

A Study of the Perception of Dutch Vowels by Polish Speakers – Theoretical Foundations and Preliminary Focal Research Points

The paper addresses the upcoming study of the perception of Dutch vowels by Polish speakers – a problem that has never systematically been researched for this particular language pair, despite the fact that linking errors in perception with errors in articulatory reproduction is of great importance for teaching Dutch pronunciation. The starting point of the paper is the critical review of existing works in this field (Balas 2017 and 2018, Czerwonka-Wajda 2021), enhanced with a review of research conducted in comparable conditions and with languages within the same language family (Hentschel 1982 and 1986, Chládková/ Podlipský 2011). The review pays particular attention to the results of experiments, applied perception tests, and used stimuli. The second part of the paper gives an overview of assumptions of the upcoming study, discussing the optimal research design, including the starting point of the experiments (Dutch front (rounded) vowels), types of perception tests (combination of identification and discrimination) and stimuli to be used (non-words of *sVs/sVze* type). The paper concludes with suggestions for possible continuation of the study in the future: all Dutch vowels must be included, as well as perception and articulation should be combined. Also, the possibility of expanding the scope of research is being taken into account, e. g. taking the longitudinal aspect into account or expanding the study group with Czech, Slovak and German-speaking students of Dutch.

Keywords: perception, Dutch, Polish, articulatory reproduction, pronunciation teaching

Eine Studie zur Wahrnehmung niederländischer Vokale durch polnische Muttersprachler – Theoretische Grundlagen und vorläufige Forschungsschwerpunkte

Der Beitrag befasst sich mit der geplanten Untersuchung der Wahrnehmung niederländischer Vokale durch polnische Muttersprachler – ein Problem, das für dieses Sprachpaar noch nie systematisch erforscht wurde, obwohl die Verknüpfung von Wahrnehmungsfehlern mit Fehlern in der artikulatorischen Reproduktion für den Unterricht der niederländischen Aussprache von großer Bedeutung ist. Ausgangspunkt des Artikels ist die kritische Übersicht der bestehenden Forschung auf diesem Gebiet (Balas 2017 und 2018, Czerwonka-Wajda 2021), ergänzt durch eine Überprüfung von Untersuchungen ausgeführt unter vergleichbaren Bedingungen und mit Sprachen aus derselben Sprachfamilie (Hentschel 1982 und 1986, Chládková/ Podlipský 2011). Die Übersicht berücksichtigt insbesondere die Ergebnisse von Experimenten, angewandten Wahrnehmungstests und verwendeten Stimuli. Der zweite Teil des Artikels gibt einen Überblick über die Annahmen der bevorstehenden Studie und diskutiert das optimale Forschungsdesign, einschließlich des Ausgangspunkts der Experimente (niederländische vordere (gerundete) Vokale), Typen von Wahrnehmungstests (Kombination von Identifikation und Diskriminierung) und zu verwendende Stimuli (nichtexistierende Wörter vom Typ *sVs/sVze*). Der Artikel wird abgeschlossen mit Vorschlägen zur Fortsetzung der Untersuchung in der Zukunft, durch zum Beispiel alle niederländischen Vokale in

die Untersuchung einzubeziehen oder durch Wahrnehmung und Artikulation in einem Experiment zu kombinieren. Auch die Erweiterung des Forschungsumfangs wird berücksichtigt, wie zum Beispiel der longitudinale Aspekt zu einkalkulieren oder die Studiengruppe um tschechisch-, slowakisch- und deutschsprachige Studierende des Niederländischen zu erweitern, usw.).

Schlüsselwörter: Perzeption, Niederländisch, Polnisch, artikulatorische Reproduktion, Ausspracheunterricht

