


How Polish Students Develop Mandarin Pronunciation through Intensive Training

波蘭學生如何透過密集訓練發展華語語音

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Abstract: Many studies (C. McBride-Chang et al. 2008; E. Bialystok et al., 2005) have shown that the syllable is the basic unit when learning Chinese pronunciation. This study attempts to explore how adult native speakers of Polish (non-tonal language with the alphabet based on Latin script) develop Chinese tonal syllables through intensive training at the beginning level. Students from the Faculty of Philology participated in a four-stage phonetic teaching program and experiment. First, learners exercise excessive articulation of vowels, practicing how to carry the tone. Secondly, students try to assign the meaning to the joined segmental and supra-segmental phonetic units. Then, acquisition of Chinese morphemes/lexemes is supported with characters to differentiate homophones in the learning process. Finally, students are trained to decode the heard syllables in a sequence into meaningful phrases and sentences. Next, based on the ongoing training, the pronunciation experiment in two series provides an insight into the development of the Chinese syllable production.

摘要: C. McBride-Chang et al. 2008; E. Bialystok et al. 2005 等均表明音節是學習華語發音時的基本單位。本研究試圖探討以波蘭語為母語的成年人，如何通過初階的強化訓練來習得華語聲調。本研究邀請 11 位波蘭漢學系學為參加一個四階段的語音教學實驗。首先，讓學習者能夠練習帶著聲調的元音；第二步驟為協調聲音（尚未成語言）的發音與感知與物理現象（聲調）反應，讓學習者能將意義連接至對應的音段和超音段；第三步驟為利用書面形式中編碼的訊息，訓練閱讀時的視覺與書寫的文字傳遞，讓學習者能夠在漢字的書面形式，區分同音詞。最後，為讓學習者大腦閱讀比說話更快，反覆訓練他們的音節、語素意義與句法結構，讓每個單位在編碼發音前，都是有意義的排序。最後，兩個不同時間點的發音成果，支持了這套密集訓練，對於這群學習者的有效性。本研究成功提供音節教學程序，讓非字母、非聲調成年學習者在學習華語時，獲得顯著進步。

Keywords: teaching Chinese, Polish native speakers, syllables, Chinese tones, tone production

關鍵詞: 華語教學、波蘭母語者、音節、聲調、發音

Introduction

The speech sound production and perception is a very complex process. As it refers to many different dimensions, it is not possible to present in one paper the full spectrum of relations between the speech sound and information when compared with the mother tongue and the second language. Speech sound awareness is meager among students as it does not contribute to L1 communication. The consideration arises when odd sounds turn to be meaningful while listening to/learning a foreign language. The more distant the phonetic structure of a language is from the acquired mother tongue, the more difficult it is for a learner to select those features of the sound which contribute to the phonemic (and thus semantic) structure of the language. Attentive listening and mindful phonation, listening to self-produced speech and monitoring phonemic differentiation leads to the awareness of the sound and effective word identification. The brain needs to be trained to discriminate speech sounds and process them into phonemes. Since auditory processing (for the comprehension) and the speech-motor skills (for the production) complement mutually while developing language skills, it is a well-thought-out teaching technique, intentionally referring to the speech sound awareness and F1 vs. FL phonetic differences, which efficiently supports a student in practicing coding and decoding speech sounds. This article explains Polish as L1 background to CFL learning and outlines the basis of the shadow-reading-like technique in the classroom instruction of Chinese at A1 and A2 levels which, respectively to the levels, turn students on to comprehending more complex utterances and monitoring their phonation.

