# Focus on English Phonetics

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Edited by

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# INTRODUCTION

*Focus on English Phonetics* is the third collection of papers created by scholars gathered around the *Belgrade International Meeting of English Phoneticians*, started in 2008 by Professor Biljana Čubrović of the Faculty of Philology, University of Belgrade. After *Ta(l)king English Phonetics Across Frontiers* (2009, CSP) and *Exploring English Phonetics* (2012, CSP), this collection represents a further step in the same direction. As the ones before it, this volume aims to bring together researchers in the rich field of English phonetics, and provide them with a forum for exchanging ideas and research experience. The 18 contributors to this volume come from different linguistic and academic backgrounds, and from 9 different countries: Austria, Bulgaria, Hungary, Japan, Russia, Serbia, Slovenia, Spain and the United Kingdom. As a result, the volume reflects the authors' diversity by both its breadth and tenor. The topics discussed, the research approaches used, and the variety of theoretical, applied and experimental aspects of phonetic investigations all speak of this diversity, a very desirable quality in any field of research.

What this collection also shares with the two previous volumes is its general outlook and organization. The chapters are organized into four thematic units. *Part One* deals with segmental issues, *Part Two* with questions of suprasegmental phonetics. *Part Three* looks into some issues related to English phonetics and phonology teaching and EFL pronunciation instruction, while *Part Four* turns to some questions related to English phonology.

Alan Cruttenden's chapter, titled *Using MRI to see English sounds and their overlap,* opens the first part of the book by a description of the use of Magnetic Resonance Imaging in the investigation of segmental articulation and, particularly, coarticulation phenomena. The author discusses the problems in the instrumental study of articulation, particularly the problem of observing the dynamics of articulatory movements in speech production, where single static images produced by x-ray based technology were not very helpful. Cruttenden describes the introduction of Magnetic Resonance Imaging into articulation study, particularly a new procedure recently developed at Oxford, which can produce dynamic images showing the tongue movements during articulation. Such images have been examined in a number of phrases containing examples of

different English phonemes, available to the public on the website attached to the 7th edition of *Gimson's Pronunciation of English.* The author illustrates his description by a number of MRI images used in this procedure.

The acquisition of English monophthongs by Bulgarian EFL learners was investigated by Tsvetanka Chernogorova. Her chapter, titled *Acquiring L2 vowels: The production of high English vowels by Bulgarian native speakers*, presents the results of a research study which focuses on Bulgarian learners' problems in acquiring the complex vowel system of English. Compared to the English system of twelve monophthongs, the Bulgarian vowel system is rather simple, containing only six vowels, which makes EFL students' acquisition very difficult. The study particularly focuses on the English high vowels /iː, ɪ, uː, ʊ/, which the author describes as especially difficult since they are all, at least seemingly, similar to Bulgarian high vowels /i/ and /u/. The study explores the vowel production of first-year English majors at the University of Sofia, who read lists of words in citation form in English and Bulgarian. The analysis presents acoustic formant measurements (F1, F2) and the results of statistical analyses. Different degrees of acquisition of high English vowels by Bulgarian students are noticed, from complete substitution by the L1 vowel, e.g. /i/, to various degrees of quality alteration towards L2 vowel quality or, in some cases, very high degrees of acquisition.

The diachronic perspective in phonetic investigations is illustrated by Andrej Bjelaković's chapter, titled *Original pronunciation: The accent of Shakespeare's London.* The author provides a sketch of Early Modern English (EME) pronunciation, based on several major works dealing with EME phonology, illustrating the main differences in pronunciation between the present-day English and that of the 17th century. The chapter is organized around individual vowel phonemes, with the standard lexical sets of contemporary English used as the starting point, and with illustrations, in the form of phonemically transcribed verses, taken from William Shakespeare's works. The author particularly focuses on the frequently quoted observation that the phonological system of EME was rather similar to present-day English system, while the differences lie in the phonetic realisation. He also illustrates the point that mainstream EME pronunciation share many features with some regional accents of contemporary English.

*Part Two* of the book, devoted to suprasegmental topics, opens with a discussion of intonation in Welsh English. Stefano Quaino's chapter, titled *Pitch alignment in Welsh English – the case of rising tones in Gwynedd*,

sets off from the common observation that Welsh English and Celtic English are well-known for their preference for rising tones in declaratives, analysed by several authors (Gimson 2008; Cruttenden 1995; Tench 1990; Walters 1999). Focusing particularly on the previous observations that rises may be the most frequent tone on declaratives (Gimson 2008:289), and that the increase in the use of rises on declaratives may be 'a strong Celtic influence' (Cruttenden 1995:155), the author presents the results of his own acoustic analysis of Gwynedd English, aiming to describe and explain its main prosodic characteristics with respect to the use of rising tones.

