen im Polnischen und Englischen. Die qualitative Analyse erfolgte hauptsächlich auf der Grundlage transkribierter Aufzeichnungen von studentischen Aussagen (Lesen des vorbereiteten Textes), die Betrachtungen basierten auf den subjektiven Höreindrücken der Autorin. Der Test von Kwiatkowska (2015) wurde verwendet, um die Wahrnehmung der Sprachlaute zu testen. Anhand der Analyse der Ergebnisse von fünf Sprechern konnte festgestellt werden, welche Konsonanten der polnischen Sprache für die Befragten hinsichtlich ihrer Differenzierung am schwierigsten und welche Cluster sich in der Aussprache als problematisch herausstellten. Es wurde festgestellt, dass die falsche Aussprache im An-, In- und Auslaut sowohl wortintern als auch an Wortgrenzen betraf, hauptsächlich im Zusammenhang mit der Änderung der Artikulationsstelle von Konsonanten, Fehlern in der Intonation, Realisierung der Stimmhaftigkeit und Vereinfachungen durch Epenthesen oder Tilgungen eines vokalischen Segments oder auch mit dem Weglassen eines Konsonanten. Darüber hinaus betrafen viele Fehler die falsche Aussprache der Laute [ʃ͡ʃ], [ʒ͡ʒ], [t͡ʃ], [d͡ʒ] und [ɛ], [ʑ], [t͡ɕ], [d͡ʑ]. Die Schlussfolgerungen der Studie können zur Entwicklung geeigneter Ausspracheübungen für englischsprachige Personen beitragen, die Polnisch als Fremdsprache lernen. Beispielübungen, die im Beitrag nicht angeführt werden, werden in der Monographie von Derych (2021) vorgeschlagen.

Schlüsselwörter: Konsonantensequenzen, Phonetik des Polnischen, Polnisch als Fremdsprache

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1. Introduction

Currently, significantly more attention is being paid to Polish pronunciation among researchers and teachers, as Polish courses become organised more frequently. Each year, the School of Polish Language and Culture for Foreigners (University of Wrocław) organises a one year preparatory course and gathers students speaking various native languages[1]. Such multilingual groups provide also rich research material in terms of language learning (and studying). As Majewska-Tworek and Majewska claim, there is not much coverage on the topic of acquisition of Polish phonology, so comprehensive research should be conducted (2014: 287). The authors also commented on the importance of the knowledge of previous research preoccupied with the phonological system's acquisition: "[d]uring class which consisted mainly of phonological hearing practise and correction of articulation (from the production of sounds in isolation to the perfection of their pronunciation in texts of disparate difficulty) it became essential to study source literature in order to determine what is already known about acquisition of Polish phonological system by foreigners" (Majewska-Tworek/Majewska 2014: 287, transl.)[2].

[1] See: „Lektorzy, prowadząc zajęcia, zawsze zwracali i zwracają uwagę na stan wymowy swoich studentów, jednak w 1996 roku uczestnicy kursu letniego pierwszy raz otrzymali w ofercie odrębne zajęcia z fonetyki" (Majewska/Majewska-Tworek 2014: 277). "Language instructors, while teaching, have always paid attention (and still pay) to their students' pronunciation but in 1996 participants of a summer course took part in the first separate pronunciation class" (Majewska/Majewska-Tworek 2014: 277, transl.). All translations are rendered by the author of the present paper and marked as (transl.).

[2] In original: „W trakcie zajęć, polegających głównie na ćwiczeniu słuchu fonologicznego i korygowaniu artykulacji (od wywoływania głosek w izolacji po doskonalenie ich wymowy

The following study was conducted as part of a master's thesis in Polish Philology[3]. As Polish phonetics and pronunciation constitute a relatively vast field of research, the scope of the study had to be narrowed. Consequently, consonant clusters were chosen to be closely analysed as Milewski and Kamińska suggest that in Polish they are both pragmatically and theoretically significant (2016: 194).

The primary aim of the study was to establish how native speakers of English, who learn Polish as a foreign language, articulate Polish consonant clusters and what difficulties emerge in their pronunciation. From this main, theoretical goal, follows a more practical one: preparation of a few exemplary exercises concerning the most difficult elements within the scope of perception and articulation of consonant clusters designed for native speakers of English.