1. Chinese speech signal features confronted with Polish sounds

In the context of communication and technology of the Polish speech signal, R. Tadeusiewicz (1988: 241) states that when identifying phonemes in the perspective of the final result of a word recognition, some phonemes display major significance for the identification of the whole word than others. He points to consonants as more meaningful and carrying more information than vowels. As early as in 1830, a very pioneering thesis on the 19th century Polish language was published in Warsaw by a scientific committee of those times. Discussing the orthography and speech sounds it codes the authors often emphasize consonants as more difficult than vowels to pronounce and more meaningful in the Polish speech if considered in the light of grammar and morphology. It was already then that the explorers were aware of the language mechanism allowing often to lose a vowel but preserve a consonant in a new word form (J. Węcki 1830: 80–86). Frequent in Polish, a vowel-zero alternation goes back to the historical phenomenon of the so called yers (E. Cyran/ E. Gussmann 1999: 220). Jassem draws the perfect picture of the modern Polish language phonetics and the dominant role of consonants when compared to vowels:

[Polish] can be described as a ‘consonantal’ language in two respects: (a) it has a rich system of consonant phonemes (...) and (b) it allows heavy consonant clusters, especially word-initially. A phonological word may begin with a five-consonant cluster: /'spstrɔnɨm / *z pstrągiem* ‘with (the) trout’, and a 4C lexeme-initial cluster is not unusual:

/ *vzglont* /*wzgląd* 'respect (n.)'. Even a geminate affricate can occur in this position: / *dʒdʒisti* / *dʒdʒysty* 'rainy'. The initial C-clusters are not simplified in fluent, spontaneous speech (W. Jassem 2003: 103).

The alphabet consists of 32 letters, including those additional with diacritical marks added to the regular Latin script (like Ś or Ę). There are also digraphs (SZ or RZ) representing single phonemes. The letters Q, X and V appear only in loan words. There are 51 phonemes in the Polish language (8 vowels and 43 consonants). The intrinsic vowel *F0* effect is minimized in Polish (E. Szpilewski et al. 2004: 568). The Polish language does not make use of the duration as a phonemically distinctive attribute of vowels (W. Jassem 1992: 222; I. Maddieson 2010: 143). Polish speakers reveal a significantly higher *F0* register when compared to English and German speakers (G. Demenko et al. 2014: 1308–1310; A. Wagner/ A. Braun 2003: 654), to which the sibilants contribute evidently. We can assume that the pitch accent in Polish over a syllable, a word (a lexical stress) or a phrase (an intonational stress) represented by the fundamental frequency in a certain range of register is still distant (i.e. higher) from the *F0* exploited in tonal phonemes (also known as tonemes) in Modern Chinese.

When Chinese phonation pitch discussed, the tones' *F0* requirements must be taken into consideration. The register range of Chinese is a 1.5 times wider (some report even more) if compared to non-tonal language users (English or German) pronouncing Chinese (Y. Wang et al. 2006: 250). Following the reports, a female *F0* operates between 180 Hz and 270 Hz when pronouncing the syllable *ma* in four Chinese tones (A. Jongman et al. 2006: 211). The average means of *F0* from another study carried out by Xu (1997: 67) run from about 90 Hz (for T3) to slightly above 140 Hz (T4). Similar results were found in C-Y. Tseng (1990, for one female) and J.I. Howie (1976, for one male) with the tonal range from 45Hz to 250Hz (female) and 40Hz to 157Hz (male).

Losing the speech spectrum below 350 Hz in the Polish language results in a loss of only 2% speech clarity. Low frequency sounds in speech seem then not to be of much meaning. Frequent in Polish sibilants and consonant clusters exploiting rather the top frequency range allow us to estimate a comprehensible speech signal (85%) at the 1kHz-5kHz range. In some way, high exposure to speech frequency within the 400 Hz-4000 Hz spectrum, relevant to comprehend the Polish language, does not endow the recipient with sufficient sensitivity to bass and treble sounds (E. Hojan/ E. Skrodzka 2005: 104–105; [1]).

