

## Regional Accent Familiarity and Speechreading Performance

*Amy Irwin, Sharon Thomas & Michael Pilling*

MRC Institute of Hearing Research, University Park,  
Nottingham, NG7 2RD, UK.  
amy@ihr.mrc.ac.uk

### Abstract

The effect of accent [pronunciation of speech sounds determined by a speaker's regional or national location] on auditory speech comprehension has been well documented, but research is lacking as to its effects on visual speech understanding. In order to address this, the present study examined the effect of regional accent variation on speechreading performance. The aim was to determine if familiarity with an accent would prove to be an advantage when speechreading, and if certain regional accents would be associated with a greater clarity of visual signal than others. The study examined both the identification of accent based on visual or auditory sentences and the effect of accent variation on auditory and visual speech comprehension. Of particular interest was the effect of accent on speechreading accuracy. The two British accents chosen for comparison were Nottingham and Glaswegian.

Results showed that accent discrimination is possible using only visual speech. Greater accuracy was achieved when participants differentiated between the accents based on auditory sentences, but with visual speech, performance was also greater than chance [ $p > .05$ ]. This suggests that the two accents have sufficiently distinct patterns of visual articulation and auditory pronunciation to allow participants to discriminate between them. Further, the participants visual and auditory speech recognition scores were adversely affected by the use of an unfamiliar accent, with keyword recognition accuracy being reduced. These findings both replicate previous findings on the effects of auditory accent, and indicate that accent can also impact the understanding of visual speech.

**Index terms:** Speechreading, Visual Accent, Accent Variation, Accent Familiarity

### 1. Introduction

Early research into the perception of auditory speech rested on the assumption that the vocal characteristics of a talker and the phonetic content of the message were processed separately – with talker variability simply forming background 'noise' [1]. Later research suggested that a talker's mode of speech production and the content of their message are processed simultaneously with each dimension having an effect on the other [1]. Evidence supporting this view includes increased word recall [2] and improved word identification [3] when words are spoken by a familiar talker. Thus,

increased exposure, leading to familiarity with a talker's voice, can improve subsequent perception of speech generated by that talker [1]. This, in turn, suggests that knowledge of a talker's mode of speech production, including their accent, pitch and speed, could provide an advantage when attempting to comprehend their speech. Since talker factors have an impact on not only the auditory signal, but also upon visual speech information, it is possible that talker familiarity may provide a comparable advantage for speechreaders; who utilise the visual signal in order to communicate. Certainly, deaf individuals have reported that familiarity with an individual leads to a greater ability to decipher that person's speech, even if their face is slightly obscured [4]. In contrast, a lack of familiarity with a speaker's facial movements could then confer a disadvantage when attempting to speechread.

Moreover, research suggests that it is not only familiarity with an individual that can have an impact; familiarity with a particular aspect of speech production; namely accent, can also have an effect. Thus, for the purposes of this paper, familiarity with an accent, rather than a particular talker, will be considered. This is an area that has yet to be fully explored in visual speech, but has been widely investigated in auditory speech comprehension.

#### 1.1 Regional Accent and Auditory Speech

One recent auditory study examined the effects of French regional accent variation on the processing of [French] auditory speech [5]. Through a series of experiments, the effect of five regional accents on speech processing was examined using a lexical decision-making task [word / non-word identification]. The results indicated that speech produced in an accent unfamiliar to the participant resulted in slower reaction times and a decreased level of accuracy in word identification. Furthermore, the pattern of deficits recorded was found to depend on the region from which the subject came – directly linked to geographical location and associated exposure to accents. That is, the more familiar a participant was with an accent, the better able they were to process it. The authors suggest, firstly, that speech processing is made more effortful when an unfamiliar accent is encountered. Secondly, the magnitude of the effect appears to depend on the amount of exposure, this suggests that prolonged exposure to an accent could reduce the effects of that accent upon speech processing.

Further research in this area investigated whether introducing context would improve comprehension

of speech produced in an unfamiliar accent [6]. The study was primarily made up of a 'gating' experiment, where words are presented initially without context and then later within a framing phrase and then a sentence. The subjects were, therefore, given more context each time they tried to identify the word. The words were produced by participants from three areas of America, with subjects also recruited for testing from the same areas. The results indicated, firstly, although higher levels of context did increase accuracy, even full context was not always enough to produce 100% performance. Secondly, all subjects were more accurate at identifying words spoken by an individual from their own region as opposed to unfamiliar accents. In conclusion, the study indicates that unfamiliar accent and the effect it has on phonological processing is enough to impair understanding even when a word is presented in context.

Overall, these studies appear to suggest that familiarity, both specific to a speaker and generalised to a type of accent, confers an advantage on auditory speech comprehension. It is possible that a similar advantage will be seen in visual speech. Certainly, accent change should lead to visible differences in the movements of speech articulators. This relates to the different patterns of pronunciation and word stress associated with each accent type. It is probable, therefore, that accent will change the appearance of the visual signal and have an impact on speechreading performance. Thus, each time an individual encounters a different accent, it could take them some time to become accustomed to the different facial movements in order to comprehend the message. During this period of perceptual adjustment [see normalization; [7] & [8]] the observer is likely to find the unfamiliar accent difficult to speechread. Furthermore, it could be hypothesised that individuals attempting to utilise visual speech should find it easier, in the first instance, to comprehend a speaker with an accent similar to their own.