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1. Introduction¹

The problems and errors in the pronunciation of Dutch sounds by non-native speakers are a topic that regularly attracts the interest of researchers. This is evidenced, for example, by special/thematic issues of magazines published regularly every few years (such as one of the issues of “Magazine van de Levende Talen” from 1991, issue 4 of “Vakwerk” from 2007, or issue 2 of the “Lage Landen Studies” series from 2011) and conferences or conference panels devoted to pronunciation (e. g., as part of the world’s largest Dutch studies conference organized by Internationale Vereniging voor Neerlandistiek, panels on pronunciation and didactics of pronunciation were held in 2018, 2022, and 2025). Importantly, the topic of pronunciation errors is of interest to researchers working in two important contexts connected to teaching Dutch. The first of the two is the context of NT2, Dutch as a second language, with studies involving multilingual groups in the Netherlands and Flanders (e. g., Neri et al. 2006 for the purpose of optimizing computer-assisted pronunciation training [CAPT], Blom/van den Heuvel 2009 and Blom/van Bortel 2012, for the purposes of the Delftse Methode, a method of learning Dutch developed in Delft). The second is the NVT context, which translates to Dutch as a foreign language and is mainly associated with studying Dutch at the university outside the Netherlands and Flanders (e. g., errors made by native speakers of French (Hilligsmann 1999), Spanish (Burgos et al. 2013), Czech (Kostecká 2016), Polish (Czerwonka-Wajda 2022), as well as Turkish (Van Boeschoten 1989) and Japanese (De Graaf 1986)).

An examination of the above-mentioned publications, especially those in the NVT field, shows that authors most often attribute pronunciation errors to differences between the Dutch phonetic system and the learner’s native language, assuming e.g. that Dutch tense vowels and diphthongs, which do not occur in Polish, are difficult to pronounce for Polish speakers. Another source of errors that is often pointed out, is

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the differences in the activation of the so-called basis of articulation. An example of this are Dutch front rounded vowels, which require parallel movements during articulation: the front part of the tongue goes upwards and the corners of the mouth are getting closer to each other. This combination of articulatory features, i. e. front and rounded, does not occur in, for example, in modern Slavic languages, which is why this group of vowels is difficult to pronounce for e. g. Polish or Czech speakers learning Dutch. On the other hand, existing analyses rarely mention the influence of the spelling of the native language on the occurrence of errors in the pronunciation of the foreign language (and even less frequently – the influence of other foreign languages and incorrect interpretation of Dutch spelling rules on articulation: Czerwonka 2016). Less attention is also paid to the role of cross-linguistic influences on the occurrence of pronunciation errors, which is interesting given that Dutch is a typical L3/L4 in the NVT context, taught after English (and often also after English and German: Czerwonka-Wajda 2025). There is also a lack of analysis of the impact of individual differences on the process of mastering Dutch pronunciation, probably because the students of Dutch in the academic NVT-context are a fairly homogeneous group in terms of age, motivation, and learning environment.

Another relatively under-researched issue is the perception of Dutch vowels by speakers of different languages. Systematic analyses in this area have been conducted with Turkish speakers (e. g., van Heuven 1986 and 2011, van Heuven/van Houten 1985) and Greek speakers (Georgiou/Dimitriou 2023), while selected aspects have been studied for Australian English and Peruvian Spanish (Alispahic et al. 2017), Spanish and German (Escudero et al. 2009), Czech (Chládková/Podlipský 2011) and Polish (selected Dutch vowels in studies by Balas from 2017 and 2018 and Czerwonka-Wajda 2021)². Additionally, it should be emphasized that the above-mentioned studies focus almost exclusively on perception, without attempting to link errors in perception with errors in articulatory reproduction. In fact, only van Heuven and Czerwonka-Wajda ask whether the problems Turkish resp. Polish speakers have with Dutch vowels are cognitive (i. e., their perception of Dutch vowels is incorrect and therefore correct articulation is not possible) or motoric (i. e., their perception of Dutch vowels is correct, but they are still unable to activate the articulatory base correctly). However, their answers to this question differ: van Heuven shows that the problem for Turkish speakers is connected to incorrect perception, while Czerwonka-Wajda (2021) points out that the lack of difference in pronunciation between Dutch [e] and the diphthong [ɛi] seems to be based on articulation rather than in perception itself.

In light of the findings described above, as well as taking into account how high interest in studying Dutch in Poland is (every year, nearly 150 students begin Dutch studies at the University of Wrocław, Adam Mickiewicz University in Poznań, and the Catholic University of Lublin), it seems reasonable, from the point of view of teaching

² More details of this works will be provided in section 2.

Dutch pronunciation, to conduct systematic research on how Dutch vowels are perceived by Polish speakers, and ultimately also to link errors in perception with problems in articulatory (re)production, exploring more broadly the issue of the cognitive/motoric (or perhaps mixed?) source of the problem. Therefore, we will dedicate the following sections firstly to a review of two existing analyses of the perception of Dutch vowels by Polish speakers and two other thematically related publications, and then, based on this review, we will indicate what preliminary focal research points could be in future experiments on such perception.

