

CALLIPSO – CALL for Irish for Parents Students and Others

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RESUME

L'irlandais est une langue complexe et opaque qui présente des difficultés pour les apprenants car une compréhension approfondie du système orthographique est nécessaire pour pouvoir lire et prononcer les mots correctement. Cet apprentissage de la langue peut se faire en autonomie grâce à des livres ou à des ressources d'apprentissage assisté par ordinateur (EAO) ou bien avec un enseignant. Toutefois, les règles de prononciation de l'irlandais sont très difficiles à comprendre pour les non-linguistes, y compris pour les enseignants. De plus, il existe très peu de ressources pédagogiques pour l'EAO de l'irlandais qui expliquent clairement les règles de prononciation de la langue. Cet article présente le système CALLIPSO 1 (CALL for Irish for Parents Students and Others) pour l'enseignement et l'apprentissage de la logique du système orthographique irlandais. CALLIPSO est un système modulable et évolutif qui s'adapte facilement à d'autres langues.

ABSTRACT

CALLIPSO – CALL for Irish for Parents Students and Others

Irish is an orthographically deep (opaque) language and presents difficulties for learners. There is a need for learners to understand the logic of the orthographical system in order to help them to read and pronounce words correctly. In order for learners to get this knowledge they either have to learn it via a teacher, a book or Computer Assisted Language Learning (CALL) resource. However, there are problems in this regard as teachers may not know the rules and information on pronunciation are often hard for the non-linguist to understand. There are very few CALL resources for Irish pronunciation that focus on explaining the rules in an accessible manner. This paper provides an overview of the CALLIPSO¹ (CALL for Irish for Parents Students and Others) system for teaching and learning the logic of the Irish orthographical system. CALLIPSO is modular and could be adapted for other languages.

MOTS-CLÉS: Enseignement Assisté par Ordinateur (EAO), irlandais, prononciation

KEYWORDS: CALL, Irish, pronunciation

¹ Available at : callipso.computing.dcu.ie

1 Introduction

Irish is an orthographically deep (opaque) language and learners need to be able to understand the pronunciation rules in order to be able to read and speak correctly. The fact that it has a deep orthography means that it presents difficulties for learners. They cannot make educated guesses as to how a word should be pronounced. There is a need for learners to understand the logic of the orthographical system in a way that they can easily understand. In order for learners to get this knowledge they either have to learn it via a teacher in a classroom setting, a book (perhaps for adult learners) or some Computer Assisted Language Learning (CALL) resource. However, there are problems in this regard. Many teachers themselves do not know the rules of Irish orthography and therefore cannot teach it to their students. They may not have been made aware of the rules themselves. This might be the case for primary school teachers who cover many subjects and are not usually Irish language specialists. Unless learners have a good knowledge of linguistics, it is often difficult to understand the correct pronunciation of Irish words just by reading the International Phonetic Alphabetic (IPA, 1999) phonetic translation of the words. There are some books that aim to show the pronunciation of words using English approximations, but these books tend to focus on explaining how to pronounce certain words and not the overall logic of the orthographical system. In terms of CALL resources for Irish pronunciation that focus on explaining the rules in an accessible manner, there are very few resources available. This paper provides an overview of the CALLIPSO (CALL for Irish for Parents Students and Others) system for teaching and learning the logic of the Irish orthographical system. CALLIPSO is designed in a modular fashion and to be language independent so that it could be adapted for other languages. The system is aimed at a broad spectrum of learners including parents, teachers and Irish language learners themselves.