2. Study structure and methodology

The experiment took place at the School of Polish Language and Culture for Foreigners (University of Wrocław, academic year 2018/2019). The participants were selected from a group of students who started Polish courses (different proficiency levels) in the academic year 2018/2019 and whose native language was English. The following study consisted of three complementary parts: a survey, sound differentiation test and reading of a short text which has been recorded, transcribed and then analysed. The survey was originally prepared by the Spoken Polish Laboratory of the Institute of Polish Philology (University of Wrocław)[4] and the Phonetics Laboratory of the Institute of German Philology (University of Wrocław)[5] and later on edited by the author of the present article so as to adjust it to the present research. The sound differentiation test was, on the other hand, created by Kwiatkowska (2015: 308) as a tool to test multilingual groups and extended by the author of this paper (using words provided also by Kita 1998). The text read by the students was entirely created by the author of the present article.

2.1 Language biography and transfer

The language biography questionnaire's goal was to examine linguistic background of each student. Each of the participants was asked about their close family (grandparents, parents, partner and eventually, children), what language (or languages) they used or use to communicate with them, which ones they used or use in general and how frequent their contacts are. The most important aspect of the survey was the part containing

w tekstach o różnym stopniu trudności), konieczne stały się studia nad literaturą przedmiotu, by dociec, co już wiadomo o akwizycji polskiego systemu fonologicznego przez cudzoziemców" (Majewska-Tworek/Majewska 2014: 287).

[3] A master's thesis entitled „Realizacja wybranych grup spółgłoskowych polszczyzny przez natywnych użytkowników języka angielskiego" was written (in Polish) in 2020 under the supervision of dr hab. prof. UWr Anna Majewska-Tworek. In 2021 the thesis was published as a monograph (under the same title) (Derych 2021).

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questions concerned with languages spoken and know by the students (along with their levels of proficiency) as the study aimed to recall also the notions of language transfer, especially phonetic interference.

Among various researchers who took up the problem of language transfer, Bednarska (cf. 2015: 296) provided a brief survey of source literature and previous studies in the field. The author mentioned e.g. Weinreich, Kellerman, and Odlin and marked for the fact that many linguists are interested in examining language interference (negative transfer): "Most frequently they analyse interferences which occur between the native language of a student (L1) and a foreign one (L2) but lately more attention is being drawn also to multilingualism and the influence of L1 and L2 on learning a consecutive language (L3)[6]" (Bednarska 2015: 295, transl.). Consequently, negative transfer should be studied not only with reference to student's native tongue, but also other languages he or she learned subsequently.

Bednarska (2015: 299) took into account also interferential error[7] in pronunciation which she linked to word stressing and articulation. Zawadzka defined transfer as: "[…] an influence of native language and/or previously acquired on reception and/or production in target language" (2015: 59, transl.)[8] and distinguished between positive and negative transfer. In other words, Zawadzka stressed not only production, but also perception of sounds in target language. Also Tambor made a point of phonetic interference and stressed a particular problem in negative transfer which is the fact that: "[a] learner substitutes the sounds similar in language learned with sounds which are phonetically and acoustically resembling from their language" (2010: 33, transl.)[9]. Thus, more distinct sounds typically cause fewer problems in pronunciation than more alike ones (Tambor 2010: 33).

2.2 Sound differentiation test and phonological hearing

Sound perception seems to be crucial in phonetic research of the sources of difficulties and errors in second language teaching as: "[c]orrect perception and articulation of speech sounds serves as an essential condition to accurate understanding and production of not only spoken, but also written texts" (Kwiatkowska 2015: 59, transl.)[10].

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[6] In original: „Najczęściej analizują oni interferencje zachodzące między językiem ojczystym ucznia (L1) a językiem obcym (L2), jednak w ostatnim czasie coraz więcej uwagi poświęca się także wielojęzyczności i wpływowi L1 i L2 na uczenie się kolejnego języka (L3)" (Bednarska 2015: 295).

[7] For stylistic reasons I am using the terms "error" and "mistake" interchangeably.

[8] In original: „[…] wpływ języka ojczystego i/lub uprzednio nabytego obcego na recepcję i/lub produkcję w języku docelowym" (Zawadzka 2015: 59).

[9] In original: „Uczący się zastępuje głoski podobne w nabywanym języku głoskami zbliżonymi artykulacyjnie i akustycznie ze swojego języka" (Tambor 2010: 33).

[10] In original: „Poprawna percepcja i artykulacja dźwięków mowy jest warunkiem niezbędnym do prawidłowego rozumienia i nadawania nie tylko tekstów mówionych, ale także pisanych" (Kwiatkowska 2015: 59).

Consequently, the second element of the following study was a sound differentiation test created by Kwiatkowska (2015) which has been extended by the author of the present article in order to explore not only single sounds but also double consonants. It bases on the notion of categorial perception (Kwiatkowska 2015: 306) and consists of ten ten-pair sets (one hundred words which are minimal pairs) differing with one sound (consonant or vowel, there is also a number of identical pairs) (Kwiatkowska 2015: 311)[11]. The extension part is composed out of three ten-pair sets differing in consonant length (single consonant – double consonant) some of which were taken out of Kita's publication (1998). The sounds tested are: [d̪], [t͡ɕ], [d͡ʑ], [k], [n̪], [s], [ʃ̺], [v], [z], [ʒ̺], [ʑ][12] and the same sounds marked as double (also in transcription, eventually [k] was palatalised in a cluster [kc]). Research participants heard each of the sets once and had to decide whether they heard two identical or two different words (Kwiatkowska 2015: 311).

