Learning from L2 learners to improve pronunciation training

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1. INTRODUCTION

The Computer-Assisted Listening and Speaking Tutor (CALST) is a multi-lingual platform for listening and pronunciation training. It both makes predictions about mistakes that learners can be expected to make and learns from actual, observed mistakes: 1) It uses typological databases to perform a contrastive analysis, which is subsequently used to select exercises depending on the learner's native language (L1). 2) For linguistic properties for which no typological data can be used to predict possible mistakes, learner data are logged. Exercises which were unproblematic for previous learners with a given native language are deleted from the learning trajectory of a new user with the same L1. 3) The rationale in 2 is also extended across target languages: If a linguistic property in one target language was unproblematic for speakers of a given L1, it is assumed that the same or a similar property will also be unproblematic for the same speaker group in another target language (L2).

The collection of an L2 learner corpus is thus an integral part of our multi-lingual computer-assisted pronunciation training (CAPT) platform. The data collection includes perception test results, voice recordings and orthographic transcriptions of auditorily presented words. The data can be analysed phonetically and will also be used directly to provide efficient learning trajectories for L2 learners.

2. PREDICTING L2 CHALLENGES

When learning a new language, L1-L2 differences are an important cause of pronunciation challenges [1]. Instead of presenting all learners with the same pronunciation exercises, information about the learner's L1 can thus be used to select L2 pronunciation exercises which can be assumed to be particularly relevant to each specific learner. Doing just that, CALST offers tailored listening, speaking and writing exercises [5]. Based on the phoneme inventories of a large number of languages in the UCLA Phonetic Segment Inventory Database (UPSID) and the Lyon-Albuquerque Phonological Systems Database (LAPSyD), the L1-L2*map* tool for contrastive analysis is used to determine all unfamiliar sounds in the L2 [3]. Only these sounds are linked to exercises for any given learner. This makes the learning trajectory in CALST more efficient than in CAPT systems where the exercises are fixed.

L2 learners not only have to learn to recognize and pronounce unfamiliar sounds, they also have to learn to pronounce them in unusual positions and unfamiliar clusters [4]. In L1-L2*map* we have provided a list of consonant clusters which can occur in the syllable onset or coda of ten languages, including Norwegian. The exhaustive lists enable us to perform a contrastive analysis and use the result to offer tailored exercises for learners speaking those languages (at present only for Norwegian as a target language). The criteria for choosing the languages were that they belong to diverse language families and are spoken by large immigrant groups in Norway.

Unfortunately, comparable consonant cluster information is not available for other languages in a form which is suitable for contrastive analysis. Although LAPSyD contains information about the maximum syllable templates in a large number of languages, it is not possible to use this information to create tailored exercises for complex syllable clusters. This would require that we can expand the syllable templates into an exhaustive list of syllables of consonant clusters which can be used for contrastive analysis, but this is not possible [4].

Learners with native languages for which no complete list of consonant clusters is available are guided through *all* consonant cluster exercises. In sections 4 and 5, we shall explain how corpus data obtained from these learners can make the learning trajectory in CALST more efficient for other learners.

Other language typological information, such as the information about word stress in the StressTyp2 database can in principle also be used for a contrastive analysis, but there are still many open questions with regard to the effect of differences between L1 and L2 stress systems on language learning [2]. Similar problems in the predictability of learning challenges exist when it comes to lexical tone, where the presence or absence of lexical tones in L1 does not predict problems with the production and perception of lexical tones in L2 [6]. Since it is not immediately clear how typological information can be used in these cases, a more pragmatic approach must be adopted. Such an approach is presented in sections 4

and 5. But first we describe the collection of a phonetic learner corpus in the next section.

3. PHONETIC DATA COLLECTION

The phonetic corpus collection is an integral part of the user logging in the CALST platform.

The user logging helps learners to evaluate their L2 language skills shown in the learner progress statistics (exercise scores presented in charts) and is at the same time used to gather phonetic learner data. The data include the results from several exercise types:

- results from perception tests using minimal pairs (see AXB and minimal pair exercises in CALST)
- voice recordings of single words (pronunciation exercises)
- orthographic transcriptions of single words (spelling exercises)

Firstly, the corpus data can be analysed linguistically to further develop L2 acquisition theory. Secondly, they can be used directly to create more efficient learning trajectories, as is explained in the next two sections. In section 4, we explain how phonetic data obtained from learners with the same L1 can be used to reduce the number of exercises for a given L2, while section 5 describes a parallel application across different target languages.