1.1 Background

The term Computer Assisted Language Learning (CALL) covers all aspects of the use of computers in the language learning process. The degree of difficulty in developing different types of resources varies greatly. Using generic software to develop static resources is quite easy, while developing sophisticated resources that use Natural Language Processing (NLP) and Intelligent Tutor Systems (ITS) techniques is very complex and complicated. The fact that the effort involved in developing one hour of instruction (~ 50 – 100 hours of development time, with the use of authoring tools Aleven et al., 2009) is obviously an important factor. Pirolli and Kairam (2013) note that this may be worthwhile for widely deployed course (e.g. mathematics related material), but may not be feasible for other domains and contexts. The resources (financial, technical and time) required to design and develop such systems and the technical challenges that need to be addressed mean that it is very difficult to build an ICALL system that would be suitable for a range of learners in the real-world. Holland et al., (2013) provide a good recent overview of the field. Irish is a Minority Language (ML) and like other minority languages, there are limited good-quality, accurate CALL resources available for students. There are some Natural Language Processing (NLP) resources available for Irish, but they were not specifically designed for language learners (Uí Dhonnchadha, 2002; Scannell, 2014; Abair, 2016).

Pedagogical design decision should be a key part of the design process of CALL resources. This includes what to teach and how to teach the material. The field of pedagogy and language pedagogy in particular, is well researched and there are a wide variety of pedagogical approaches that can be incorporated into CALL resources. CALL designers may focus on a particular language skill (e.g. listening or writing) or a particular language level. Consideration is usually given into how to teach a

particular language construct, and perhaps, mechanisms to test and evaluate a learner's progress. These are important considerations.

1.2 Motivation

Most CALL resources for students concentrate on the needs of the immediate learners. However, many younger learners often receive help and guidance from their parents as part of the learning process. This is particularly true at primary school level and specifically when learners are doing their homework. Parents may be asked to check that their children know how to spell words or to check their reading of a piece of text. This is usually straightforward for parents – their literacy levels are usually higher than primary school children. However, problems can arise when parents are asked to check their children's ability in a language that the parents may not be competent and/or confident in or may not even speak the language.

This is a situation which arises in Ireland. Irish is a compulsory subject (with some exceptions) in schools in Ireland, yet it is the spoken as a first language by only a tiny minority of the population. Motivation is one of the key factors in determining learning success. Gardner and Lalonde (1985) noted that intrinsic and instrumental motivation are important factors in the learning process, while Dörnyei and Csizér (1998) state that learner level and learning situation level are also important components in L2 motivation. In the case of Irish, there is no real need to be able to speak Irish. Apart from the fact that only about 10,000 people speak it as their main language of communication on a daily basis, all native Irish speakers are fluent in English, and there are very few situations where it would be absolutely essential to be able to speak Irish to communicate with someone. Thus, for Irish, there is no real communicative need to learn the language (Watson, 2008). There are several socio-cultural reasons for learning the language e.g. heritage reasons such as fearing the loss of cultural identity without the language (Darmody and Daly, 2015), but these have less of an impact on learners than if a real communicative need existed. There are instrumental reasons for learning the language – principally, the need to do well in state exams in Irish – but many learners aim to learn just enough, without any high aspirations to master the language. The situation for parents is complex. On the one hand, they would like their children to learn the language, but on the other, they bemoan the time spent learning the language, the difficulty of the language, and their own lack of ability in the language. They tend to have a Machiavellian attitude towards the language. They just want their children to learn enough to not struggle too much with the language and to learn enough pass the state examinations (Darmody and Daly, 2015). Also, Hickey and Stenson (2011) note that the teaching methods can also have an influence on motivation to learn Irish.

1.3 Different Learner Groups

There are several personas or learner groups to consider in the context of Irish. The most common persona (false beginners) are parents who has learnt Irish in school, but may have forgotten it, never really mastered it or lack confidence in the language. The next persona are (novices) are parents that have never studied the language, as they immigrated to Ireland as an adult or did not study in either primary or secondary school in Ireland. The third persona (intermediates) consists of parents who have studied Irish and generally have some ability in the language, but may not sufficient competence to help their children. CALL resources for these learners must be tailored to their differing needs. A CALL resource should provide basic information for novices, refresher information for false beginners and access to more detailed information for intermediates. An interesting feature about

parents and their Irish language capability is that parents may often underestimate their ability. MacIntyre et al. (1997) showed that anxious students underestimated their language ability and this has implications for the language learning process. It is useful feature for a CALL resource to help users to identify their own ability and perhaps show them that they are not as ‘bad at Irish’ as they think they are. An adaptable CALL resource e.g. the learner can decide on the interface language and audio speed, gives learners more control over the learning process and this is good. As more data is gathered about learners, a CALL resource can be modified to adopt a more adaptive approach e.g. determining an appropriate path through the resources based on the learners’ achievements and knowledge to date.