Sound perception is also a relatively vast field of study so various researchers attempted to provide definitions of related terms. Especially on Polish grounds some terms sound similar but in fact they differ from one another and scholars proposed varied definitions[13] related to phonological hearing and sound perception. For the purpose of the following study only three researchers' ideas will be briefly mentioned: Styczek's (1982), Rocławski's (2010) and Biernacka's (2014) (for more, cf. Lipińska 1987 and Biernacka 2014). Styczek stated that: "minor lack of full development or phonemic hearing's disturbance cause lack of stability of the words' auditory patterns and, in relation to that, in differentiation of words […] differing with only one distinctive feature […]" (1982: 10, transl.)[14]. Rocławski (2010: 18 and 19) distinguished between two similarly sounding terms related to hearing (słuch fonemowy and słuch fonetyczny)[15] and related the first one to the ability of linking sounds to proper phonemes and the latter to differentiating realisations of the same phoneme. Biernacka aimed to catalogue various types of hearing and thus enumerated and defined eight of them, i.e.: musical (muzyczny), prosodic (prozodyczny), phonetic (fonetyczny), phonematic (fonematyczny), phonemic (fonemiczny), phonological (fonologiczny) and the last one related to speech (mowny) (2014: 38–39).

[11] Cf. Kwiatkowska (2015: 311) for a more detailed test description, also its bases.

[12] In transcription I differentiate between Polish apical [ʃ̺ ʒ̺ t͡ɕ̺ d͡ʑ̺] (Lorenc 2016: 128) articulated with the tongue placed slightly to the back in comparison to English counterparts [ʃ ʒ t͡ʃ d͡ʒ] and dental Polish sounds such as [d̪] and English alveolar [d]. Rules and symbols employed in this article come from publications by Kita (1998), Porayski-Pomska, et al. (2013), Rybka (2015) and Lorenc (2016).

[13] Cf. similarly sounding terms: słuch fonemowy (phonemic hearing), słuch fonematyczny (phonematic hearing), słuch fonologiczny (phonological hearing) etc. in Polish research papers.

[14] In original: „[…] nieznaczne niedokształcenie lub zaburzenie słuchu fonematycznego powoduje brak stabilności w rozróżnianiu wyrazów […] różniących się tylko jedną cechą dystynktywną […]" (Styczek 1982: 10).

[15] The terms can be translated respectively as phonemic hearing and phonetic hearing.

2.3 Text as a source of the consonant clusters studied

The crucial part of the study consisted of reading aloud a short text prepared by the article's author. The text (description of the day) along with its lexical and grammatical content was designed to be consistent with A1 and A2 levels of Polish proficiency so as to adjust it to every person's level as the study was not concerned with lexical and grammatical knowledge but rather with pronunciation. Employing too complicated text could have led to participants making more mistakes in pronunciation originating not in phonetic competence but rather in lack of understanding of words and grammatical constructions typical for higher levels (cf. Kwiatkowska 2015: 307). Thus, the prepared description (around 250 words) was read and recorded. Each recording lasted around four to five minutes depending on the speaker's fluency.

Consonant clusters appearing in the original text were transcribed in accordance with the rules of Polish pronunciation and transcriptions provided in a dictionary by Karaś and Madejowa (1977). Consequently, only clusters appearing in the text were taken into consideration in further analysis. Moreover, I decided not to explore specific clusters which occur during articulation of palatalised consonants such as e.g. in a word *biały* ('white') where initial consonant undergoes palatalization and palatal semivowel [j] emerges. This process was not the subject of the present study. Apart from the aftermentioned ones, the original text contained approximately 200 clusters among which the most frequent were two-element combinations (around 160), then three- (around 30) and four- (only two groups, each one occurred only once). Clusters were categorised by, firstly, their position in a word (cf. Dunaj 1985: 14): word-initial (after a vowel followed by a pause) (Dunaj 1985: 14), word-medial, word-final (followed by a pause) and the ones between words (final-initial ones). The word-medial clusters proved to be the largest group (approximately 80), followed by the clusters between words (and sentences), then word-initial ones (around 50) and only three in the word-final position. What is more, place and manner of articulation were also marked. Thus, as for manner, the most common clusters of two sounds (each represented by approximately 25 to 15 occurrences, here also double consonants were taken into consideration) were combinations of a fricative with a plosive, a plosive with a semi-consonant, two plosives, a semi-consonant with a plosive and a plosive with a fricative.