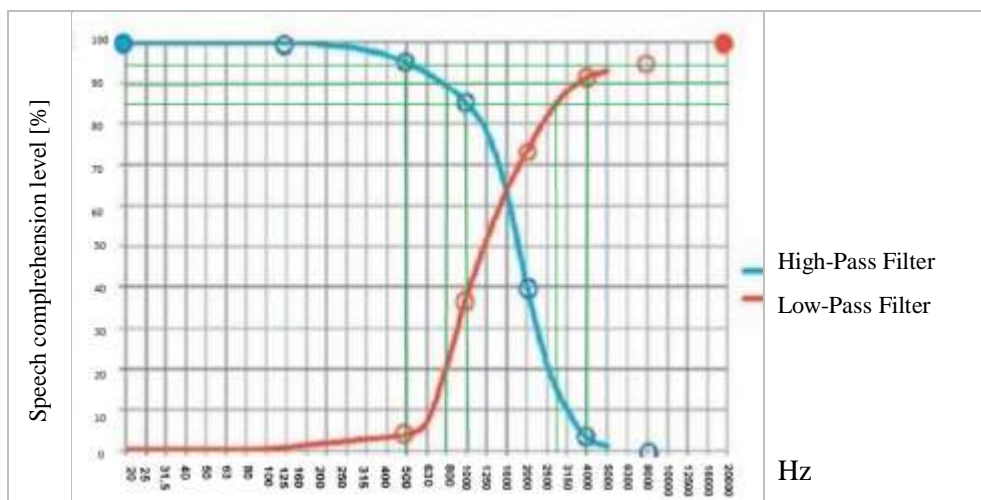


Fig. 1. Speech comprehension vs. speech signal frequency.

At a lexical-level representation in European languages, suprasegmental cues refer to limited prosodic properties integrated in the utterance and not derived from the segmental sequence of phonemes (S.G. Nooteboom 1997). The lexical tones in tonal languages are incorporated into segments the way that the same segment conveys a different meaning based on contrastive tones. High-Pass and Low-Pass Filtering applied to the Polish language shows the substance of a certain scope of register (most words in Polish language operate in the range of 1300-1600 Hz for speech, with a significant range of 100-2300 Hz), while the Low-Pass Filtering of the Chinese speech under 1000 Hz preserves rather the whole manner of speaking, while over 1000 Hz it may let a listener be confused regarding the speaking manner (J.-H. Guo et al. 2010: 80).

Having in mind that the tone is physically manifested in the fundamental frequency F_0 contour, always associated to vowels (or glides) because only vowels have obvious formants, the three basic dimensions: F_0 register, F_0 contour, and duration need to be emphasized when teaching sensitivity to the Chinese speech sound (J.-H. Guo et al. 2010: 79). Due to the L1 related habits (narrow register, top register range in use, no sound duration input to the meaning), the fairly different attitude to listening and pronunciation as well as mindful awareness build up gradually and will contribute to the best use of phoneme cues in mutual exercising sound discrimination and production in the initial and elementary stage of learning CFL.

2. Effective didactics

An introduction to the tones in Mandarin Chinese text books usually refers to the numerical scale 55, 35, 214 and 51, and its simplified figure of the tone inflection. So far, it has used to be considered as a clear enough approach in Chinese pronunciation teaching.

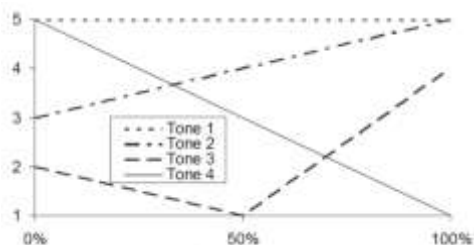


Fig.2. Scale vs. time.

The tone contour scheme presented in Fig.2 shows just one syllable-level prosodic variation; if considered as such, it is a proper but extremely simplified explanation. Unfortunately, in the perspective of non-tonal language users there are many jigsaw puzzle-like features of speech to be grasped by CFL learners. Fig.3 provides more real *F0* contour traces of the four tones confronted to each other in the dimension of normalised time. Segmental and non-segmental features of the L1 on the level of syllable (in a tonal language), lexeme (a stress language) and phrase and utterance (an intonation focussed language) distribute across languages irregularly, yet contribute to the Chinese lexical tone identification performance.