2 Irish Pronunciation and Orthography

Irish pronunciation is challenging for learners, including learners whose first language is English. Spelling and pronunciation in Irish is very regular – but there are problems for learners. There are about basic rules that learners may need to know, but in general, they are never taught them. This is in part because language teachers themselves are generally unaware of some of the more common rules. Furthermore, there are dialectal differences (there are three main dialects) and the rules have not been fully defined (Hickey and Stenson, 2011).

2.1 Irish – an Orthographically Deep Language

An orthographically shallow (transparent) language is one in which the letter and phoneme relationships is maintained, whereas an orthographically deep (opaque) language is one in which the letter/phoneme correspondance is not as consistent and complete. While not as deep as English, Irish is an orthographically deep (opaque) language (DAI, n.d.). This means that the logic of the orthography is not as transparent as an orthographically shallow language like Spanish. For example, in Spanish, the word for house is ‘casa’ and most readers will be able to pronounce this word correctly as ‘kasa’. The word for house in Irish is ‘*teach*’, which many English native speakers would pronounce as the English word ‘teach’ (as in teacher). However, the word is actually pronounced ‘chock’ and this lack of immediate correspondence between the written form and the spoken form of the word can be disconcerting for many learners. Frost and Katz (1992) outline the Orthographic Depth Hypothesis (ODH) which indicates that the reading process is different for deep orthographies compared to shallow orthographies.

Consonants

The Irish alphabet uses the following consonants for Irish words: b, c, d, f, g, h, l, m, n, p, r, s, t. It also uses the letters j, k, v, w, x, y and z in loanwords. In many cases, the pronunciation of a consonant is predictable, but there are differences in pronunciation depending on whether a broad vowel (a, o, u) or a slender vowel (e, i) follow the consonant. For example, ‘s’ with ‘ú’ (a broad vowel) is pronounced as /sʲ/, whereas ‘s’ with ‘í’ (a slender vowel) is pronounced as /ʃ/. Thus, the word *suil* (expected) is pronounced as suul, whereas the word *siúl* (walk) is pronounced as shuul.

Irish, in common with other Celtic languages, uses lenition and eclipsis. Lenition occurs when a stop becomes a fricative. In Irish orthography, lenition is denoted by a h after the consonant being lenited. For example, *peann* (pen, /pʲaːnʲ/) becomes *pheann* (/fʲaːnʲ/). Eclipsis, sometimes known as

nasalisation, causes the letter of the new sound to be placed in front of the original letter. For example, *peann* (pen; /pʲaːn̪ˠ/) becomes *bpeann* (/bʲaːn̪ˠ/).

Vowels, Di-graphs and Tri-graphs

Depending on classification, Irish could be considered to have 10 vowels but there are many more digraphs and trigraphs. The most basic vowels are a, e, i, o and u and they can be either stressed or unstressed. Each vowel also has an accented form: á, é, í, ó and ú. The accents denote a long form of the vowel. For example, *a* is pronounced like the ‘a’ in bat, while *á* is pronounced like the ‘aw’ in raw. However, there are di-graphs and tri-graphs in Irish. For example, *ai* is pronounced as ‘a’ (*baile*, /ˈbʲalʲiə/, home) and *iai* is pronounced /iə/ (*bliain*, /bʲilʲiəni/, year). The list of di-graphs and tri-graphs can be initially daunting, but there are rules that can help the learner understand the system.

3 Overview of CALLIPSO

CALLIPSO (CALL for Irish for Parents Students and Others) is a CALL resource for learning about Irish pronunciation. The aim of the CALLIPSO system is to provide a learning resource that explains the basics of Irish pronunciation in a layperson’s terms, rather than in a more technical (i.e. linguistically-oriented) manner. The learners can listen to letters, both individual, digraphs and trigraphs. There are a series of language exercises for learners to try out their knowledge of Irish pronunciation. The learner can also choose the interface language (e.g. English or Polish).