*An acoustic analysis of the punch lines in English jokes* is presented in the chapter by Ken-Ichi Kadooka. The author uses acoustic analysis to explore the description of the punch-line paratone in jokes as a subtype of the low paratone, characterized by a combination of phonetic features, such as a lower pitch, slower tempo, and a pause preceding it, by which the end of the joke is signalled. The punch line paratone also includes a gradual lowering of the baseline pitch from the beginning towards the end of the joke - until the punch line. The author presents an analysis which illustrates this description, to a certain extent.

Brian Mott presents a comparative study of English and Serbian intonation, specifically the characteristics of the nucleus. In the chapter titled *Observations on the nucleus in English and Serbian* the author summarizes some differences between English and Serbian utterances as regards the position of the nuclear stress. The versatility of the nucleus in Serbian was established through a number of informants, and then a list of examples was composed, aiming to test which elements of the Serbian sentence can receive tonic stress, and what concomitant changes in their pragmatic value this would entail. The author analyses the recordings and classifies the utterances into a number of types, such as WH-questions, interrogatives with an emphatic particle in Serbian, and those containing negative adverbs, intensifiers, emphatic pronouns or possessives, in order to compare English and Serbian in this respect.

*Methodological issues in the acoustic analysis of spontaneous speech* prosody are discussed by Aleksandar Pejčić. The author presents the methodological design of a research study investigating the prosodic characteristics of Serbian and British persuasive political speech, and uses this example to discuss some methodological problems and difficulties common to most spontaneous speech prosody studies. The author especially highlights the problems related to the choice of suitable speech tokens, in terms of their subject, register, style, as well as the regional, gender and age differences of the speakers. The problems include the

variety of sources used for the extraction of speech tokens, as well as the need to address speech errors and repairs made by speakers.

Vladimir Phillipov discusses a model of intonation representation in his chapter *The status of intonation in a level approach in the organization of language*. The discussion sets off from the traditional representation of intonation between phonology and syntax, and the recent generativist suggestion that intonation conveys postlexical pragmatic meanings, or, in the author's words, that "it occupies the 'safest' component that comes hierarchically after syntax". The author presents a view of intonation as an exponent of fluctuation, or a shift in the status of a linguistic item leading to a different function, while preserving the form. The analysis attempts at establishing a correlation between syntax and intonation.

In the chapter by Yulia Nenasheva, titled *Intonation patterns and phonetic stereotypes: New life for old terminology* different approaches to prosodic research are discussed, and some results of intonation study presented. To illustrate the point that the meaning of an utterance is expressed through the arrangement and interaction of prosodic elements in an intonation pattern, Nenasheva presents a study of the prosodic components of the utterance, such as its durational, dynamic and tonal qualities. The analysis involves acoustic measurements and a statistical analysis, which indicate that prosodic elements comprise a complex structure of interrelated units, that the arrangement of the units is predictable, and that it carries specific meanings. The research study shows that these prosodic complexes possess certain distinctive features, and that sets of these features identify them as intonation patterns that serve as models in speech production, through a realization of phonetic stereotypes.

Oksana Pervezentseva looks into the topic of *Intonation interference and its impact on effective communication between native/non-native speakers.* The study the author presents focuses on the ways in which prosody affects communication between native and non-native speakers in situations of artificial bilingualism, specifically the communicative-pragmatic types of utterances that are likely to be subject to L1 interference, and to cause miscommunication. The research presented is based on the zone conception of intonation, and the findings indicate native speakers' sensitiveness to the inaccurate use of intonation patterns, mostly in the emotional-modal aspect.

Although some of the papers in the first two parts of the volume also include English phonetics from the perspective of non-native speakers, *Part Three* is specifically devoted to issues of 'applied phonetics', either

phonetics and phonology teaching or pronunciation training as part of EFL learning and teaching.