2. Theoretical background

2.1 Existing research

As we have already pointed out above, the perception of Dutch vowels by Polish speakers has not yet been systematically studied as a stand-alone issue. Therefore, it is even more important to discuss the research conducted so far, including that relating to languages with a similar vowel repertoire, which would allow us to identify, on the one hand, the technical experimental solutions that are worth retaining/repeating in the planned study, as well as those that should be modified/changed. At the same time, an analysis of the results obtained so far will allow us to identify the most interesting areas of research and to formulate preliminary hypotheses. The following paragraphs discuss the research conducted by Hentschel (1982 and 1986, with German vowels as stimuli and Polish-speaking participants), Chládková and Podlipský (2011, study conducted with Czech speakers and using stimuli based on Dutch vowels), Balas (2017 and 2018, Dutch vowels were used as stimuli, and Polish speakers participated in the study, but the study itself examined the influence of second language vowels on foreign language vowel perception and selective attention to vowel features) and Czerwonka-Wajda (perception of the contrast between the Dutch vowel [e:] and the diphthong [ɛi] by Polish speakers).³

Hentschel's research can be considered relevant due to its comparable context: it addresses the perception of German vowels and German has a similar vowel system to Dutch (i. e. both languages use the opposition tense/lax to differentiate vowels qualitatively), as well as due to the participants, as the subjects were Polish speakers studying language. This research also provides a complete picture of perception, as all German vowels and diphthongs were systematically tested using identification and discrimination tests, and a total of over 100 participants took part in the study, of whom 60 were ultimately assessed for perception. From the point of view of future

³ Transcription of the vowels as well the vowel graphemes in the whole section 2 was directly transferred from the discussed works. Nevertheless, it should be noted that some of the IPA symbols used by the authors are not correct for the transcription of Polish vowels. The suitable symbols are the [i], for the Polish <y>-vowel, [ɔ] for the Polish <o>-vowel, and [u] for the Polish <u>-vowel as all of those vowels are lax.

research, the following three results seem to be the most important (Hentschel 1986: chapter 5.2.1):

- There is a group of seven German vowels that are clearly (in nearly 100% of cases) categorized as specific Polish vowels: [a:] → [a], [a] → [a], [ɛ:] → [ɛ], [ɛ] → [ɛ], [ɔ] → [ɔ], [i:] → [i], [u:] → [u].
- There is a group of three German vowels that are categorized as specific Polish vowels in ca. 90% of cases: [ø:] → [i], [ʏ] → [i], [œ] → [ɛ].
- There is a group of five German vowels that are categorized as one of two Polish vowels: [ɪ] → [i] or [i], [e:] → [i] or [i], [y:] → [i] or [i], [ʊ] → [u] or [ɔ], [o:] → [u] or [ɔ].

From the point of view of selecting Dutch vowels for the first test studies, as well as for setting focal points for the future research, Hentschel's conclusion regarding the significant influence that the presence of both [i] and [i] in the Polish vowel system has on the perception of German pre-dorsal vowels seems important: "Das größte Loch im Sieb polnischer Lautstrukturen gegenüber Vokalen des Deutschen [...] ist offensichtlich der Raum, den sich im Vokalismus des Polnischen [i] und [i] teilen. Schon der erste Blick auf die Ergebnisse hatte jedoch gezeigt, daß es sich keineswegs um ein homogenes Perzeptionsverhalten gegenüber den deutschen Vokalen handelt, die einem dieser zwei polnischen Vokale oder beiden zugeordnet werden, sondern, daß sich quasi drei Untergruppen feststellen lassen. Eine invariante Perzeption ist sowohl für dt [i:] als auch für dt [ø:] zu beobachten. Während für dt [i:] stets der perzeptive Substituent pl [i] eintritt, werden dt [ʏ, ø:] dagegen konsequent durch pl [i] substituiert. Sie bilden sozusagen stabile Extrema. Varianzen der auditiven Beurteilung sind für dt [ɪ, e:, y:] zu ermitteln, die einer Erklärung bedürfen" (1986: 150).