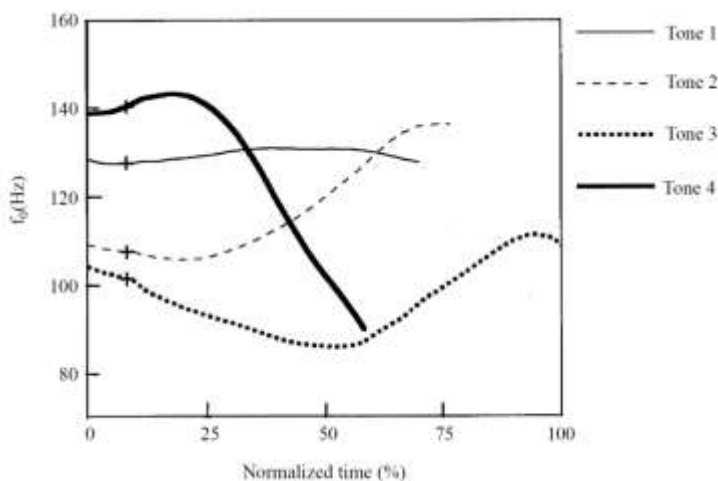


Fig.3. Native speakers of Mandarin Chinese tones production. Adopted from Xu (1997: 67).

It is unquestionable that different L1s equip learners in dissimilar ways with diverse cues in learning CFL as well as with limitations, i.e. a low sensitivity to a particular set of features in Chinese. Nevertheless, presenting the linguistic theory is not what most of the language students are fascinated with. Then, how to balance the knowledge in phonetics and phonology and the practical skills of a language? It is rather a teacher who should instruct the students to search for segmental and non-segmental cues for:

- sound/syllable perception;
- sound/syllable differentiation;

- the morpheme/lexeme recognition in the context of a gradually more complex utterance.

All that is conducted in listening to given external speech stimuli and speech self-production. While monitoring self-produced speech a learner matches his/her physical efforts and results with the segmental and non-segmental patterns exercised under the strict control of the teacher in the class. Some empirical studies on lexical / tonal differentiation in Chinese by English, German, French and Polish students of CFL show that foreigners are not deaf to the tones (X. Wu/ H. Lin 2008; P.A. Hallé et al. 2004; E. Zajdler/ A. Stal 2013; H. Ding et al. 2011). What they need is, for an initial period of learning time, awaken awareness of these features of Chinese which are crucial in gaining new speech perception and articulation habits. The more habitual (correct) production and perception becomes, the less self-controlled awareness is applied. Here it is also a place for a remark that the more careless and incorrect speech sound becomes habitual, the more difficult it is to correct it in future. Basic linguistic competence in phonetics (know-what) applied to listening to and pronouncing exercises (can do) will in a long term become a proper habitual behaviour of decoding the stimuli (i.e. the speech) and coding the information in pronounced segments. Acquired gradually segmental and non-segmental features will occur as an absolutely involuntarily reaction (passive and active) when the vocabulary in isolation (like reading the new words), in phrases (word construction obtaining) or sentences (as in dialogs) will be in use.

In the teaching practice at the Faculty of Philology at the Jagiellonian University in Cracow, Poland, the four overlapping stages of training in Chinese phonetics and phonology occur in intensive courses (the zero starting point) at the A1. and A2. levels (see: CEFR). They are programmed in the light of the above-presented features of Polish – a non-tonal high register language, consonantal and sibilant, with a lexical stress as a prosodic value but without duration as a phonemically distinctive attribute of vowels.

Stage 1.