2.4 Study group

The chosen group was relatively small and consisted of five students (minimal age of 17) who started a one year preparatory course organised by the School of Polish Language and Culture for Foreigners (University of Wrocław) in the academic year 2018/2019. They represented different levels of proficiency in Polish: one person was a beginner (A1), the rest represented different stages of, in general, intermediate levels. L1 was marked by all of them as English (different varieties though: American by three students, Scottish and Australian each by one of them). Moreover, some of the students can be treated as bilingual: the first one moved from the USA to Switzerland at

the age of eleven and acquired also Swiss variety of German (her main communicative language is also German) and another two were acquiring Polish at home. Students have the following combination of parents: two Polish who moved to Australia, Polish and Scottish, Polish and American, American and Argentinian and two Americans. All members of the group lived in Poland during the study so they were to a certain extent surrounded by Polish also outside class. What is also important, almost everyone declared that they knew at least one foreign language at the intermediate level.

The questionnaire used in the study also included a question about communicative importance of languages known by each participant: all of the students marked English as number one, Polish appeared as the second one in four out of five cases (one case was German and Polish was not mentioned by this person at all). Taking into account the notion on transfer and phonetic interference, one may assume that a vital source of interference may be English sounds projected onto certain the Polish ones. Moreover, the members of the study group were also asked what element(s) of Polish pronunciation they perceive as the most difficult one(s). Their answers concerned:

1) three groups of consonants, the first one: [s], [z], [t͡s], [d͡z], the second: [ʂ], [ʒ], [ʈ͡ʂ], [ɖ͡ʒ], and the third: [ɕ], [ʑ], [t͡ɕ], [d͡ʑ];
2) consonant clusters, double consonants;
3) discrimination of vowels.

3. Differentiation of Polish sounds and pronunciation of selected consonant clusters

This part of the article discusses perception of Polish sounds and pronunciation of the selected consonant clusters. I will briefly present the results of the sound differentiation test and, finally, the analysis of the realisation of chosen consonant clusters.

3.1 Sound differentiation

In general, differentiation of consonants caused significantly more trouble than of vowels. The first student[16] (an American, basic level of Polish) managed to distinguish all of the vowels correctly. His errors involved examples of words which included the following pairs of single consonants: [ɖ͡ʒ] and [d͡z] (pair: *dżudo – dziudo*), [s] and [t͡s] (pair: *senny – cenny*), [n̪] and [ɲ] (pair: *len – leń*) and double consonants from the extended part of the test: [zz] and [z] (pair: *rozzłoszczony – rozłoszczony*. Interestingly, the first person marked as different also pairs [v] and [v] (in *wozić – wozić*), [vv] and [vv] (*wwozić – wwozić*), also [ʂʂ] and [ʂʂ] (*niższy – niższy*. Difficulties emerged though within the sounds which belong to laminal retroflex and alveolo-palatal affricates, dental fricatives and affricates, dental and palatal nasals, and, moreover, some double consonants.

[16] Later on, I will use abbreviations: P1 for the first student, P2 for the second, P3 for the third, P4 for the fourth and P5 for the fifth person.

The second student (P2, American, lower intermediate level of Polish) expressed difficulties in differentiating vowel [ɛ] from its nasal counterpart. As for single consonants, mistakes have been made in pairs [d͡ʒ] and [d͡ʑ] (*dżudo – dziudo*), [ʒ] and [ʑ] (twice: *barze – baize a*nd *żarno – ziarno*), [t͡s] and [t͡ɕ] (*macki – Maćki*), [s] and [t͡s] (*senny – cenny*), [ʂ] and [ɕ] (twice: *szata – siata* and *kasza – Kasia*), [ɲ] and [ɲ] (*len – leń*), and [t͡ʂ] and [t͡ɕ] (twice: *czapki – ciapki* and *boczek – bociek*). Double consonants which have not been distinguished were [zz] and [z] (in *rozzłoszczony – rozłoszczony*) and semi-vowels [j] and [jj] (*najaśniej – najjaśniej*). The student had problems with the sounds which belong to laminal retroflex and alveolo-palatal affricates and fricatives, palatal and dental nasals, dental affricates and fricatives and two double consonants, one of which is a semivowel.