The study by Chládková and Podlipský (2011) is also interesting from the perspective of the planned study, as it concerns the perception of Dutch vowels by Czech speakers, which vowel system, like in Polish, don't use the opposition tense/lax to differentiate vowels qualitatively. Importantly, the study focused on the perception of 12 Dutch vowels (only [ə] was not included), and its participants were university students/graduates with no prior knowledge of Dutch, which allows them to be compared to students starting Dutch studies in Poland. The results of the identification test, in which Czech vowels were used as a reference point, are presented in the table below.

Dutch vowel	Identification with Czech vowel ⁴
/i/	/i:/ or /ɪ/
/ɪ/	/ɪ/ or /ɛ/
/e:/	/ɛ:/ or /ɛ/
/ɛ/	/ɛ/ or /e:/

⁴ The order of vowels in the table reflects their proportion in the responses: the first vowel was chosen more often than the second and third. For clarity, only vowels that accounted for at least 10% of the responses are included in the table.

Dutch vowel	Identification with Czech vowel ⁴
/y/	/ɪ/ or /i:/ or /u:/
/ʏ/	/ɛ/ or /u/ or /ɪ/ or /ɛ:/
/ø/	/ɛ:/ or /ɛ/ or /o:/
/a:/	/a:/ or /a/
/ɑ/	/a/ or /a:/
/ɔ/	/o/ or /o:/
/o:/	/o:/ or /o/
/u/	/u/ or /u:/

Tab. 1. Identification of Dutch vowels in terms of Czech vowels
in Chládková and Podlipský (2011)

The results show that the most problematic from the point of view of Czech speakers are Dutch front rounded vowels, for which the respondents' answers were the most diverse, as well as front unrounded [ɪ], which was partially categorized as Czech [ɛ]. In addition, the authors included the factor dialectal varieties in the perception of Dutch vowels: half of the participants were speakers of Bohemian Czech, and the second half – of Moravian Czech. It was necessary to take dialectal variety into account due to the differences indicated by Podlipský et al. (2009) in the perception of the “high front vowel contrast /i:/-/ɪ/, which in Bohemia is distinguished perceptually more by a spectral difference and somewhat less by a smaller durational difference than in Moravia” (Chládková/Podlipský 2011: EL187). The results of the statistical analysis indicated that there is indeed a statistically significant difference between the groups in the perception of the Dutch vowels [i] and [ɪ], which also occurred in the case of the vowels [y] and [ʏ], which do not exist in the Czech phonetic system. This leads to the conclusion that Moravian Czech listeners “are predicted to follow different paths in acquiring these Dutch vowels” (2011: 186).

Balas' study on the perception of Dutch vowels, described in her publications from 2017 and 2018, is definitely the closest to the planned experiment in terms of the stimuli used, which were Dutch vowels, and is also interesting because of the types of perception tests used (categorization tasks with goodness ratings and discrimination of contrasts). However, it should be noted that studying the perception of Dutch vowels by Polish speakers was not an objective in itself for Balas, but rather a tool in a broader study concerning influence of second language vowels on foreign language vowel perception, assuming, based on Pajak and Levy (2014), an important role for selective attention to features in second language speech perception. Hence, this particular selection of subjects included in the study and Dutch as a source of stimuli: “The subjects were three groups of native Polish students of: English, French and Dutch. They were all second language learners, instead of L1 speakers of respective languages, so that a common L1 with no rounded vowels could serve as *tertium comparationis*. The second languages were chosen to have larger

vowel inventories than Polish with (French and Dutch) and without (English) front rounded vowels. The tested language was Dutch” (2017: 1). Therefore, the subgroup of subjects with advanced Dutch was treated as a control group and was limited to 9 people, and the repertoire of tested vowels was limited to eight (out of 13) Dutch vowels: /ɛ, e:, ø:, ɪ, i:, u:, ʏ:, ʏ/.