The CFL learner acquires the vowel as the core of a phonetic segment. At that stage, more important than distinguishing between four tones of the vowels are the following short-term objectives:

- (a) Exercising excessive articulation of vowels, starting the training with the pronunciation of all Chinese syllables in the first tone only; Exaggerating the syllable's timing into unnatural duration makes the students aware of the level-tone phenomenon. Such a sound production designates the top of the individual register. Providing that the female register needs to be only slightly pushed up, male students of CFL face the extremely difficult task to widen up the top limits of the phonation.
- (b) Only in the contrast to the high-level first tone, the falling-rising third tone (or low tone) determines the bottom of the individual register; Contrary to the first tone and the difficulties the male students meet, the female students need to be taught to make a better use of the diaphragm (more naturally used by males) in order to project voice in the unnatural for females bottom of the individual register; Confronting high-level tone and low tone (after initial explanation realized in fact as half-third to or even close to low-level tone) the students approach the goal of

building up the register range sufficient for the tonal language, and nearly double as wide as their L1. The same exercises of all the syllables are continued for the rising second tone and falling fourth tone, with clearly indicated the mid high starting point to rise in the second tone and sharply falling from the top to the bottom within the range of the full scale; All the time the individual register range is to be kept in mind consciously.

- (c) Special attention of the teacher should be paid to compare the stretch of the timing for all the four tones (see Fig.3). Partly alike rising and falling tone contours (T2. and T3., T1. and T2., T3. and T4.) gain a new feature when compared in timing sections. Though discriminating the second tone (from the third and sometime from the first tone) will always be the most tough challenge, it is the key moment for a student to organize the timing cues in the frequency change dimension.

Stage 2.

When a vowel with the toneme (still presented excessively) as a nucleus of the Chinese syllable is at a certain rate distinguished by a student both in perception and production, the distinctive features of the consonants (initials and finals) are all the time under mindful control (aspiration, sonorants, nasal endings). The early stage of learning CFL is a perfect moment to begin to introduce to students useful words, phrases and simple sentences in the communication approach overlapping with the cognitive strategy. At this stage, sounds and words perceived by a student as homophonic or alike should naturally call for attention to the distinctive features differentiating the syllables and thus the meaning.

Stage 3.

Common in Chinese homophones units (in tonal and segmental sense) build a wall hard to break when a student faces the limited number of syllables that represent the growing number of morphemes or lexemes. Though for a native or native-like speaker of any language speech sound directly designates the meaning, there is a stage when acquisition of Chinese morphemes/lexemes must be supported with visual (when read) and motor (when write) indicators of the information encoded in the writing system. Then the reading skill supports vocabulary development and writing skills extend the range of possible language practice. Sound and vision reinforce a word concept, thus teaching Chinese to adults without writing seems to be a mistake.

Stage 4.

Starting at the beginning from short phrases and simple sentences, soon turning into complex sentences, the students concentrate on listening to and repeating the utterance for up to 4 hours a week for 30 weeks. One textbook is totally dedicated to that kind of training (實用視聽華語 1., 2.) in the course. The audio recordings by qualified native speakers is in use. All attention focuses on the sound and meaning with no textbook open in the class. The teacher's tips to the purposely and mindfully excessive articulation and register range is aimed to control tone contours which, finally in reduced speech, are expected to turn into the proper natural pronunciation.

The following part of the article presents some insight into the development of Chinese syllable production concerning its tonal features. The two series of articulation are assessed and compared.

3. Research: A Longitudinal Study – Methodology and Results

A passage, a total of 151 syllable lexical units, pronounced in four lexical tones (T1, T2, T3, T4) and the fifth reduced tone (T0), describes how to live in Taiwan when being an exchanging student, as shown in Appendix A.

Eleven participations (3 Male, 8 Female) in their early 20s from the Jagiellonian University in Krakow, Poland, who have started studying Mandarin Chinese as a foreign language as their major subject were recruited for the experiment. For all these participants, the Polish language is L1. All of them are advanced in English (B2). They were asked to read and record the same material one time at A1-minus level (further referred to as 1st series) and one time at A2 level (further referred to 2nd series) proved in the language tests (according to CEFR standards). The intensive course of Chinese provided them with A1-minus after initial 12 weeks of training and A2 after following 22 weeks (including 30 weeks of phonetics and shadowing class discussed above). The two recordings were judged by three Taiwan native speakers of Chinese trained in teaching Mandarin Chinese as a foreign language. What the judges did was to give evaluation to each syllable pronunciation in the scale from 1 as the worst to 5 as the best, based on the start point, end point and contour of each tone. In other words, each syllable had three different scores given by three judges, and then a mean was calculated. The data were analyzed using a linear mixed-effect model, where the Mean (e.g., start, end and contour score) is the dependent variable, Time is the fixed effect, and Participant is the random effect.