Patricia Ashby opens this part by a description of a new teaching methodology, labelled 'the flipped classroom'. In her chapter titled *To flip or not to flip? Phonetics, phonology and the flipped classroom* Ashby describes the first steps in introducing modern technologies such as screen-capture software, or educational vodcasting (videocasting), which aim at enhancing students' learning experience, increase their motivation, and create an environment in which they would develop their potentials more fully. The author describes how the success of these first steps encouraged Bergmann and Sams to introduce the technique of the flipped classroom (Sams 2010; Bergmann & Sams 2012), as the 'asynchronous online delivery of lectures', or switching the place of homework and lectures, so that vodcast lectures are watched at home before the class, while class time is freed for hands-on work, various activities or discussion. The author describes the use of the 'flipped classroom' in phonetics or phonology teaching and presents the results of a study of the effectiveness of this technique in a course attended by final year students of phonology at the University of Westminster. The study compares success rates (grades) in a traditional group or 'cohort' to those of a 'flipped cohort' achieved over two weeks of a 12-week course. The author concludes that 'flipped lectures' indeed result in students' greater confidence and deeper knowledge of the subject-matter.

*Minimal pairs in English phonetics teaching* are discussed by Rastislav Šuštaršič, from the point of view of English-Slovene contrastive analysis and teaching of English pronunciation. The author states that a first step in this process should be the identification of the phonemic contrasts in English, their frequency of occurrence, and then their possible application in specific pronunciation classes. The author describes the main differences between the sound systems of English and Slovene, so that the practice can focus on those distinctive sounds which are particularly problematic for Slovene students of English. He illustrates his point by an inventory of minimal pairs taken from John Higgins, and some possible approaches and activities based on involving minimal pairs in pronunciation classes.

Tatjana Paunović discusses the use of prosodic cues at the discourse level, specifically, in signalling discourse structure. In the chapter titled *Beginnings, endings, and the in-betweens: Prosodic signals of discourse topic in English and Serbian,* the author presents a research study which investigates how prosodic cues are used to signal discourse topic beginning, continuation and ending in a reading task performed by two

groups of participants: L1 speakers of Serbian, who are also EFL learners, and L1 speakers of British English. The acoustic analysis includes F0/pitch, intensity, and duration measured at intonation unit boundaries, first peak/onset, and nuclear accent syllable, and overall pitch range and intensity of intonation units. The statistical analysis points to some important differences between the native-speaker group and the EFL group in reading the English text, while certain similarities, as well as differences were identified in the English and Serbian texts when read by their respective native speakers. The author points out that some, but not all of the EFL students' problems in reading the L2 text could be attributed to L1 prosodic transfer.

Snezhina Dimitrova's chapter, titled *British or American pronunciation?* turns to the issue of language attitudes among Bulgarian EFL learners. The study she presents compares the students' pronunciation preferences with their spoken performance, based on analyses of the students' recordings. The analysis of forty-seven recordings involved auditory and acoustic analyses, aiming to establish how consistent the Bulgarian tertiary-level learners were in their use of the well-known salient segmental and suprasegmental features of the pronunciation model of their choice. The study shows that the vowel quality of words from the LOT and BATH lexical sets, along with rhoticity and t-voicing, position of lexical stress and variable individual word pronunciations are among the most prominent traits that students use inconsistently when trying to imitate the British Received Pronunciation or the General American accent.

Biljana Čubrović's study deals with the topic of linguistic credibility of what film industry approves of as acceptable Russian accents. The chapter entitled *Slavic English accents revisited - A case study of Russian Serbian-English in films* provides the results of the phonetic analysis of Rade Šerbedžija's speech in four recent films. Some segmental phonetic features of the actor's English idiolect are studied with the aim of establishing how much effort was invested into him sounding like a Russian native speaker, and whether he can pass as one. Carefully selected audio recordings are analyzed from a segmental viewpoint, with the help of acoustic phonetics tools, and also from an auditory perspective, where necessary. The results of the analysis show that the actor's "Russian-coloured" speech does not necessarily include the most striking features of Russian EFL speech like palatalization, but his South Slavonic language background seems to be satisfactory for an international audience.

The chapter titled *Phonetic similarity in transliterated English trademarks – A preliminary study in Japanese* by Isao Ueda investigates

the phonetic and phonological problems encountered by applicants for new foreign trademarks, related to relevant legal decisions. Ueda explains the trademark and application procedure in Japan, and describes a number of examples of trademarks which were turned down by Japanese examiners because they were judged to be phonetically similar, although they sounded (and looked) completely different to the foreign applicants. The author states that the main reason for this apparent discrepancy is the Japanese trademark law, which demands newly proposed foreign trademarks to be transliterated into Japanese orthography. This process can result in a kind of phonetic distortion of the original form. The author discusses several examples of trademarks in which the similarity decision was affected by certain factors, such as segmental contents, the different position of the syllable in a word, and the total length of the trademark. Some possible improvements of the procedure are suggested, based on an example of apparent inconsistent judgment.