Despite the specific assumptions described above, Balas’ findings can definitely serve as a starting point for further research, especially if we assume that the students of English participating in the study (in Balas’ study: L2 English; hereinafter: L2E) could potentially be compared to beginner Dutch language students (who do not yet know Dutch, but have advanced English skills, which is the basis for obtaining a high number of recruitment points), and students with advanced Dutch (in Balas’ study: L3 Dutch; hereinafter L3D) – to Dutch language students from later years. In the first part of the study, which focused on the perception of contrasts (/ɪ - ʏ/, /i: - ʏ:/, /ɪ - u:/, /ø: - u:/, /ɛ - ʏ/, /ø: - ʏ/, /ɪ - ø:/ and /e: - ø:/) discrimination was excellent for all contrasts (>98%) – for both L2E and L3D group (Balas 2018: 113). In the second part of the study, based on categorization tasks with goodness ratings, as a part of which the Dutch vowels /i:, ɪ, e:, ε, u:, ø:, ʏ:, ʏ/ were assimilated to Polish vowels /ɪ, i, e, a, o, u/ represented by orthographical letters, the results were as follow (Balas 2018: 115–116):⁵

- the (Dutch vowel) /i:/ was categorized as Polish /i/ both groups in more than 98% cases;
- the /ɪ/ was categorized as Polish /i/ in 69% en as Polish /i/ 30% of the cases by the L2E group; in the L3D group answers were divided 50/50 between Polish /i/ and /i/;
- the /e:/ was categorized by the L2E group as Polish /i/ in 26%, as /i/ in 23% and as /ɛ/ in 48% of the cases; in the L3D group answers were divided between Polish /ɛ/ (91%) and /i/ (9%);
- the /ε/ was categorized by the L2E group as Polish /ɛ/ in 71% of the cases and as /a/ in 29% of the cases; the L3D group mostly chose for /ɛ/ (89% of the answers) and less often for /a/ (9%);
- while categorizing the /ʏ:/ the L2E group chose rather for /u/ (52%) than for /i/ (46%) and the L3D group – rather for /i/ (78%) than for /u/ (22%);
- the /ʏ/ was categorized similarly to /ʏ:/, as the L2E group rather chose /u/ (67%) than for /i/ (29%) and the L3D group – rather /i/ (52%) than for /u/ (44%);
- the /ø:/ was categorized as /o/ (68%), /i/ (18%) or /ɛ/ (12%) by the L2E group and as /u/ (50%) or /i/ by the L3D group;
- the /u:/ was categorized as Polish /u/ in 100% of the cases in both groups.

⁵ The results are discussed in greater detail as Balas experiment was the only one taking multiple Dutch vowels and Polish speakers into account. For presentation clarity only Polish vowels with at least 5% of the answers are being mentioned and values are rounded to whole percent points.

The results again show that the most problematic from the point of view of perception are Dutch front rounded vowels and front unrounded [ɪ], for which the responses were most varied between groups.

Last study to discuss is the paper of the author herself, presenting the results of a investigation on the audition of a Dutch tense vowel [e:] and the diphthong [ɛi] by Polish native speakers. Both sounds are absent from the Polish phonologic system, but it was hypothesized that Polish native speakers may pronounce the Dutch [e:] in a specific way, i. e. as a combination of [ɛ] and [j], because they generally fail to auditively distinguish the [e:] from the diphthong [ɛi], as both sounds are acoustically close to each other (especially those produced by speakers of Dutch from the Netherlands). Instead, the experiment has shown that Polish native speakers are very good at differentiating the isolated Dutch [e:] and [ɛi], regardless of the Dutch variant of the speaker (Dutch or Flemish), their Dutch level and the combination of previously learned foreign languages. It seems that the pronunciation of the Dutch [e:] as a combination of [ɛ] and [j] appears to stem from articulatory rather than perceptual factors, indicating a production-based rather than a perception-based problem according to the already mentioned study of van Heuven (2011).

2.2 Experiment and stimuli types

Studies of the auditory perception are typically based on trials during which the participants “are presented with special test sounds and are required to evaluate a given aspect of the auditory sensation or to perform a certain kind of task in response to the sounds. The task performed by the listeners depends on the aim of the experiment” (Miśkiewicz n.d.). There are two basic listening tasks in psychoacoustic studies on sound perception: discrimination and identification (see also Barry 1975). The purpose of a discrimination task is to check if the listener has the ability to differentiate sounds from each other, mostly by indicating whether the sounds presented in a trial are identical or different. Identification on the other hand is the task of assigning chosen labels to sounds, which means that listener may be asked, for example, to categorize the test sounds in terms of sounds from his/her mother tongue or in terms of the sounds of the language that is being tested (the second option is, naturally, only possible for participants who already know the language being tested to some extent). When it comes to test sounds in both types of experiments can be of different nature, from isolated sounds, through syllables, to non-words, existing words or word pairs. Describing all the possible options mentioned above in details goes far beyond the scope of this text, so we will limit ourselves to describing the stimuli and types of experiments in the studies mentioned above (Hentschel 1982 and 1986, Chládková/Podlipský 2011, Balas 2017 and 2018, Czerwonka-Wajda 2021).