The third person (P3, Scottish, intermediate level of Polish) made only one mistake in distinguishing between vowels [ɛ] and [i] situated word-finally (*nowe – nowi*) and only two in single consonant differentiation, [ɕ] and [ʂ] (*siata – szata*) and [t͡ʂ] and [t͡ɕ] (*czapki – ciapki*). The rest of errors were related to double consonants: [zz] and [z] (*rozzłoszczony – rozłoszczony*) and examples which show incorrect perception of difference in two identical words: [ʂʂ] and [ʂʂ] (*niższy – niższy*), [jj] and [jj] (*najjaśniejszy – najjaśniejszy*), [vv] and [vv], (*wwozić – wwozić*), [ss] and [ss] (*hossa – hossa*], and [j] and [j] (*najaśniej – najaśniej*). Here some difficulties in differentiation between alveolo-palatal affricates and laminal retroflex palatal affricates and fricatives emerged.

The next one (P4, American, intermediate level of Polish) interpreted all vowels correctly and expressed at the same time problems with eight consonantal examples. These were: [ɲ] and [ɲ] (*len – leń*), [ɕ] and [ʂ] (*siata – szata*), [ɕ] and [ʑ] (*śle – źle*) from the original part of the test and: [zz] and [z] (*rozzłoszczony – rozłoszczony*), [ɲ] and [ɲ] (rana – rana), [s] and [s] (*kasa – kasa*), [ss] and [ss] (*hossa – hossa*), also [ʂ] and [ʂ] (*pisze – pisze*). The fourth student expressed difficulties similar to the previous ones concerning laminal retroflex and alveolo-palatal affricates and fricatives along with a dental and palatal nasal and a double consonant [zz].

In turn, the fifth student (P5, Australian, intermediate level of Polish) marked only five examples incorrectly. As for the vowels, it concerned distinguishing [ɛ] from its nasal pair word-finally (*pisze – piszę*). Three more mistakes involved single consonants [d͡ʒ] and [d͡ʑ] (*dżudo – dziudo*), [l] and [w] (*lata – łata*), also [ɕ] and [ʂ] (*siata – szata*), and double one [zz] and [z] (*rozzłoszczony – rozłoszczony*). The student from Australia failed to distinguish between laminal retroflex palatal affricates and alveolo-palatal affricates and fricatives, two approximants [l] and [w], and one double consonant [zz].

According to Biernacka (2016, cf. 2015), Seretny/Lipińska (2005) the three groups mentioned, precisely: [s], [z], [t͡s], [d͡z] (fricatives and affricates, alveolar and dental), [ʂ], [ʒ], [t͡ʂ], [d͡ʒ] (laminal retroflex fricatives and affricates), and [ɕ], [ʑ], [t͡ɕ], [d͡ʑ] (alveolo-palatal fricatives and affricates) are difficult for foreigners who learn Polish

(including native speakers of English) (Seretny/Lipińska 2005: 33-34, Biernacka 2016: 111, cf. 2015: 254-255). One of the reasons can be the fact that there exist no [ɕ], [ʑ], [t͡ɕ], [d͡ʑ] sounds in English (Tambor 2010: 43, cf. Maciołek/Tambor 2014: 34)[17]. What is more, double consonants appear as problematic (Biernacka 2015: 258) since in English their occurrence is limited to word boundaries (Swadesh 1937: 4).

On the whole, all of the research participants did not perceive the difference in length between [zz] and [z], and place of articulation differing a minimal pair [ɕ] and [ʂ]. Three of them did not distinguish between [d̪͡ʒ̪] and [d͡ʑ], [n̪] and [ɲ], [t̪͡ʂ] and [t͡ɕ]. Moreover, three student perceived pairs [ʂ̪ʂ̪] and [ʂ̪ʂ̪] and [ʂ̪] and [ʂ̪] as the same. Two of them marked pairs [v] and [v], [vv] and [vv], [jj] and [jj], [j] and [j] as different. The rest of mistakes consisted of wrongly perceived pairs [ss] and [ss], [s] and [s] as the same (two of them). Two students had difficulties in distinguishing between [ʒ̪] and [ʑ] (different place of articulation, same manner),[s] and [t͡s] and [ɛ] from a nasal vowel. The rest of wrong test answers appeared only once (pairs: [l] and [w], [n̪] and [n̪], [t͡s] and [t͡ɕ], [ɕ] and [ʑ], and vowels [ɛ] and [i]. The consonants checked were placed word-initially, word-medially and word-finally. This leads to a number of conclusions consistent also with the pronunciation analysis which will be presented in the following sections.

