Visualizing the Rules of English Pronunciation

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ABSTRACT
We investigate a method of visualizing English pronunciation for TESOL applications. Though the problem is too complex to produce a complete set of rules and techniques for people who are learning English for the first time, if we concentrate on a limited set of situations, along with some knowledge of exceptions, a useful system should be able to be developed.

General Terms
Data visualization

Keywords
TESOL, data visualization, educational technology.

1. INTRODUCTION
The motivation for this work originally came from a project called **Silenc**, presented at Data Visualization Week 2012 at the Copenhagen Institute of Interaction Design [1]. This project undertook to illustrate which letters were silent, i.e. not themselves pronounced, in three languages: French, English, and Danish. Letters which are pronounced were printed in black, while silent letters were printed in red. A red screen was then placed over the text, which effectively made the silent letters disappear.

While this illustrated clearly which letters in a word are not pronounced, it was noticed that no distinction was made between letters which make no sound and letters which influence the pronunciation of other letters. A good example of this involves the letter 'c', which generally is pronounced like a 'k' unless followed by an 'e', 'i' or 'y', whence it is pronounced like an 's'. Indeed, this is seen in the name of the project itself, "Silenc".

Therefore, we attempt to investigate the problem and present some ideas for visualizing the rules of English pronunciation.

2. THE ENGLISH LANGUAGE
In English, many words are borrowed and adapted from other languages, as those new words encapsulate and convey a particular idea more succinctly. Along with the words and their meaning often came the spelling. Because words have come from a wide range of source languages, spelling rules in English appear to be very inconsistent. There is no one-to-one association of a letter to the sound it represents in English.

Noah Webster published the first edition of his "An American Dictionary of the English Language" in 1828 and a second edition in 1840 [4]. Webster changed the spelling of many words to better align them with the phonetics. Most variations in English and American spellings started here [4].

3. PHONETIC ALPHABETS
There have been various attempts over the years to develop a phonetic alphabet system, in which each different sound in a language is represented by a different character. We present some examples.

3.1 Sir Isaac Pitman
Sir Isaac Pitman (1813-1897) developed a shorthand form of phonetic speedwriting [2]. The symbols represent the sounds of words. Strokes, loops and hooks are used that differ in thickness, length and also their position above, through or below the line. Vowels are light or heavy dots and dashes.

3.2 International Phonetic Alphabet (IPA)
The International Phonetic Alphabet is a system of phonetic notation which attempts to represent all sounds spoken in all languages. Like Pitman's speedwriting, it is a phonetic alphabet where each symbol represents a unique sound [3].

IPA uses symbols of two basic types: letters and diacritics. Letters stand for basic sounds, which can then be modified with diacritics to represent a more accurate representation of the sound actually produced [3].

3.3 Phonetic alphabets: conclusion
While phonetic alphabets are extremely useful for representing the actual pronunciation of words, they do require the student to learn and use yet another alphabet apart from English. This may or may not be appropriate depending on the situation and the students involved. For academic endeavours phonetic alphabets are invaluable; for others it could be another source of confusion and may be of very limited usefulness.

4. SPELLING RULES
The object of this research is to move from spelling to pronunciation. IBM text to speech applications tackle this with a descriptive table for software (XML based) speech production systems [5].

Humans are inefficient list processors so as an example of the sort of problem we're dealing with, let's look at a few common spelling/pronunciation rules:

Table 1. Spelling rules for c and g

letters	sound	written	spoken
ce, ci, cy	s	circus	sirkus
c otherwise	k	accent	aksent
ge, gi, gy	J	Giraffe	jiraf

While many pronunciations of these words defy the rules stated, they are general enough to use as a starting example.

The Silenc project introduced an interesting concept, namely the use of colour to represent pronunciation [1]. We can apply this idea to the spelling rules for 'c' and 'g' as above by describing the alternatives--for example, 'c' pronounced as 's' or 'k'—and then printing words with the letters in question in different colours, for example 'c' as 's' is shown in green and 'c' as 'k' is shown in red.
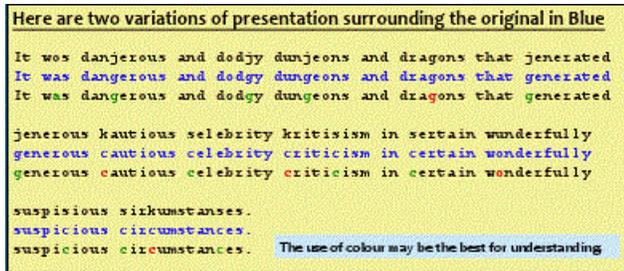

Figure 1. Using colour to represent pronunciation variances.

5. CONCLUSION

The Silenc project produced an interesting concept in distinguishing spoken vs. silent letters by colour. However, it did not distinguish between letters which are simply not voiced and those which modify the pronunciation of other letters. We have expanded on this idea by proposing to use different colours to represent different ways to pronounce individual letters. This could be a very useful approach in developing teaching tools in a TESOL environment. The use of Webster's dictionary spellings has advantages here but New Zealand generally follows the English spelling practices.

6. Further Work

Further research could explore the application of these ideas in a controlled language pronunciation class to identity how such a system is received and how successful it may be.

The system currently envisaged is essentially paper based. However, if computer based environments were also to be considered, computer generated speech could be used as a reinforcing agent while original and phonetically derived spellings are highlighted for the learner.

7. REFERENCES

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