Hentschel used both basic types of tests in both of his experimental studies. As his earlier experiments, described in the monography from 1982, only cover the front vowels, we will concentrate on the later experiments which included all vowels (1986).

As Hentschel himself claims, stood “die Identifikation im Mittelpunkt” (1986: 109), divided between two identification tests:

- one basic, in which the participants had to either assign the German vowel to one of the six Polish vowels (indicated with one of the with one of the six Polish vowel graphemes <i>, <y>, <e>, <a>, <o>, <u> thanks to the high level of opacity of the Polish orthography) or classify it as “something else”, i. e. a sound that is foreign to Polish;
- second one more specific, designed to test the tendency of Polish native speakers to hear certain monophthongs in German as diphthongs or diphthonglike VV-sequences; in this test participants could choose between the Polish “normal” vowel, a long vowel (i. e. longer than the standard pronunciation of Polish), a diphthong with an [i] as the second element, a diphthong with an [u] as the second element or “something else”, i. e. a sound that is foreign to Polish.

Parallel to the two identification tests, two discrimination tests took place, both of the AX-type. In those tests two elements, A and B, must have been compared by the participants in order to answer the question “Is A equal to B”? The two test series differed in the possible answers to the question: in the first one the participants could choose between stimulus “yes” and “no” (AX2), while in the second one also the third option “unclear” was available (AX3).

For all the four tests Hentschel decided, based on Wurzel (1981: 976 ff.), to go for 47 CV, CCV and CCCV combinations which are possible and common in German. As the post-vocalic consonant, the /t/ was chosen, as the one of the word-final contexts of German, before which all the vowels may occur, both long and short (Kohler 1977: 178). As a result all the 47 stimuli were “einsilbige, strukturell mögliche Formative des Deutschen der Form: ((C)C)Vt” (Hentschel 1986: 115).

Experiments described by Balas in her work from 2017 and 2018 were based on two auditory tests. In both of the tests stimuli were based on the sentences with non-existing words used for Spoken Dutch Corpus (nl. Corpus Gesproken Nederlands) by Adank et al. (2007). The short vowels were embedded in the following carrier sentences: *In sVs en in sVsse zit de V*, /ɪn sVs ən ɪn sVsə zɪt də V/ [eng. ‘In sVs and in sVsse is the V’]. The carrier phrases for the long vowels were: *In sVs en in sVze zit de V* /ɪn sVs ən ɪn sVzə zɪt də V/ [eng. ‘In sVs and in sVze is the V’]. The sentences were recorded by a native speaker of the Southern Dutch and the CVC contexts of sVs/sVze were cut out for further preparation of test sounds. First, the subjects performed an AXB discrimination test, in which they listened to 32 AXB triads, in which eight Dutch vowel contrasts were examined: /ɪ - ʏ/, /i: - y:/, /ʏ - u:/, /ø: - u:/, /ɛ - ʏ/, /ø: - ʏ/, /ɪ - ø:/ and /e: - ø:/. Each triad combination was repeated three times. The second task was, as already mentioned, a categorization task with goodness ratings, which meant that the participants were asked to identify the Dutch vowels /i, ɪ, u, ø, ʏ, ʏ/ in terms of six Polish vowel categories /i i ɛ a o u/, marked with orthographical labels <i>, <y>, <e>, <a>, <o>, <u> (which was possible as the Polish vowel orthography is transparent).

The participants listened to every stimulus twice: 1st time for categorization and 2nd time for “goodness”-rating on the scale from 1–7 (“1 being barely similar and 7 being a very good fit”, Balas 2018: 136).