4. LEARNING FROM OTHER L1 LEARNERS

In cases where language typological information cannot be used to make a selection from all available pronunciation exercises (cf. section 2), logged phonetic learner data collected about actual, *observed* problems for each learner can be used to tailor the learning trajectory.

CALST logs all the results from exercises (cf. section 3) together with user data, esp. the learner's L1. If there is no typological information available which can be used to select a subset of exercises, learners must complete the full set of exercises (cf. section 2). Exercises with close to 100 % correct responses for a set of learners with a shared L1 (and no learners with the same L1 having problems with the exercise) are taken out of the learning trajectory for learners with the same L1, reducing time spent on unnecessary exercises and leaving more time to focus on other properties of the L2 which do need attention.

5. LEARNING ACROSS LANGUAGES

CALST is a truly multilingual CAPT platform, not only because it takes into consideration learner's L1 in generating the learning trajectory, but also because any new language can be implemented on the CALST platform. By supplying language content, all the exercises in CALST automatically become available for the new target language. CALST is available for Norwegian and is presently being extended to British English.

Any user data logged for a given L2 not only contributes to a more effective learning trajectory for learners with the same L1 who want to learn the same target language (section 4), it can also be used to create an effective learning trajectory in other languages. If learners with a shared L1 do not have problems with a particular sound in a given target language (e.g. Norwegian), we can assume that the same sound is equally unproblematic in another L2. Consequently, the exercise for that sound in a different L2 can also be taken out of the learning trajectory for learners with the given L1.

This is not only true for unproblematic sounds, but also for any other language property. CALST offers exercises for different repair strategies which learners may adopt when confronted with an unfamiliar consonant cluster: reduction, substitution, metathesis or epenthesis. It is not possible to predict on linguistic grounds which repair strategies learners with a given L1 will use, but exercises for consonant clusters which are unproblematic as well as exercises for repair strategies that other learners with the same L1 do not apply can be deleted from the learning trajectory. This helps to reduce the large number of exercises for consonant clusters.

6. SUMMARY AND CONCLUSION

CALST uses large language typological databases to adapt the learning trajectory to the learner's native language. At the same time, there are many phonetic properties for which we cannot predict whether learners will have problems with them. In these cases, CALST generalizes across learners, deleting exercises from the learning trajectory when other learners with the same L1 have high scores for them.

Languages can share phonetic properties. Consequently, it is possible to generalize information from one language to another: If learners with a shared L1 do not have problems with a given sound, sound cluster, stress pattern, etc. in one target language, we can assume that it will also be unproblematic in another language. This generalization strategy makes the CALST concept truly multi-lingual.

CALST is restricted to simple drill exercises using single words or short word sequences. We hope that knowledge obtained from these exercises can be a useful complement to more spontaneous phonetic learner corpora with L2 speech recordings, which are likely to display more variation in learner behaviour.

REFERENCES

[1] Ellis, R. 1994. *The Study of Second Language Acquisition.* Oxford University Press.

[2] Kijak, A. 2009. *How stressful is L2 stress? A cross-linguistic study of L2 perception and production of metrical systems.* Utrecht: LOT (Ph.D. thesis).

[3] Koreman, J., Bech, Ø., Husby, O. & Wik, P., 2011. L1-L2*map:* a tool for multi-lingual contrastive analysis, *Proc. ICPhS2011,* Hong Kong.

[4] Koreman, J., Martínez-Paricio, V., Abrahamsen, J.E., Husby, O. 2015. A systematic approach to the pronunciation training of phonotactics, *Proc. ICPhS2015,* Glasgow.

[5] Koreman, J., Wik, P., Husby, O. & Albertsen, E. 2013. Universal contrastive analysis as a learning principle in CAPT, *Proc. SLaTE 2013,* 172-177.

[6] van Dommelen, W. & Husby, O. 2009. Native and non-native identification of Norwegian word tones, *Proc. Xth Nordic Prosody Conf.*, Helsinki, 237-247.