*Part Four* of the collection turns to two phonological issues. The contribution by Jelena Vujić, titled *Level ordering of affixes: A phonological perspective*, examines the phonological aspect of the mechanisms responsible for affix combinations in English, particularly when it comes to level ordering and restrictions that govern affix combinations in English. To illustrate the point that phonology and morphology interact closely, the author offers an outline of various theoretical approaches to English word-formation, from TG, via Siegel's views (1974), Kiparsky's Lexical Phonology and Morphology model (Kiparsky 1982), or Giegerich's views (1995), to the most recent Optimality Theory (Raffelsiefen 2004). The author points out that all these different theoretical approaches acknowledge some aspects of the interdependency of phonology and word-formation.

Csaba Csides closes the volume by the chapter titled *The functional classification of English vowels: Phonological and orthographic evidence,* which focuses on the phonological evidence and orthographic justification underlying the division of English vowels into tense and lax. Csides points out that in addition to phonetically-based explanations, namely, that tense vowels are produced with more tension of the articulatory muscles, more length and a degree if diphthongization, phonological alternations seem to support the view that the categories of tense and lax are indeed functional/phonological in nature. Phonological processes discussed in connection with these arguments are Vowel Shift, Trisyllabic Laxness, Laxing by ending, CiV laxing, Pre-cluster laxing and Laxing by free U. In the second part of the chapter, Csides focuses on the regular sound values of English vowel letters and discusses the difference between free and

covered graphic positions. Based on orthographic evidence, the author concludes that tense and lax vowels respectively tend to occur in different types of graphic (orthographic) positions in the default case, but also that the effect of the free position rule may be eliminated by overriding regularities that are phonological in nature.

* * *

*Focus on English Phonetics* presents empirical research findings, and can, therefore, be of special interest to other researchers in the old but nonetheless exciting field of phonetics. It can also be appealing for graduate and doctoral linguistics students, since chapter authors also discuss some theoretical questions, models of representation and recent methodological approaches. Lastly, we believe that the contributions in this volume, although not all of them deal with teaching and learning problems, can also help applied phonetic practitioners or EFL teachers, since some of the topics discussed stem from extensive classroom experience and the problems observed working with EFL or phonetics students. Therefore, we hope that this collection will find a way to communicate to an audience at least as diverse as the authors and topics of these chapters.

Editors
April, 2013

# PART I.

# PHONEME AND BEYOND

# USING MRI TO SEE ENGLISH SOUNDS AND THEIR OVERLAP

ALAN CRUTTENDEN

## Outline

Until the 20th century we had no way of looking directly at tongue movements. In the 20th century x-rays were used to study such movements. At first making x-rays was too expensive for this procedure to be used very often. As the procedure became cheaper, a new problem arose: x-rays were thought to present a cumulative radiation hazard to health if used too frequently. So only a very limited number of x-rays of the tongue were ever made and of course those that were made showed only single static images, so the subject would have to hold an articulation for an unnatural length of time. With the introduction of the new procedure of Magnetic Resonance Imaging the radiation hazard has been overcome. But this could still produce only single static images. A new procedure has recently been developed at Oxford whereby we can produce dynamic images actually showing the tongue moving in the mouth. Such images are examined in a number of phrases containing examples of all the phonemes of English. The dynamic images are available on the website attached to the 7th edition of *Gimson's Pronunciation of English*.

## 1. Introduction

A new method of studying the articulation of vowels and consonants has been developed at the Phonetics Laboratory in Oxford. Most people have heard of Magnetic Resonance Imaging or MRI: it is one of the successors to the old-fashioned X-ray. It uses changes in electro-magnetic current to study various tissues of the body. It has been extensively used over the last twenty years for looking at various internal organs of the body, e.g. the heart and the liver. I, for example, had MRI images made of my lumbar spine twenty years ago.

More recently there has been a development called dynamic MRI: this means producing pictures of movements as opposed to states. Dynamic MRI has been used to picture blood flow through the brain and heart. Producing single MRI images is very slow, much too slow on its own to show the rapid movements involved in, say, blood flow through the heart. Therefore, use is made of the fact that blood flows through the heart in regular pulses (i.e. the heart beat). To capture regular movement, an MRI image is taken at a slightly later stage in each pulse; when these images are put together, they show the continuous movement involved in each pulse.