Firstly, research participants difficulties in discrimination of the sounds belonging to three groups: the first one: [s], [z], [t͡s], [d͡z] (fricatives and affricates, alveolar and dental) the following: [ʂ̪], [ʒ̪], [t̪͡ʂ̪], [d̪͡ʒ̪] (laminal retroflex fricatives and affricates), and the latter: [ɕ], [ʑ], [t͡ɕ], [d͡ʑ] (alveolo-palatal fricatives and affricates). Within single consonants errors occurred e.g. while distinguishing between:

1) laminal retroflex and alveolo-palatal fricatives: [ʂ̪] from [ɕ] and [ʒ̪] from [ʑ] so consonants differing in manner of articulation;
2) laminal retroflex and alveolo-palatal affricates: [d̪͡ʒ̪] from [d͡ʑ], [t̪͡ʂ̪] from [t͡ɕ] and [ʒ̪] from [ʑ] so (as above) consonants differing in manner of articulation;
3) an alveolar affricate [t͡s] and a dental fricative [s] (within the same group of sounds) so consonants differing both in manner and place of articulation;
4) alveolo-palatal fricatives [ʑ] and [ɕ] so consonants different only in voice;
5) a dental and a palatal nasal [n̪] and [ɲ] so consonants differing in place of articulation;
6) an alveolar approximant [l] and a velar approximant [w].

As for double consonants, discrimination between [zz] and [z] turned out to be difficult for all of the students and three of them did not perceive the difference between [zz] and [z]. Moreover, in a number of examples designed to test double-single consonant differentiation, students decided that different sounds were perceived while two words were phonetically identical.

[17] For more information on distribution and rules of composition of consonant clusters in Polish cf. Dunaj (1985), Kozyra (2015), Śledziński (2010, 2013, 2019); in English: cf. Swadesh (1937), Rubach (1977), Roach (1988), Kreidler (2004).

3.2 Pronunciation

Errors (or in many cases rather certain imperfections) in pronunciation in general did not cause misunderstanding of the words and sentences. They occurred, though, in all positions within words (initially, medially and finally) and across word boundaries (no consonant cluster emerged between sentences). Study showed that the greatest number of mistakes and imperfections emerged within the same group of sounds students had difficulties in discriminating: laminal retroflex and alveolo-palatal fricatives and affricates. In the following section, exemplary results (incorrect realisations juxtaposed with model pronunciation) of every person will be presented with brief comments prior to conclusions regarding the whole study group in general.

The analysis highlighted that P1 committed the largest number of errors in the group. They occurred word-initially, word-medially, word-finally and between words within two- and three-element clusters (and one in four-element one). Some of the selected groups pronounced incorrectly are listed below as examples.

No.	P1's pronunciation	Model pronunciation
1.1	pʃ-	pʃ̻-
1.2	-ɲ ɕ t͡ɕ -[18] (-)(--)	-ɲɕt͡ɕ-
1.3	v$_ə$st̪-	fst̪-
1.4	tf-	t̪rf-
1.5	v$_ə$t͡ʃ-	ft̻͡ʃ̻-
1.6	-ʃt͡ʃ-	-ʃ̻t̻͡ʃ̻-
1.7	-ɹɲ-	-rɲ-
1.8	-rʲk-	-rk-
1.9	-v-	-zv-
1.10	-vək-	-fk-
1.11	-v$_ə$s-	-fs-
1.12	-ʃvpr-	-ʃ̻fpr-

Tab. 1. Examples of P1's mistakes in pronunciation of selected consonant clusters

P1 expressed difficulties mostly in articulation of laminal retroflex and alveolo-palatal fricatives and affricates in conjunction with various other consonants (examples 1.1, 1.2, 1.5, 1.6, 1.12). Laminal retroflex ones tended to be pronounced similarly

[18] The mark (-) as a diacritic under an IPA symbol of a consonant stands for the weaken palatalization of the sound, e.g. [ɕ(-)].

to their English counterparts [ʃ], [ʒ], [t͡ʃ] and [d͡ʒ] (with a tongue moved further to the front than in Polish ones) (examples 1.1, 1.5, 1.6, 1.12). Alveolo-palatals, on the other hand, were articulated less palatally (example 1.2). A tendency to vowel intrusion ([ə]) and therefore addition of a syllable in order to make consonant cluster less complicated can also be noticed in P1's articulation (examples 1.3, 1.10, 1.11). Moreover, some Polish dental sounds such as [t̪] were pronounced like English alveolar [t] (example 1.4)

P2 committed fewer mistakes than P1. Still, certain specific difficulties within consonant clusters can be listed, such as the ones presented below.