3.1 CALLIPSO Design Approach

The main design approach of the CALLIPSO system is modular and language-independent. A modular system leverages the benefits of good software engineering design. A modular system means that components are organised in a logical manner and that the code has good cohesion and is lightly coupled. This means that it is easy to change a part of the system without impacting on other parts of the system.

Sustainability was one of the key principles behind the CALLIPSO design. Very often resources are developed for a particular learning domain but cannot be adapted to another domain or different type of end-user. This is obviously wasteful in terms of money, time, effort and general resources. In recent years, the concept of sustainability has emerged as a theme in software development, including CALL (e.g. Sanz, 2015). The CALLIPSO system is designed with sustainability in mind. It has a modular design to facilitate extendibility and reuse. This is especially important when developing resources for Minority Languages, particularly if the resources could be used for other languages that currently lack CALL materials. User Modelling has been discussed in the literature for many years and has been used in Intelligent Tutoring Systems, but it has not been used extensively by CALL researchers when designing and developing CALL resources. There may be some consideration given to different user groups and their needs, but the use of user models per se is either very limited or under-reported. One of the future goals of the CALLIPSO system is to use user models in the system to try to enhance the learner’s experience (along Fischer’s (2001) lines). The target end-users are time-poor and Machiavellian and want the maximum gain with minimal effort.

CALLIPSO is designed using an agile approach (Beck et al., 2001), with a focus on designing and developing components that use useful and usable, rather than a more traditional software

engineering approach which places more emphasis on a structured, sequential model. The aim of using an agile approach is to be able to deliver working pieces of software in small increments so that users can avail of some functionality without having to wait until the entire system is complete. In recent years, the use of the agile paradigm has become more common in the area of software development. CALLIPSO developed its functionality incrementally and sought feedback from target users after each component was developed.

CALLIPSO also aims to reuse existing resources where possible. This is especially important for Minority Languages where resources are limited. It would be challenging and time consuming to provide the audio files required by CALLIPSO from scratch. Native speakers would be required to articulate the words used by CALLIPSO and given the agile approach adopted by CALLIPSO it would not be feasible to do this in a piece-meal manner. In order to overcome this problem, CALLIPSO uses resources from Abair (Abair, 2016), the Irish Text-To-Speech (TTS) tool. Abair is a high-quality system that provides TTS audio for three different dialects of Irish: Donegal (Gweedore), Connemara and most recently Munster (from the Dingle Peninsula). This is important as learners may wish to hear a word spoken in the particular dialect or even compare two different dialects. Abair also provides five speed settings: very slow, slow, normal, fast and very fast. The slower speed is particularly useful for learners as they often find it difficult to understand an L2 spoken at normal pace. As learners progress with their understanding of Irish pronunciation, they can progress towards understanding a word, phrase or text spoken at normal pace. The required audio files are generated by Abair and these are then incorporated into CALLIPSO.

CALLIPSO also builds on the research of Hickey and Stenson (2011) who outline an approach for teaching Irish pronunciation to learners. They combine knowledge of language pedagogy with Irish linguistics to propose a mechanism for teaching the sound system of the language to beginners. They present a mechanism for teaching Irish pronunciation in a logical and coherent fashion and this approach is used in CALLIPSO. For example, they suggest that learners should be explicitly taught the basic values of simple (orthographic) vowels and the length difference indicated by an acute accent), that in a vowel sequence with an accent, the vowel with the accent is the one to pronounce and that word-final vowels are never silent. They also suggest teaching that *c* in Irish is always pronounced a /k/ and *g* as /g/, that *s* is pronounced as *s* or *sh* depending on the adjacent vowels and that the use of *h* in lenition changes the pronunciation (learners often ignore the *h*). The system provides a brief summary of these rules to learners.