A method has now been developed using a similar technique to study the movement of the tongue in the mouth. To make MRIs of tongue movements an element of repetition has to be built in (like the pulses of blood in the heart). Individual speakers are trained to repeat a short phrase (like *ride in fog*) rhythmically to the beat of a metronome. MRI images are produced slightly later on each repetition. Putting the images together produces a picture of the tongue movement throughout the phrase.

One advantage of these MRIs over X-rays (as well as the absence of the radiation hazard) is that they show soft tissue variations more clearly. The disadvantage is that some hard tissue does not always show up very well; for images of the mouth this refers mainly to the upper teeth. Additionally these MRIs are taken in only one plane, the midsagittal section, with the result that vertical movement is shown but horizontal movement is not, so the larynx can be seen moving up and down while the opening and closing of the vocal cords cannot be seen. There is thus no direct information on voicing.

## 2. Gimson's Pronunciation of English

For the website accompanying the seventh edition of *Gimson's Pronunciation of English*, dynamic MRIs of fifteen English phrases were produced by a speaker chosen as representing a modern form of RP (a female in her twenties). The phrases were chosen to include all the consonants and vowels of English. MRI is an expensive procedure and my fifteen phrases were a free addition to the end of an experiment which had its own funding. If I were able to collect the MRIs again, there are some things I would change. I would, for example, change the angle at which the images of the head and mouth were taken; you will see that the head is tilted backwards because of the way the informant was lying. I would also make some of the phrases a little more realistic (a phrase like *Crawl a zoo* is rather peculiar!). But neither of these things affects the basic validity of

the videos. To view the videos the website has to be accessed at http://www.hodderplus.co.uk/linguistics and *Gimson's Pronunciation of English* selected from the sidebar. At this point registration is necessary, although it is free and purely for contact purposes. After registration, the list of MRI videos (in wmv) can be seen; select the one entitled *Ride in fog*. It can be downloaded as a web archive if so wished. Select the arrows on the bottom bar to go to full screen view and use the slider or the space bar to start and stop.

## 3. Ride in fog

The various parts visible can fairly easily be identified. Firstly the vertebrae and the intervertebral disks can be seen, with the spine itself behind them. In front of the vertebrae is the trachea (the black tube) and, on a level with the bottom of the chin, the larynx. Just in front of the point where the spine goes into the head can be seen the uvula; between the uvula and the spine a gap will open up in the nasopharynx during the production of nasals. In front of the uvula and along the top of the mouth can be seen the soft palate (relatively bright-looking) and the hard palate and the teeth ridge (not so bright-looking) and then the lips. Notice again that we cannot see the upper teeth. Filling almost the whole of the mouth is the ball of the tongue.

Now, look at *Ride in fog* in more detail. You can use the bottom slider to advance the video slowly. In the first eighth you can see the tip of the tongue somewhat curled to the rear of the teeth ridge for [ɹ]. Around one quarter the body of the tongue is in position for the first half of the diphthong [ä] and, approaching one third, the front of the tongue moves towards the hard palate for the second half of the diphthong [ɪ]. The tip of the tongue is now forming the closure for the [d]. You can see the tip of the tongue showing up as the bright bit; although not able to see the teeth, you can judge that the tip is against the juncture between the teeth ridge and the upper teeth. There is no realization of the [ɪ] between the [d] and the [n]; rather the nasopharynx can be seen opening behind the uvula to change oral [d] into nasal [n]. This can be seen around half way. The next movement (as the nasopharynx closes again) shows the lower lip moving upwards to make contact with upper teeth for the [f] (the lip movement but not the upper teeth showing for the labiodental articulation). By two thirds the base of the tongue is pulled backwards to form the lower back vowel [ɒ] and following this the back of the tongue then rises up to make a closure for the [g]. Notice that, even following a low back vowel, the

closure is still in the middle of the soft palate and nowhere near being uvular.

## 4. Curious beer

Now select the MRI video *Curious beer*. The tongue starts at the position for /k/, similar to the position for /g/ in the previous *fog* but further forward because it is before a [j]. Around one eighth of the phrase the body of the tongue has slid forward for the front position for [j]. The [ʊ] is hardly visible on the video; it is obviously even more fronted than usual because of the preceding [j] and it might be seen (from a front view) in some rounding of the lips which of course is not visible in the video. The following [ɹ] shows no curling of the tip (as it had at the beginning of *ride*) but is made by raising the blade of the tongue towards the back of the teeth ridge; evidently this is like the 'bunched [ɹ]' often described as a common realization of /r/ on American English: see, for example, Zhou *et al.* (2008). The [ɪə] moves the front of the tongue back while remaining raised and then lowers it somewhat. At the same time the tip is moving forward and at around half way is at the base of the teeth ridge for [s]. The lips now move together for the [b], the front rises again for the [ɪ] and finally lowers somewhat again for the [ə].

