

Institution: University of Glasgow (UofG)		
Unit of Assessment: 27 English Language and Literature		
Title of case study: Seeing Speech: promoting understanding of speech production and how speech and sounds change over time		
Period when the underpinning research was undertaken: 2007–present		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Jane Stuart-Smith	Professor of Phonetics and Sociolinguistics	1997–present
Eleanor Lawson	AHRC Research Assistant	2014–2015
Satsuki Nakai	AHRC Research Assistant	2014–2014
Period when the claimed impact occurred: 2014–31 st December 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact The critical processes governing speech sound production are difficult to describe and understand because they largely take place unseen within the mouth. UofG research, in collaboration with Queen Margaret University, into sound production and change over time has: - captured the public's interest in <i>understanding speech and sound change in the community</i>. This has sparked lively debate, creative collaborations and the contribution of recollections from different communities; - demonstrated the benefits of visualising speech by providing <i>effective practical assistance in understanding speech production</i> for language teaching and learning, speech therapy and vocal coaching through the generation of unique digital resources for speech articulation.		
2. Underpinning research Stuart-Smith's long-term programme of research on accent change in Scottish English, and especially in vernacular Glasgow English, revealed the emergence of several sound changes towards the end of the 20th century, including the adoption of new features (e.g. TH-fronting, [f] for /th/ in e.g. <i>think</i>), and the loss of traditional features, e.g. weakening of /r/ in e.g. <i>car, card</i> [3.1]. This motivated two intersecting and simultaneous strands of research: - investigation of the development of the Glasgow accent across the 20th century, from the earliest recordings made during the First World War, in the <i>Sounds of the City</i> project (2011–2014). This work has shown that, contrary to predictions from sociolinguistic theory of a shift towards Anglo-English norms because of increased mobility and dialect contact with Southern English, Glasgow English is changing, but in ways that are distinct from sound changes documented for Anglo-English over the same period [3.2; 3.3]. - in-depth investigation into one of these changes, specifically the weakening and loss of word-final /r/ in Scottish English, in order to understand (a) why it was so difficult to analyse this change using auditory and acoustic phonetic methods and (b) what the underlying articulatory mechanism for this change might be [3.4]. Stuart-Smith invited colleagues Jim Scobbie (Queen Margaret University) and Eleanor Lawson (initially a UofG PhD student, later QMU/UofG researcher) to collaborate on an initial ESRC project, <i>Looking Variation and Change in the Mouth</i>, to use Ultrasound Tongue Imaging (UTI) to research these questions. Since 2007, Stuart-Smith, Lawson and Scobbie have worked together as an integrated collaborative research team, with Stuart-Smith particularly contributing to the sociolinguistic theory, design and method, the core phonetic analysis (especially auditory and acoustic, but also articulatory), the statistical analyses of the data, and the core phonetic and phonological		

theorising about the roles of speaker and listener in sound change [3.5, 3.6]. A distinctive aspect of Stuart-Smith and her colleagues' research has been the successful use of UTI to capture speech production data from vernacular speakers, young and old, not only in lab settings, but also in everyday environments, such as in school [3.4].

A significant finding emerging from this body of work was to demonstrate conclusively that visualising speech production helps uncover mechanisms of speech variation and change in a way that static images, acoustic records, and verbal explanations cannot. This is because many key aspects of speech production, and especially the position, shape and movements of the tongue, occur out of sight within the vocal tract. It became clear that there was a lack of easily accessible resources for understanding speech production for people working with speech, for example phoneticians, speech and language therapists, teachers and learners, dialect coaches, drama and singing teachers. Indeed, the research also showed that some available resources are inaccurate. These issues, and the fact that investigating articulation requires dedicated, expensive technology (ultrasound/MRI machines) and complex, costly software to process and create films, motivated Stuart-Smith to lead in the creation of *Seeing Speech* to make visible speech production freely available to all.