3.2 CALLIPSO Design

CALLIPSO uses the LAMP (Linux Apache MySQL PHP) stack. It uses an Apache HTTP server with MySQL relational database management system and the PHP programming language. The benefits of using the LAMP stack include ease of developing applications, easy to deploy, flexibility, security and there is a large support community. One other important benefit in the context of CALLIPSO and Minority Languages is the fact that it is open sourced and non-commercial. The CALLIPSO files are stored in Git, which is a free and open source version control system. Figure 1 shows an overview of the CALLIPSO LAMP stack.

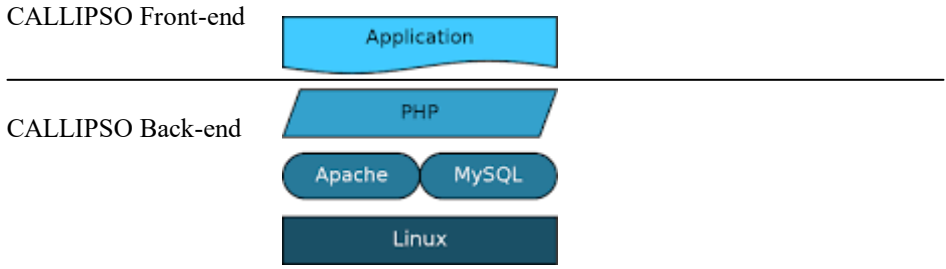


Figure 1 : Overview of the CALLIPSO LAMP Stack

3.3 CALLIPSO Database

CALLIPSO contains information on different entities. Table 1 shows the Business Rules for some of the main entities in the CALLIPSO system – these include letter, language, word, learning item and syllabus. The Business Rules provide a non-technical explanation of what each component means in the CALLIPSO system and the information that the system should store about that component. There are also Business Rules for user related components (e.g. user, login), quiz related components (e.g. quiz, mix quiz, match quiz, cloze quiz) and learner analytics (e.g. user progress and badge).

<p>A letter is written character or combination of characters. It has associated audio, an International Phonetic Alphabet (IPA) phonetic representation and an example. A letter can have different examples depending on the language of instruction.</p> <p>A language is a language that is used as the language of instruction for the CALLIPSO system. A language will have a language id, and the name of the language in English and the language itself.</p> <p>A word is a combination of letters. A word has a word id, the word itself and a translation. There will be at least one translation for each language of instruction. A word may also have an associated image.</p> <p>A learning item is a component that has information about some part of the orthography. It has an id, a type, an associated letter (or letter combination) or word. It also has textual information for the user. The textual information can be in different languages.</p> <p>A syllabus is a collection of learning items and quizzes. A syllabus has an id, a type and a description.</p>
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Table 1 : Main Business Rules in the CALLIPSO system

CALLIPSO is built using a relational database (MySQL). The main linguists-related tables are Letter and WordDetail. Each letter has a unique id (letter_id), the character of the letter, a classification (vowel, consonant), a class type (simple alphabetic, limited, eclipsed, double, simple accent, acute accent, digraph, diphthong), a sample word with the letter, the IPA representation of the letter, a dialect_id, an audio of the letter, and a speed. The WordDetail table contains information on how to pronounce a letter. It contains a unique word_id, the example word, the meaning of the word, the letter(s) being explained, if the word is with a broad or slender consonant, or stressed/unstressed for a vowel, what it sounds like (for a lay learner) and a word with a similar sound in the learner's L1 (initially English). Table 2 shows the Letter table with an example of a consonant and a vowel. Table 3 shows the WordDetail table with examples. (Note that there is a LetterInfoCode table used to join the Letter table with the WordDetail table to cater for consonants combined with broad or slender vowels, but this is omitted here for simplification purposes). O'Siadhail (1988) provides further examples of broad/slender pairs.

There are also tables for quiz related data, including Mix, Match and Cloze which contain information on mix quizzes (i.e. multiple choice quizzes), match quizzes (match items on the left hand side with their corresponding match on the right-hand side) and cloze quizzes (where the learner has to fill in the blank). There are also tables to keep track on learners and their progress through the system. There are plans to incorporate learner analytics in CALLIPSO to help improve the learner experience and to improve the resource over time.