## 5. Pain in the mouth

As a final illustration I will do a walkthrough of the video *Pain in the mouth*. The opening picture shows the lips closed. The lips open and the front of the tongue rises through the [e] position to the [ɪ] position. Then the tip can be seen rising to touch the teeth ridge (around a quarter way through). Notice that at the same time the nasopharynx has opened. There is no [ɪ] between the <n> in *pain* and the <n> in *in*, just a long [nː]. Just before half way through the video the tongue tip is moving from its position on the teeth ridge to a further forward position on the teeth for [ð]; notice that the nasopharynx is still open through this dental fricative. The body of the tongue then moves back to a neutral position for [ə] while the lips come together for the [m]. At the end of the [m] the nasopharynx closes. As the lips open the body of the tongue lowers for the [ä] before the back rises for the [ʊ] while the tip is moving towards the teeth again for the [θ].

## 6. Articulations of /r/

I now consider what the videos tell us about one particular articulation, that for /r/. Recall the position for /r/ in *Ride in fog,* shown in Figure 1. The /r/ here is before a front (or mid) open vowel. It has the tip of the tongue curled back to a position at the back end of the teeth ridge; in fact it looks from the video as if it is almost touching it.

In *Crawl a zoo* the articulation of /r/ is much the same, although overall the articulation shows the position before a back vowel, as in Figure 2.

But in *Curious beer* the /r/ involved a raising of the front and blade of the tongue, as shown in Figure 3. In this phrase /r/ is made like this presumably because it is between close /ʊə/ (which is monophthongized and almost fronted to [ÿː] following /j/) and close beginning of /ɪə/.

Similarly in *Dream of debt,* as shown in Figure 4. Here /r/ follows the alveolar /d/ and precedes the front vowel /iː/. Hence curling the tongue tip back would be a rapid contortion which is avoided by instead bunching the very front of the tongue up towards the front of the hard palate.