Chládková and Podlipský (2011) decided to use stimuli recorded by a female and a male native speaker of Dutch from the western Randstad area of the Netherlands. The base for the stimuli were sentences *Hoor je hVb?* (eng. ‘Do you hear hVb?’), where V was one of the 12 Dutch monophthongs. The *hVb* realisations were cut out to serve as stimuli in the perception experiment. The reason behind choosing this particular coda consonant was the fact that it is phonotactically possible in both Czech and Dutch. The experiment itself consisted of a multiple forced-choice identification task and the participants were beforehand informed that “they would hear nonsense but possible Czech nouns spoken by a Czech man and a woman and upon hearing each word they had to choose which of the ten words it was” (Chládková/Podlipský 2011: EL188). In practice, this meant that participants had to categorize a Dutch stimulus as one of ten *hVb* non-words displayed in Czech orthography on a computer screen. There was no discrimination test involved.

The last experiment by Czerwonka-Wajda (2021) was a discrimination test based on stimuli pairs build around isolated [e:] and [ɛi] sounds, which were extracted from an alphabet recording made by one male speaker of Northern Dutch variant and one of the for Southern Dutch variant. For both variants four pair were made: [e:]–[e:], [e:]–[ɛi], [ɛi]–[e:] and [ɛi]–[ɛi]. After adding four fillers, two sets of 12 pairs were created, with the intention that the subjects had to differentiate each of the four [e:]–[ɛi] pairs twice, with the fillers in between. There was no identification test involved.

3. Preliminary research focal points and most promising research design concepts

Before we move on to discussing thematic and technical details of the future research on the perception of Dutch vowels by Polish speakers, let us recall the most important assumptions and focal points of the planned study that will set it apart from existing analyses (they have already been briefly mentioned in section 1). Firstly, the research should focus on the Polish students of the Dutch language as they form one of the biggest students group in the NVT-context at university level (only at University of Wrocław there is a possibility of examining ca. 70 students of the first, ca. 35 of the second and ca. 25 of the third year) and their perception of Dutch vowels has never been systematically examined (in the studies of Balas the Dutch vowels have been a part of the research design but not the focus point itself). Secondly, the study should incorporate divergences between students with different level of Dutch (from A0, through A1, A2, up to B1/B2). Last (but definitely not least), the research should rather be TLA⁶ oriented, taking into consideration that the perception of participants

⁶ By TLA we mean the context of Third Language Acquisition.

may be influenced by advanced knowledge of other Germanic languages they learned before Dutch: English and German. Especially the potentially positive role of advanced German in the perception of Dutch vowels needs to be addressed.

Based on the results of already carried out research and stimuli/experiment types described in section 2, our goal in this section would be to describe the most favorable research options. Let's start with vowel groups that seem to be the most promising starting point for the experiment series. Results of Hentschel (1982 and 1986) and Balas (2017 and 2018) make the front vowels the obvious point to start and to test different stimuli and experiment types. The following two sets of vowels seem to be the most promising alternatives:

- a) Perception of the front rounded vowels [y], [ʏ] and [ø]. Justification: rounded front vowels cause many articulation difficulties and deliver different types of errors, some of which cannot be explained by other factors that have already been investigated (Czerwonka-Wajda 2022 and 2025). Even students at higher levels of Dutch (B2/C1), who should already have developed perception, have difficulties in the production of the three Dutch rounded vowels. Organizing the experiment around this particular set of vowels lets therefore combine perception with the articulation reproduction as the front rounded vowels fit well with the future target research question (i. e., are the problems in articulation rather motoric or cognitive in nature).
- b) Perception of the front vowels [i], [ɪ], [ʏ] and [y]. Justification: it is a potentially interesting set of stimuli from the perspective of foreign language perception models – Perceptual Assimilation Model (PAM) by Best 1993, Speech Learning Model (SLM) by Flege 1995 – as [i] occurs in both languages, Dutch [ɪ] and [ʏ] are similar to Polish [ɪ] (the difference in articulation is small as the Polish vowel is pronounced with neutral lips and the Dutch vowels with lips respectively slightly spread and slightly rounded, which makes perceptual differences potentially also small) and [y] does not occur in Polish. Organizing the experiment around this particular set of vowels with can therefore shift comparing students with different levels of Dutch to the focus of the study.