Tone 1.

In analyzing the tone 1, there was no difference between the two periods at their start point $t(635) = -1.928$, $p > 0.05$, but there was a difference at their end point $t(635) = -2.505$, at the contour $t(635) = -2.607$, both $p < 0.05$. The performance in the 2nd series is much better than that in the 1st series in both cases. Overall, there was not a consistent pattern that 11 learners have improved their T1's ending and its tonal contour after 22 weeks continue in-class practicing (excluding a summer break). One should note that there was much room for improvement because the learner's T1 start point in the 1st series is good enough ($M=4.85$ vs. $M=4.928$), yielding no dramatical improvement at T1's start point.

Tone 2.

For the tone 2 condition, none of the factors show any difference between the two times, $t(680) = -1.243$ for start point, $t(680) = 1.557$ for end point, $t(680) = -0.211$ for tonal contour, all $p > 0.05$. That means learners did not have enough time to improve their T2 in neither aspect.

Tone 3.

For the tone 3 condition, apart from the contour, $t(482) = -2.294$, $p < 0.05$, the start point $t(482) = -1.938$, and end point $t(482) = -1.728$, both $p > 0.05$, indicate that learners make progress only in T3's tonal contour after 22 weeks of practicing.

Tone 4.

By contrast to tone 2, learners showed a significant improvement under the condition of T4 in all aspects, $t(1272) = -3.567$ for start point, $t(1272) = -3.669$ for end point, $t(1272) = -3.671$ for tonal contour, all $p < 0.05$.

Tone 0

Similar phenomenon of T4 was also observed in T0, where learners did improve a lot in all aspects, $t(240) = -2.775$ for start point, $t(240) = -2.855$ for end point, $t(240) = -2.838$ for tonal contour, all $p < 0.05$.

The results show that the tonal contour of T1, T3, T4 and neutral tones (T0) improve significantly after 22 weeks of phonetic training. So does the end point of T1, T4 and T0 and the start point of T4 and T0. This means that to 11 Polish learners, 22 weeks is an enough period to improve their T4 and T0 in terms of three aspects of tones, while it is not enough for them to improve their T2 significantly.

4. Discussion and Conclusion

Table 1 presented below demonstrates the MEAN for each tone in various conditions and time. Overall, the performance of the 2nd series is better than that of the 1st series in all aspects, except to T2, which makes no difference. One should note that both in the 1st series and in the 2nd series, T3¹ proves to be more difficult when compared to other tones, although it has improved significantly in the 2nd series. To control the shape of each tone seems to be the most difficult task to learners. Nevertheless, it improved significantly, except for T2, after 22 weeks. Summarizing, as to Polish learners, it is concluded that T3 is effectively learned by the 2nd series experiment, while T2 is least effectively improved though in the 1st series it got very promising assessment, better than T4 and T3 pronunciation. The order of tones according to the difficulty degree is as follows: T3>T4>T2>T1;T0² (1st series) and T3>T2>T4>T1>T0 (2nd series).

	start		end		contour		average		improved average
	1 st series	2 nd series	1 st series	2 nd series	1 st series	2 nd series	1 st series	2 nd series	2 nd series – 1 st series
T1	4.850	4.928	4.762	4.896*	4.708	4.868*	4.773	4.897	0.124
T2	4.786	4.845	4.757	4.663	4.613	4.628	4.719	4.712	-0.007
T3	4.612	4.760	4.450	4.599	4.227	4.467*	4.430	4.609	0.179

¹ For T3 the contour 214 and 21 (half third) is taken into consideration.