**Figure 1.** /r/ in *Ride in fog*

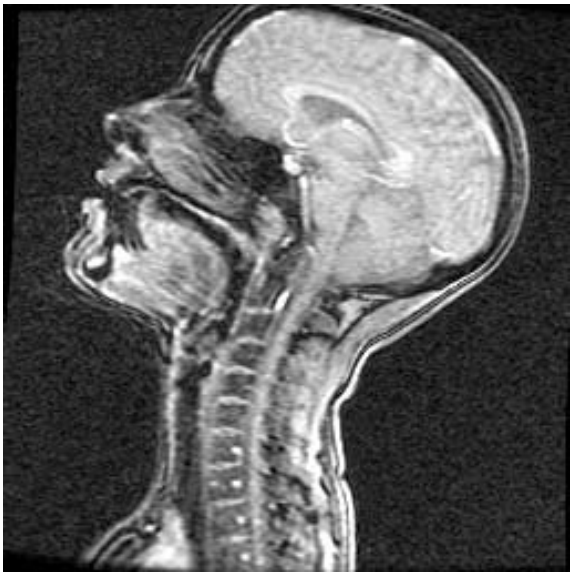


**Figure 2.** /r/ in *Crawl a zoo*

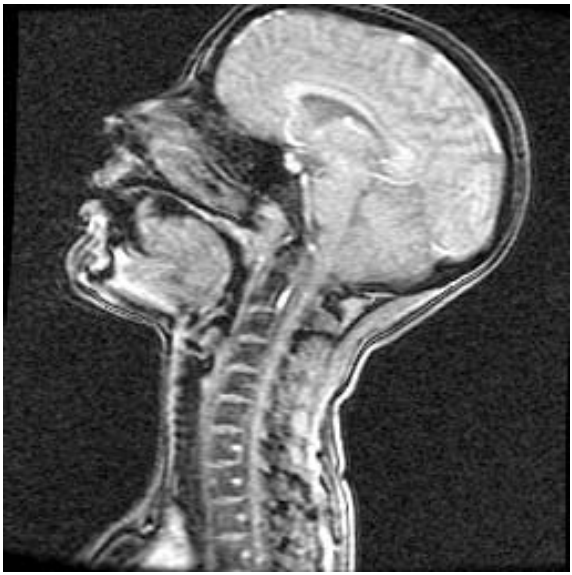


**Figure 3.** /r/ in *Curious beer*

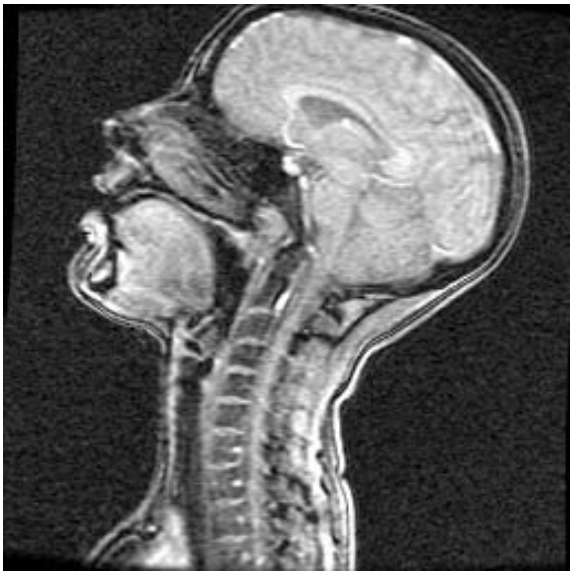
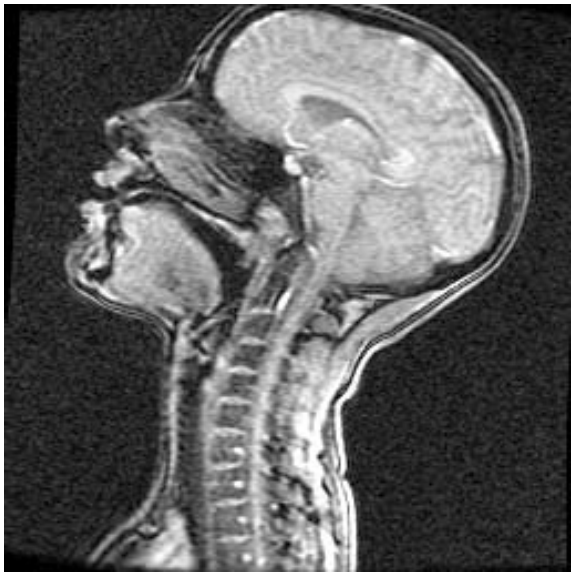


**Figure 4.** /r/ in *Dream of debt*



Similar variation in the realizations of /r/ in American English have been previously shown (Delattre & Freeman 1968; Westbury, Hashi & Lindstrom 1998; Zhou *et al.* 2008; Stavnes *et al.* 2012) but it is apparent that such variation also occurs in this speaker of British English. Zhou et al. refer to this articulation as 'bunched' although it is not clear how 'bunching' applies as opposed to just raising.

## 7. Velars, close back vowels, and laterals

Some other interesting articulations (confirming or provoking current thinking) are shown on the MRI videos on the *Gimson* website:

(a) The velars /k, ɡ, ŋ/ are seen as generally farther forward than is usually imagined. Even before the open back vowel /ɑː/, as is seen in *Guard my thumb*, /ɡ/ is articulated in the middle of the soft palate and certainly nowhere near approaching the uvula. Following [ɪ] in *A weird thing* /ŋ/ is towards the front of the soft palate (though not on the hard palate). As expected, before /j/ in *Curious beer* /k/ is on the verge of being palatal.

(b) Many recent descriptions of RP, e.g. Hawkins and Midgley (2005), Cruttenden (2008: 81), note the recent fronting of the /uː, ʊ, ʊə/. This can be clearly seen in the videos containing these vowels. The only example seen in the phrases I have discussed here is in *Curious beer* where of course co-articulation following palatal /j/ predictably produces fronting of /ʊə/. But in other phrases on the website it is also very apparent, e.g. /uː/ in *zoo,* in *July* (no matter whether the vowel is analysed as /uː/or /ʊ/), and /ʊə/ in *tour*.

(c) No /l/'s figured in the current discussion but the videos do show noticeably different tongue positions for clear and dark /l/: varieties of clear [l] can be seen in *valley, leisure, line, July,* and *curly*; and varieties of dark [ɬ] in *crawl* and *bull.* Neither of the last two words showed vocalisation of dark [ɬ], possibly because the speaker was conscious of articulating relatively carefully.