When we look at different stimuli types which have been used in the existing research, isolated vowels don't seem a good option as isolated vowels rarely form a word on their own in Dutch and are rarely perceived as such in the natural communication process. The most suitable option – according to research that has already been carried out – are the non-words. In this regard, our preference goes to the non-words of the *sVs / sVze* type as they have been used by Balas (2018) and before also by Adank et al. (2007) for making recordings for Spoken Dutch Corpus. A big advantage of non-words is that they just as unfamiliar for all the participants, which means they can also be used also with students who are absolute beginners in Dutch. Another option, could be using the sets of (partially) existing words which are being applied for perceiving/pronouncing specific differences between vowels in the so-called minimal pairs. This

type of stimuli hasn't been used yet in relation to Dutch vowels, although they are an interesting option for testing participants who aren't beginners. All stimuli will be recorded at Utrecht University, which is cooperating in the project, with speakers of the Northern variant of Dutch.

Finally, when we look at auditory perception experiment types that had been applied in the existing research, it is clear that a combination of identification and discrimination tests is the best option. For identification test, we propose to reuse the categorization task used by Balas, in which the participants are asked to identify the Dutch vowels in terms of six Polish vowels /i/, /ɨ/, /ɛ/, /a/, /ɔ/ and /ʊ/⁷, marked with orthographical labels <i>, <y>, <e>, <a>, <o>, <u>⁸. This type of categorization has, again, the advantage of being also useable for participants who are absolute beginners in Dutch. The extra goodness rating aspect tested with Lickert-scale will provide extra insight into identification process. For participants more advanced in Dutch, who are able to be working with (partially) existing words, it is also possible to categorize the stimuli as one of words displayed in Dutch orthography. When it comes to the discrimination part of the tests, the 4I-oddity discrimination task should be taken in consideration (when possible as this type of task mostly generates a large amount of stimuli pairs for evaluation), because of its beneficial relationship between classification and discrimination performance, instead of AX2, AX3 and AXB tasks which have been used in the existing research (for the full description of advantages of the 4I-oddity discrimination task, see e. g. chapter 2 and 3 in Gerrits 2001).

4. Conclusions and future research options

The main goal of this article was to present the most relevant existing research on perception of Dutch vowels by Polish speakers and critically comment on it to construct the theoretical foundations and set some preliminary focal points for planned experiments in this particular field. Because of a rather scarce number of publications on the chosen topic (Balas 2017 and 2018, Czerwonka-Wajda 2021), it was necessary to also incorporate research on perception of German vowels by Polish speakers (Hentschel 1982 and 1986) and of Dutch vowels by Czech speakers (Chládková/Podlipský 2011) to get a broader perspective. The results of the studies by Hentschel, Chládková and Podlipský and Balas clearly show that Dutch front vowels, especially the rounded ones, are the most interesting group of vowels to start the future research. When it comes to perception tests, a combination of identification and discrimination tests should be applied, with the following assumptions: stimuli for both test should be based on non-existing words, the identification test should use the orthographical labels and

⁷ The symbols /ɨ/ and /ʊ/ were used deliberately to emphasize that these two Polish vowels are lax.

⁸ We deliberately choose grapheme <u> instead of <ó> to avoid potential confusion between <ó> and <o> buttons in the answer area of the questionnaire.

the discrimination test should be a 4I-odddity discrimination task when possible (if not possible, an AXB task is also an option).

Naturally, the study of the perception of Dutch front vowels by Polish speakers, should only be considered as a starting point for more experiments to come: other Dutch vowels and diphthongs are to be examined as well. After that, combining perception and articulation must be examined to link errors in perception with errors in articulatory reproduction and to bring us closer to answering the question of the cognitive/motoric/mixed source of the pronunciation difficulties of Polish speakers with Dutch vowels. There are also other research options to broaden the perspective, e. g. taking the longitudinal aspect into account, i. e. the possibility of tracking changes over time by examining the same group of participants several times during their studies (e. g., at the beginning of the first semester, at the end of the first semester, etc.) to see how the perception improves and to create individual profiles of changes. Another option can be expanding the study group to include Czech and Slovak students on the one hand, and German-speaking students of Dutch on the other, for comparative purposes. Lastly, incorporating stimuli recorded by speakers of the southern variety of Dutch to the study, can also add an interesting comparative aspect to it, as there are some differences in the pronunciation of [e], [ø], [o] and the diphthongs between the varieties (Verhoeven 2005: 245-246). It would be interesting to investigate whether these differences are also reflected in the perception of Dutch vowels by Polish speakers.

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