Letter Field	Function	Example: 'b'		Example: 'á'
		Broad vowel	Slender vowel	
letter_id	Unique id	700		800
characters	Letter(s) used	<i>b</i>	<i>b</i>	<i>á</i>
classification	Type of letter	simple_alpha	simple_alpha	simple accent
word_id	Link to sample word	131	132	110
IPA	IPA transcription	/bʲ/	/bi/	/a:/
dialect_id	Dialect identifier			
audio	Audio file			
speed	Very slow, slow, normal			

Table 2 : Letter table with examples

WordDetail Field	Function	Example: ‘b’		Example: á
		Broad vowel	Slender vowel	
wd_id	unique id	131	132	110
wd_word	word in Irish	<i>bord</i>	<i>béal</i>	<i>bán</i>
wd_meaning	meaning of the word	table	mouth	white
wd_letter	the letter(s)	b	b	á
wd_classification	Broad or slender	s	b	stressed
wd_like	Similar sound	b	b	aw
wd_in	Similar sound in L1 word	boot	beautiful	raw
wd_lang	Language of instruction	English	English	English

Table 3: WordDetail table with examples

3.4 CALLIPSO User Interface

The design of the User Interface was a simple, consistent look and feel. There is an overview of the alphabet, as well as information on consonants and vowels. Within consonants, there are the simple consonants (b, c, d, f, g, h, l, m, n, p, r, s and t), the consonants with lenition (bh, ch, dh, fh, gh, mh, ph, sh and th), the consonants with eclipsis (bhf, bp, dt, mh, nd, and ng) and the special consonants (ll, nc, nn, rr and ts). Within the vowels, there are the simple vowels (a, e, i, o and u), the accented vowels (á, é, í, ó and ú) as well as the many digraphs (e.g. ai, ui) and trigraphs (e.g. aei, uai) that exist in Irish.

Figure 2 shows the CALLIPSO information for the letter b. It explains how the letter b is pronounced with a slender vowel (e or i) and a broad vowel (a, o, or u). In this example, the information is provided in English. A word for b with a slender vowel (*béal* – mouth) and with a board vowel (*bord* – table) are provided. These words can be clicked and the learner can hear the word being pronounced. All this information comes from the database so it can be modified as required. For example, if a different word was preferred as the example word, that could easily be changed. Also, the standard text explaining something (e.g. ‘The letter ... sounds’) can easily be shown in a different language based on learner preference.

Figure 3 shows the CALLIPSO information for vowels. It provides a simple explanation of the vowels in Irish. The learner can click on the panel on the left-hand side to see more details on the vowels.