² T1 (4.773); T0 (4.791) – the two numbers show no *significant* differences.

T4	4.751	4.863*	4.627	4.797*	4.513	4.701*	4.630	4.787	0.157
T0	4.810	4.967*	4.810	4.959*	4.752	4.942*	4.791	4.956	0.165
ave- rage	4.7618	4.8726	4.6812	4.7828	4.5626	4.7212	4.669	4.792	

Table 1.³ The mean for each tone in various conditions and time.

The reduced T0 pronunciation rate in the 2nd series is the best. Underlining in the course of training the timing of the level-tone (T1) equips the learners with the top of the individual register coherent with the Polish speech sound meaningful features (high frequencies). The lexical stress as the prosodic value in Polish turns to be crucial when acquiring and improving significantly the falling tone (T4) pronunciation. Though the rising tone's start and end point as well as the contour gained a relatively high score in the 1st series of the experiment, the promising result did not develop into close to perfect pronunciation. It seems the reduced speech is responsible for the rising tone (T2) insufficient control over timing and timing sections, clear in the ending and contour scores of the 2nd series. Finally, the falling-rising tone (T3) is obviously the most difficult lexical tone for the Polish learners of Chinese. Even though the pronunciation improvement of the falling-rising tone gains the highest scores in the 2nd series assessment, the discussed tone pronunciation causes the most trouble to the participants of the experiment. Contrasted to the high-level tone, the falling-rising tone (in a particular context a half-third tone) depends on the bottom of the individual register both in the frequency scope it explores and in control of timing and timing sections. Alien to the Polish L1 users, the low speech sound frequencies require more individual training to discriminate the cues and control articulation of the low register speech sounds in the tonal language.

The prosody is an integral part of a language. Though the lexical tones in Chinese are sometime compared to prosodic features, their function is more crucial for the word recognition than prosody in the non-tonal languages. That is why some linguistic competence in phonetics and phonology, auditory sensitivity and well-thought training, as well as correct pronunciation habitual skill, contribute to listening comprehension in Chinese and perfection in production. When standing in front of students who are the Latin script users, teachers cannot help that *pinyin* spread in teaching Chinese though it is a tad misleading. However, they can turn to characters and phonological memory as fast as possible.

This study is a result of searching for years for an effective teaching technique to overcome the non-tonal language users (here, Polish as L1) limitation in learning Chinese. It was applied in the presented here scheme for four years to the freshmen in Faculty of Philology, Department of Japanology and Sinology, sinology program. Though one can communicate (more or less successfully) with a poor pronunciation in a foreign language, the well laid foundation allows to build a more stately language

³ With * the score showing a significant difference between the performance in 1st series and 2nd series is marked.

skills construction. Starting from the phonetic features and syllables, getting through the semantic meaning in a sound and syntactic structure in the utterance, the students become equipped with a perspective of the decoding process from a sound to meaning. Yet, the routine of monitoring self-produced speech should become a tool in the ongoing language development. For the Polish L1 users, both the experience in teaching and the results of the collected data draw the attention to the scope of speech frequencies somehow less exploited in L1, and thus alien to the auditory potential and language processing. This study has provided Chinese syllable teaching procedures to adults with non-tone L1 background who approach learning the Chinese language for the professional use in future. It also revealed some difficulties in tonal phonemes production (and perhaps distinction) and discussed the possible reasons falling into L1 qualities.

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[1] <http://livesound.pl/tutorial/artykuly/4629-zrozumialosc-mowy> [Retrieved 15.09.2017.]

Appendix A

去台灣當留學生要辦很多事。在大學的辦公室要辦學生證，選課，還有辦圖書館卡。留學生可以住學生宿舍，也可以在外面租房子。想要在外面住，就得找房子。可以跟別的學生一起租房子，這樣就很便宜。每個月都得付房租費，還有，要給房東一個月的押金。大學附近找地方住不難。這樣不需要坐公車去大學，可以走路去上課。還有，那兒商店，便宜的餐廳都有。住大學附近真方便。