No.	P2's pronunciation	Model pronunciation
2.1	pʃ-	pʂ-
2.2	ɕ̞ɲ- / ʃɲ-	ɕɲ-
2.3	kɕ̞- / ɕ̞-	kɕ̞-
2.4	vɨst̪- / vəst̪-	fst̪-
2.5	pɹ-[19]	pr-
2.6	-nn- / -n- / -n̪-	-t̪n̪-
2.7	-ɕ̞ t͡ɕ̞-	-ɕt͡ɕ-
2.8	-t-	-wt̪
2.9	-ʃt	-ɕt͡ɕ
2.10	-ʒfpr-	-ʂfpr-
2.11	-vᵢk-	-fk-
2.12	-vᵢpʲ-	-fpʲ-
2.13	-mvᵢpʲ-	-mfpʲ-

Tab. 2. Examples of P2's mistakes in pronunciation of selected consonant clusters

Observations similar to the ones in P1's case can be made regarding P2's consonant clusters' pronunciation. P2 shown some difficulties within laminal retroflex (example 2.1) and alveolo-palatal affricates and fricatives (examples 2.2, 2.3, 2.7). Vowel-intrusion (after a labial fricative) (examples 2.4, 2.11, 2.12, 2.13) and consonant reduction (simplification of clusters) were also observed (examples 2.3, 2.6, 2.8), moreover certain incorrect devoicing and voicing occurred (examples of voicing: 2.4, 2.10, 2.11, 2.12, 2.13).

P3's mistakes (selected ones) are listed below as exemplifications of the processes which occur in the student's pronunciation.

[19] In order to distinguish between Polish trill [r] and English approximant [ɹ] I decided to introduce the latter sign in transcription.

No.	P3's pronunciation	Model pronunciation
3.1	pʃ-	pʂ-
3.2	t͡ʃ-	t͡ʂ-
3.3	ʃp-	sp-
3.4	ɕ̍ɲ-	ɕɲ-
3.5	-ʒd͡ʒ-	-ʒ̪d̪͡ʒ̪-
3.6	-n̪-	-t̪n̪-
3.7	-p-	-t̪p-
3.8	-ɕ̍t͡ɕ-	-ɕt͡ɕt͡ɕ-
3.9	-v-	-d̪v-
3.10	-vɨvʲ-	-vɨvʲ-
3.11	-ʃbʲ-	-ʒ̪bʲ-

Tab. 3. Examples of P3's mistakes in pronunciation of selected consonant clusters

P3 also showed tendency to articulate laminal retroflex fricatives and affricates similarly to [ʃ], [ʒ], [t͡ʃ] and [d͡ʒ] the student's native language (examples 3.1, 3.5) and alveolo-palatals less palatally (examples 3.4, 3.8). Vowel intrusion was also marked ([i] inserted e.g. after a voiced labial fricative [v], example 3.10), also simplifications of some clusters such as in plosive-affricate, plosive-plosive and plosive-nasal pair of consonants (the first sound was deleted in the examples 3.6, 3.7, 3.9).

The next student (P4) mistakes lack vowel-insertion between two consonants. She made other errors exemplified in the table though.

No.	P4's pronunciation	Model pronunciation
4.1	pʃ-	pʂ-
4.2	ɕ̍ɲ-	ɕɲ-
4.3	-tn̪- / -n̪-	-t̪n̪-
4.4	-vvʲ-	-vwʲ-
4.5	-ɔ̃w̃t͡ɕ-	-ɲt͡ɕ
4.6	-sn-	-sn̪-

Tab. 4. Examples P4's mistakes in pronunciation of selected consonant clusters

P4, as it was mentioned above, did not utter any vowel to split a cluster of consonants. However, alveolar articulation of typically dental sounds of Polish can be observed (example 4.3). Moreover, the same phenomenon within the pronunciation of alveolo-palatal (examples 4.2, 4.5) and laminal retroflex (example 4.1) consonants

which was observed in P1's, P2's and P3's realisation can be noticed in this student's case.

P5, who pronounced selected cluster most correctly, made also certain errors similar to those committed by P1, P2, P3 and P4.

No.	P5's pronunciation	Model pronunciation
5.1	pʃ-	pʂ-
5.2	kɕ-	kɕ-
5.3	-ʒd͡ʒ-	-ʐd͡ʒ-
5.4	-ɲ ɕ t͡ɕ-	-ɲɕt͡ɕ-
5.5	-j ɕ t͡ɕ-	-jɕt͡ɕ-
5.6	- ɕ t͡ɕ-	-ɕt͡ɕ-
5.7	-ʃt͡ʃs-	-ɕt͡ɕs-
5.8	-ʃbʲ-	-ʒbʲ-
5.9	-kt-	-kʈ-

Tab. 5. Examples of P5's mistakes in pronunciation of selected consonant clusters

The last student, P5, committed similar mistakes within laminal retroflex affricates (example 5.3), fricatives (example 5.1) and alveolo-palatal consonants (examples 5.2, 5.4, 5.5, 5.6), and some dental stops (example 5.9). Moreover, incorrect devoicing of a voiced affricate was present in the material (example 5.8), also substitution of the alveolo-palatal fricative [ɕ] with the fricative [ʃ] followed by similar substitution of the alveolo-palatal affricate [t͡ɕ] with the affricate [t͡ʃ] (example 5.7).