3. References to the research

- 3.1 Stuart-Smith, J., Timmins, C. and Tweedie, F. (2007) '[Talkin' Jockney'? variation and change in Glaswegian accent](#). *Journal of Sociolinguistics*, 11(2), pp. 221-260. (doi:[10.1111/j.1467-9841.2007.00319.x](#)) [available on request from HEI]
- 3.2 Stuart-Smith, J., José, B., Rathcke, T., Macdonald, R. and Lawson, E. (2017) [Changing sounds in a changing city: an acoustic phonetic investigation of real-time change over a century of Glaswegian](#). In: Montgomery, C. and Moore, E. (eds.) *Language and a Sense of Place: Studies in Language and Region*. Cambridge University Press: Cambridge, pp. 38-64. ISBN 9781107098718
- 3.3 Stuart-Smith, J. and Lawson, E. (2017) [Scotland: Glasgow and the Central Belt](#). In: Hickey, R. (ed.) *Listening to the Past: Audio Records of Accents of English*. Series: Studies in English language. Cambridge University Press: Cambridge, pp. 171-198. ISBN 9781107051577
- 3.4 Stuart-Smith, J., Lawson, E. and Scobbie, J.M. (2014) [Derhoticisation in Scottish English: a sociophonetic journey](#). In: Celata, C. and Calamai, S. (eds.) *Advances in Sociophonetics*. John Benjamins: Amsterdam, The Netherlands, pp. 57-94. ISBN 9789027234957 (doi:[10.1075/silv.15.03stu](#))
- 3.5 Lawson, E., Stuart-Smith, J. and Scobbie, J. M. (2018) [The role of gesture delay in coda /r/ weakening: an articulatory, auditory and acoustic study](#). *Journal of the Acoustical Society of America*, 143(3), pp. 1646-1657. (doi:[10.1121/1.5027833](#)) (PMID:[29604687](#))
- 3.6 Lawson, E., Stuart-Smith, J. and Rodger, L. (2019) [A comparison of acoustic and articulatory parameters for the GOOSE vowel across British Isles Englishes](#). *Journal of the Acoustical Society of America*, 146(6), 4363. (doi:[10.1121/1.5139215](#))

Quality: the Online Ultrasound Tongue Imaging project was funded by the Carnegie Trust, and the AHRC-funded Dynamic Dialects (AH/L010380/1), and all outputs are peer-reviewed so it is expected that the body of work should meet or exceed the 2* threshold.

4. Details of the impact

4.1 Impacts on public understanding of speech and speech production

[Sounds of the City](#) was widely covered in the press for challenging assumptions about the decreasing influence of regional dialects, and for the finding that the Glasgow accent had retained distinctive sounds while also incorporating UK-wide speech changes, sparking wide

debate and engagement. *The Guardian* in 2015 noted that ‘*predictions that this Scottish dialect would be homogenised by TV and population movement have been confounded by University of Glasgow research.*’ The findings engendered lively online debates (*Daily Mail* 15/11/2015: 138 shares/140 comments; *The Guardian* 17/11/2015: 493 comments) including readers sharing their own regional speech. The findings were also highlighted in the BBC’s CrowdScience ([‘Why do we have so many accents?’](#); 2017).

The researchers regularly use ultrasound imaging to allow members of the public to view their own mouth and tongue movements during speech, or to view videos of mouth/tongue movements as different sounds are made (Figure 1). For example, *Seeing Speech* featured at the annual Glasgow Science Festival (2014–2019), which reaches ~50,000 people every year. The majority of feedback respondents (93%, n=36) learned something new, either about the involvement of so many different parts of the mouth for speech, or the role of the tongue. For children, the size and importance of the tongue were most frequently given in their drawings (n=60) [5.1]:

‘It proves how important [sic] your tong [sic] is’;

‘I lernd [sic] if I didn’t have a tong [sic] I couldn [sic] talk.’



Figure 1: portable UTI being used to engage members of the public with speech production. Fabienne Westerberg (left) contributed strongly to the outreach activities of the project.