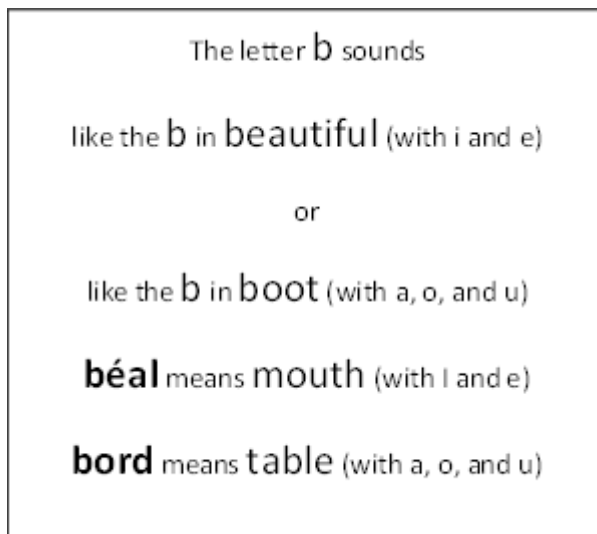


Figure 2 : CALLIPSO information for the letter b

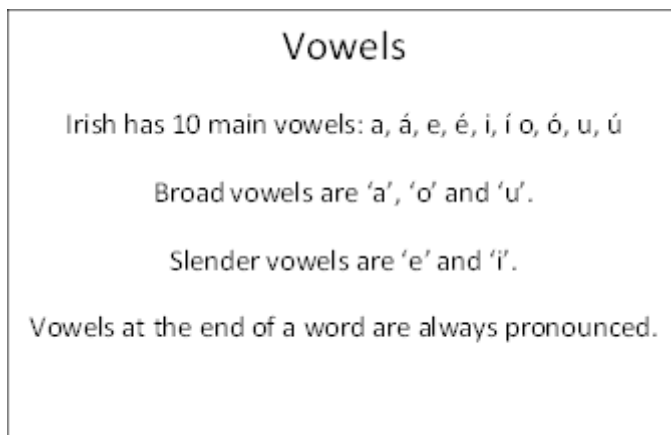


Figure 3 : CALLIPSO main vowel information

4 CALLIPSO – Future Developments

4.1 CALLIPSO for Other Celtic Languages

CALLIPSO was designed to be modular and language independent. It would be possible to adapt CALLIPSO for another Celtic language by populating the database tables with the relevant information for that language. All the information displayed on the CALLIPSO pages is generated by data in the database tables so it is fully flexible. The remaining infrastructure elements of the LAMP stack would not need to be changed. This is the theory – in reality there may be some changes that would be required, but these should not be too substantial.

4.2 CALLIPSO – Animation Module, Gamification, Learner Analytics

Further modules are being developed to enhance CALLIPSO. There is an animated visualisation module under development that will show the steps involved in pronouncing a word. Figure 5 shows an example of how to pronounce the word *Seán* (a popular male name in Ireland). It shows that the *á* means that the *á* is pronounced as ‘aw’, while the ‘s + e’ means that the ‘s’ is pronounced as ‘sh’, which gives a final pronunciation of ‘shawn’.

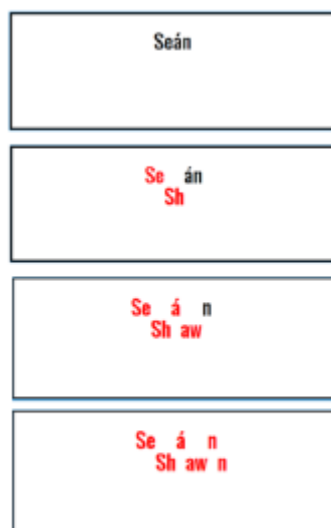


Figure 5 : Diagrams of animated visualisation of how a word is pronounced

Gamification is an increasingly popular area in CALL and in Computer Assisted Learning (CAL) in general (Kapp, 2012). Gamification provides learners with a chance to experiment and try things out with a safe set of boundaries (e.g. test their understanding of Irish pronunciation in private rather than in public). Deterding et al., (2011) define gamification as the use of game design elements in non-game contexts, including education. CALLIPSO aims to provide exercises (or mini-games) where learners can test their knowledge and receive immediate feedback. There will be different levels as learners increase their knowledge and understanding of Irish. CALLIPSO is designed to be

able to award badges to learners as they progress through the system to encourage them to continue their learning. This feature has not been fully implemented. Learner Analytics is an area of active research interest (Ferguson, 2012), particularly in the area of educational data mining and there are plans to incorporate an element of learner analytics in CALLIPSO. Extra information about how learners interact with the system (e.g. do they look at the basic vowels or the more complex combinations ?) can be used to enhance CALLIPSO and provide an improved learning experience.

5 Conclusion

There is a need for a CALL resource to help learners understand Irish pronunciation. At first glance, Irish pronunciation looks difficult, as many learners are not explicitly made aware of the rules and they try to map their understanding of English pronunciation to Irish, which results in incorrect pronunciation. Furthermore, while there are some books that explain pronunciation, they often explain things in linguistic terms and use the IPA which may not be comprehensible for the average learner. A CALL resource has the advantage of allowing learners to be able to hear sounds and words being spoken and this can facilitate their understanding. CALLIPSO is a CALL system designed to explain the rules of Irish pronunciation to a non-technical learner. It is aimed at parents who want to help their children with their Irish homework, children themselves and even teachers who may wish to revise their knowledge of Irish pronunciation. CALLIPSO is module in design and could be adapted for other Celtic languages.

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