On the whole, taking into account all five participants, most frequent incorrect pronunciation involved the following clusters:

1) word-initially: [ɕɲ-], [pʂ-], [tʂ-], [ft͡ʂ-];
2) word-medially: [-ɕlʲ-], [-ɕɲ-], [-ɕt͡ɕ-], [-fʂ-], [-ʃt͡ʂ-], [-jtʂ-], [-ɲɕt͡ɕ-], [-ɲt͡ʂ-], [-ɲt͡ɕ-], [-ʂc-], [-ʂk-], [-spʂ-], [-ʒd͡ʒ-], [-lɳ-], [-jɕt͡ɕ-], [-mpɳ-];
3) word-finally: [-ɕt͡ɕ], [-ɲt͡ɕ];
4) between words: [-ɕt͡ɕs-], [-ɕt͡ɕt͡s-], [-ɕvɖr-], [-ft͡ʂ-], [-ŋkʂ-], [-ʂfpr-], [-t͡ɕɕ-], [-t͡ɕmʲ-], [-t͡ɕpʂ-], [-ʒbʲ-], [-ʒɖ-], [-lɳ-], [-vvʲ-], [-ɖv-].

It can be concluded that most of errors within consonant clusters involve a change of a place of articulation in the two following groups:

1) [ʂ], [ʒ], [t͡ʂ], [d͡ʒ] (laminal retroflex fricatives and affricates);
2) [ɕ], [ʑ], [t͡ɕ], [d͡ʑ] (alveolo-palatal fricatives and affricates).

The first one was often pronounced with a tongue placed more to the front of the oral cavity (for instance: 1.1, 1.5, 2.1, 3.1, 3.5, 4.1, 5.1) and the second one with weakened palatalization (for instance: 1.2, 2.2, 2.3, 3.4, 3.8, 4.2, 5.2, 5.6) Both phenomena

can be linked to phonetic interference from English. They occur regardless of the cluster's position in the word (or between words). What is more, vowel intrusion appeared in some places, [ə] or [ɨ] was added between two consonants (for instance: 1.3, 1.5, 2.12, 3.10). Another way of simplification of problematic clusters was deletion of one consonant (for instance: 1.9, 2.8, 3.6, 3.7, 4.3). Both processes contribute to the articulation's facilitation. Students of Polish origin did not tend to use vowel insertion (P4 and P5), contrary to the others (P1, P2 and P3). This phenomenon can be further studied with reference to L1 acquisition and learning Polish as a foreign language.

4. Conclusions

The study surfaced difficulties in discrimination between some alveolo-palatal fricatives and affricates and laminal retroflex fricatives and affricates by non-native learners of Polish. The problems were detected in research participants' pronunciation of consonant clusters as the place of articulation was changed and some consonants were replaced with one another, either within one set or between them. The students who participated in the experiment tended to divide some consonant clusters by vowel insertion, consonant deletion or addition of a pause between words. Moreover, voicing and devoicing of consonants in clusters occurring within word boundaries were often not applied or uttered contrary to phonetic rules. The process could also have been influenced by the students' L1. Thus, some representatives of the types of clusters listed here[20] can be treated as the most difficult to differentiate and articulate for the study group of native speakers of English, e.g., as for two-element clusters: 1) a lateral and a nasal, 2) a lateral or a semi-vowel and a fricative, 3) a plosive and a fricative, 4) an affricate and a nasal, 5) an affricate and a fricative, 6) a fricative and an affricate, 7) a fricative and a plosive, 8) a fricative and a nasal or a lateral, 9) two fricatives, 10) two affricates. As for three-element ones: 1) a semivowel, an affricate, and a nasal, 2) a nasal or a semivowel, a fricative, and an affricate, 3) a nasal, a plosive, and a nasal, 4) a fricative, an affricate, and a second fricative, 5) a fricative, a plosive, and another fricative, 6) three affricates, 7) an affricate, a plosive, and a fricative. Finally, two more four-element clusters similar to one another can be mentioned: 1) a fricative, another fricative, a plosive, and an approximant, 2) an affricate, a fricative, a plosive, and an approximant.

Studies in Polish pronunciation among native speakers not only of English, but also of other foreign languages seem important as they may contribute to better understanding of students' educational needs. The analysis which was briefly presented above proves that the participants' subjective intuitions concerning most difficult elements of Polish pronunciation (mentioned in the subchapter 2.4) adhere to differentiation test results and their actual pronunciation which should be further studied.

[20] The clusters listed were classified by manner of articulation.

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