## 8. Conclusion

The procedure for producing 'dynamic' videos using repetition is artificial (it is described as only an 'animation' on the website of the Phonetics Laboratory of the University of Oxford—see references below). In various laboratories in the U.S., experiments are being made with MRI scanners which reduce the interval between scans (Zhou *et al.* 2008) so that real-time movements can be scanned but both the instrument and expense still put limits on what can be done. At the moment, real-time video MRI can only operate between 3 and 6 frames a second whereas the constructed videos on the Gimson website have around 34 frames a second. No doubt in time this will be overcome.

MRI video has the potential for confirming much articulatory information that we previously knew (if at all) only by our feeling for what is going on in the mouth. This particularly applies to allophonic variation and gestural overlap. We have other equipment (like palatography) which can measure static positions but MRI leads in portraying movement.

The principal worth of these videos to teachers is to better inform their own knowledge. But it can also bring home to students the continual change and overlap in articulation and get them away from the idea of static sequences which can be an unfortunate side-effect of transcription. It can of course also be another way to spark an interest in phonetics.

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# ACQUIRING L2 VOWELS: THE PRODUCTION OF HIGH ENGLISH VOWELS /iː, ɪ, uː, ʊ/ BY BULGARIAN NATIVE SPEAKERS

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## Outline

Unlike the English language, which has 12 monophthongs, Bulgarian has only six. This difference in number makes the acquisition of L2 vowels difficult for Bulgarian learners of English, who find the production of the English high vowels /iː, ɪ, uː, ʊ/ especially difficult, because of their seeming similarity to the Bulgarian high vowels /i/ and /u/. This paper presents the results of a study of the production of L2 high vowels and attempts to show how the articulation of L1 high vowels interferes in this process and affects the acquisition of L2 high vowels. The subjects of the study were first year students at the University of Sofia whose major is English philology. They were recorded pronouncing a number of English words in their citation form containing the high vowels /iː, ɪ, uː, ʊ/ and a number of Bulgarian words containing the high vowels /i/ and /u/. Spectral qualities (F1 and F2 values) were measured and statistically analysed. The results show different degrees of acquisition of L2 high vowels – from complete substitution with the L1 high vowel /i/, through an acceptable alteration of the quality of the sound in the direction of L2 to satisfactory or very good acquisition.

## 1. Introduction

Different aspects of the contrastive phonetics and phonology of English and Bulgarian have already been examined at various length in a number of previous studies (Minkoff 1973; Despotova 1978; Danchev 1988, 1990) which have raised numerous issues regarding L1 transfer in the production and perception of L2 sounds. Due to fundamental

differences between the vowel systems of Bulgarian and English, Bulgarians tend to disregard the qualitative-quantitative distinction between the English long and short vowel phonemes. Bulgarian learners of English find the production of the English high vowels /iː, ɪ, uː, ʊ/ especially difficult, because of their seeming similarity to the Bulgarian high vowels /i/ and /u/. Thus, it can be said that the process of acquiring L2 phonological categories is greatly impeded by the categories of one's L1. The results of some studies have shown that, in establishing the new categories in the foreign language, non-native speakers may resort to phonetic cues from the native speakers (Bohn & Flege 1992; Flege *et al.* 1997; Escudero 2002).

The purpose of this study is to investigate how the acquisition of phonological contrasts and phonetic realizations in a second language is affected by the first language phonological knowledge. Although initially the study did not aim to test the two models of L2 vowel acquisition, Flege's *Speech Learning Model* – SLM (Flege 1995) and Best's *Perceptual Assimilation Model* – PAM (Best 1995), the results of the experiment prompted the author to make these two the most influential models which explain the perception and production of L2 phoneme categories in relation to the categories found in the learners' native language part of this paper.

Flege's model predicts that L2 vowel phonemes which exhibit sufficient phonetic difference from the L1 target categories are developed earlier into new phonetic categories by non-native speakers. Best's model describes a process by which we perceptually assimilate non-native phonemes into our own phonemic inventory. If a foreign category is similar to an L1 category, it will be assimilated to it. Therefore, if a single L1 category is similar to two distinct L2 sounds, discrimination is expected to be poor. So these two models are also tested and it is shown that the degree to which an L2 sound is acquired greatly depends on its articulatory and auditory similarity to or difference from the corresponding L1 category.

This paper presents the results of an experiment which investigates the production of the English front and back high vowels /iː, ɪ, uː, ʊ/ by a group of first year students who study English philology at the University of Sofia in an attempt to show how the production of L2 vowels by relatively proficient speakers whose first language is Bulgarian is influenced by the prior L1 phonological knowledge and to show that the extent to which L2 sounds have been acquired depends on the articulatory and auditory similarities and differences between the two languages.