4.2 Impacts on understanding, learning and participation among specialists

Ultrasound videos of the International Phonetic Alphabet are available on a bespoke [ArticulatoryIPA](#) YouTube channel with 1,558 subscribers. These videos, the first of their kind, have attracted over 549,000 views. Then, in 2014-15 when the researchers found that NHS workers were unable to access YouTube in the workplace, the resources were adapted to widen access. Companion websites were established: [SeeingSpeech.ac.uk](#) (modelling speech production) and [DynamicDialects.ac.uk](#) (dialectal speech production). In 2018 the websites were made fully accessible for all devices. In addition, [Viewing speech in action](#), a non-technical journal article based on the research, is now the most downloaded article for *Innovation in Language Teaching and Learning*, with 9,554 reads since 2016.

Since 2014, [Seeing Speech](#) has accumulated over 7.8 million hits from 244,898 unique visitors, with 491,881 visits, viewing over 3.1 million pages [5.2]. Usage has steadily increased with substantial geographical range (Figure 2), indicating its value to users worldwide.

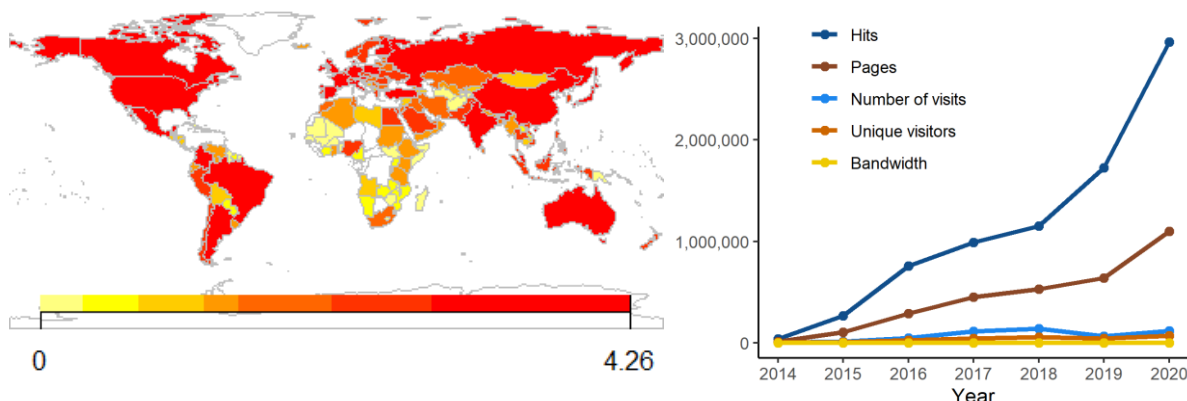


Figure 2 (left): geographical distribution of users (log₁₀ scale) for Seeing Speech (10 April 2018 to 31 Dec 2020); (right): user data for Seeing Speech (1 Jan 2014 to 31 Dec 2020) [5.2]

To investigate this further, a site-user survey was launched in 2019 [5.3]. Of 522 respondents who could each indicate more than one role, 79.4% are engaged with phonetics in a higher education environment: phoneticians/linguists (28.2%), phonetics/linguistics students (34.3%), speech and language therapy students (9.8%) and clinical phoneticians (7.1%). Teachers and learners of English and many other languages are the second largest group (36.9%), while 10% are Speech and Language Therapists (SLTs) and 9.6% general interest users. A further 7.5% are drama/voice coaches, singers and actors. 70.3% of survey respondents use the resources at least once a month, and 99% find *Seeing Speech* useful, with 78.6% reporting a change to their work, learning or understanding because of *Seeing Speech*.

Language teachers use *Seeing Speech* for their own learning and professional development, for demonstration and teaching in lectures, seminars, online/blended learning, to recommend to students, and for their own revision of sounds and IPA symbols [5.4; 5.3]. One English language teacher stated: *'not only could I now HEAR the sounds but I was able to SEE the articulators moving. Now when I mention these "tricky" [sounds] I am better able to explain them to my students, imitate them and ask the learners to imitate what they hear and see'*. One clinical phonetics trainer uses the site for assessment [5.5]:

'...I play a sound... and the task for the students is to identify what the sound is and give descriptors for it. I also...have taken stills of the animations at a point that is iconic for a given production and I use that for both learning and assessment for place of articulation.'

Seeing Speech is the only online phonetics resource included in the Royal College of Speech & Language Therapists' [Good Practice Guidelines](#) for *Transcription of Children's Speech Samples in Clinical Practice and Research*, because it allows 'SLTs to see the whole vocal tract', and is 'based on anatomical data and covers non-English consonants [which] is essential for SLTs, as children with disordered speech often produce non-English sounds' [5.6]. SLTs report using *Seeing Speech* in clinic, for therapy with patients, and to recommend and train patients and carers. One survey respondent working in a cleft palate service described it as a *'great tool to ... help me assess children with complex or unusual speech patterns.'* An SLT who works with children said [5.7]: *'Seeing Speech enables me to train the child's therapy partners more efficiently and therefore improves intervention outcomes.'* Another clinician reported that *Seeing*

Speech gives '[a] way to show clients what is happening in the mouth so they have a better understanding because of COVID-19 and having to use teletherapy.'

The user survey revealed that the diverse range of beneficiaries of Seeing Speech also includes dialect coaches and software developers. One developer selected the site's animations for their app to support speech therapy for therapists and the parents of minimally verbal autistic children, because unlike other resources *'they can be absolutely trusted since they are based on MRI scans [of the vocal tract] and therefore contain accurate representation of speech sounds'* [5.8a]. Another US-based language learning app developer agreed: *'Being able to actually visualize the hidden workings of the vocal tract is pedagogically invaluable'* [5.8b]. A California-based dialect coach describes Seeing Speech as *'game-changing in the creative industry ... I suspect that [the site] has saved actors and producers large amounts of time and money'* [5.9]. Finally, *Seeing Speech* is being used in the production of highly popular and commented-upon YouTube videos on phonetics for mainstream audiences by [Wired](#) and [Vox](#).

5. Sources to corroborate the impact

- 5.1 Portfolio of audience feedback, including children's drawings and feedback sheets, from public events such as Glasgow Science Festival. [PDF]
- 5.2 Web data report compiled from AWStats for Seeing Speech and Dynamic Dialects (1 Jan 2014–31 December 2020), and from Google analytics for geographical coverage of Seeing Speech (10 April 2018–31 December 2020) and usage of YouTube channel Articulatory IPA (1 Jan 2013–31 December 2021). [PDF]
- 5.3 Report generated via Online Surveys of the pop-up survey on Seeing Speech (responses until 31 December 2020, when survey closed). [PDF]
- 5.4 Testimonial letter, Committee Member, Pronunciation Special Interest Group (PronSIG) for the International Association for the Teaching of English as a Foreign Language (IATEFL), and editor of the PronSIG biennial journal, *Speak Out*. [PDF]
- 5.5 Testimonial from clinical trainer, Lecturer in Speech and Hearing Sciences, University of Cork. [PDF]
- 5.6 Speech and Language Therapy (SLT) evidence [PDF]:
 - a. Royal College of Speech and Language Therapists (RCSLT) *Good practice guidelines for transcription of children's speech samples in clinical practice and research*
 - b. Testimonial letter, Chair of Speech Disorder Research Network, on rationale for inclusion of Seeing Speech in the RCSLT guidelines.
- 5.7 Testimonial from clinician, Speech and Language Therapist [PDF].
- 5.8 Testimonials from software developers [collated as PDF]:
 - a. developer of Linguisticator (UK)
 - b. developer of SuperCoco (US).
- 5.9 Testimonials from dialect coach for actors and other dialect coaches, based in Los Angeles, USA: <https://www.dialectcoachesworldwide.com/pamela-vanderway> [PDF comprising both a letter to UofG and transcript of recorded interview]

See also: YouTube videos explaining production of /r/ using Seeing Speech videos:

- Vox: Why some Asian accents swap Ls and Rs in English, posted 26/03/19: <https://www.youtube.com/watch?v=2yzMUs3badc>; [over 2.8 million views]
- WIRED: Accent Expert Breaks Down 4 Amazing Things about Languages, posted 23/09/19: <https://www.youtube.com/watch?v=5aXmNle560k> [around 1.6 million views]