### **1.2 Regional accent and visual speech**

This hypothesis is partially supported by a previous study [9] that discovered, through the development of a speechreading test, that accent had an impact on speechreading performance. Two talkers with Southern English accents were recruited to produce stimuli for the new speechreading test. However, the participants who were chosen to take part in the experiment were from both the North and South of England. The results indicated that participants from the North showed a significantly lower level of speechreading performance than those participants from the South. The authors suggest that a mismatch in regional accent, between observer and talker, may hamper performance.

The main aim of the experiments reported here was to discover, firstly whether two regional British accents [Glaswegian and Nottingham] are distinct enough to be discriminated using visual or auditory speech. Secondly, the main aim of this study was to

determine if accent has an impact upon speechreading performance.

## **2. Experiment 1: Accent Identification**

### **2.1 Participants**

Ten participants were recruited for the study, all were native English speakers, had been born in Nottingham, had good hearing and normal [or corrected to normal] vision.

### **2.2 Stimuli**

168 BKB [10] sentences were recorded in sets of fourteen, each set spoken by a different talker. The twelve talkers recorded were split into two groups according to accent – six had a Nottingham accent and the remainder had Glaswegian accents. Each talker's face was fully illuminated and recorded against a light background with only the face and neck visible. All of the stimuli were recorded using both a video camera and a microphone so that each sentence could be used as either an auditory or visual stimulus.

### **2.3 Procedure**

Each test session contained 168 sentences, 84 visual and 84 auditory. Each participant was asked to attempt to speechread 60 sentences, comprised of 12 sets of 5 sentences, each set spoken by a different talker and all presented in random order. They were then asked to listen to, and attempt to understand, 60 auditory sentences, split as before. Finally, each participant was asked to identify each talker's regional accent based on the remaining 48 sentences [24 visual, 24 auditory]. The last part of the task did not require them to understand the sentence, they simply had to indicate whether they thought the talker's accent was Glaswegian or Nottingham.

### **2.4 Results**

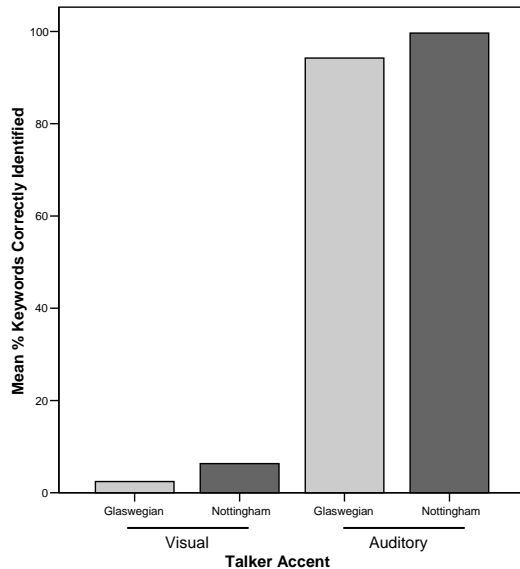
The results suggest that the participants were able to discriminate between the two accents using the visual sentences [mean percentage correct responses: 58.4%]. However, greater accuracy was achieved when participants differentiated between the accents based on auditory sentences [mean percentage correct responses: 86.6%], but in both cases task performance was greater than chance [p. > .05].

Although the participants were able to discriminate between the accents based on either auditory or visual information at a level above chance, further analysis showed that they were significantly better at the task when the stimuli were auditory [p. < .005]. This suggests that the hearing observers recruited found accent easier to identify when speech was presented as an auditory, rather than a visual, signal.

Analysis of auditory and visual sentence comprehension revealed that the Nottingham participants were adversely affected by the Glaswegian accent, as illustrated by Figure 1 below. The results shown indicate the percentage of

keywords correctly identified within a sentence set [3 keywords per sentence]. The difference in performance was, in both the auditory and visual sentence sets, significant [ $p < .05$ ]. This indicates that the Glaswegian accent is not only identifiably different from the Nottingham accent, but that the differences have an impact on the clarity of both the visual and auditory speech signals for Nottingham observers.

**Figure 1: Accent Effects upon Auditory and Visual Sentence Comprehension**



Having established that the Nottingham and Glaswegian accents appear to be both visually and auditorially distinct, the next step was to look at the effects on speechreading performance using a larger sentence set.

### 3. Experiment 2: The Effect of Regional Accent Variation on Speechreading Performance

#### 3.1 Participants

Twenty-four participants were recruited from Nottingham for the study. All were native English speakers, had good hearing and normal [or corrected to normal] vision.

#### 3.2 Stimuli

A total of 260 sentences from the BKB [10] were recorded. These formed 3 lists, the first of which comprised 20 sentences all produced by a single talker with a Southern English accent which formed a basic speechreading measure, to be collected before the experiment proper. The further 240 sentences were split into twelve lists comprising 20 sentences each, every list spoken by a different talker.

The talkers used for the recordings were grouped as follows: six talkers [3 male, 3 female] with Nottingham accents, while the remaining six [4 male and 2 female] had Glaswegian accents. Each clip contained only visual information.

#### 3.3 Procedure

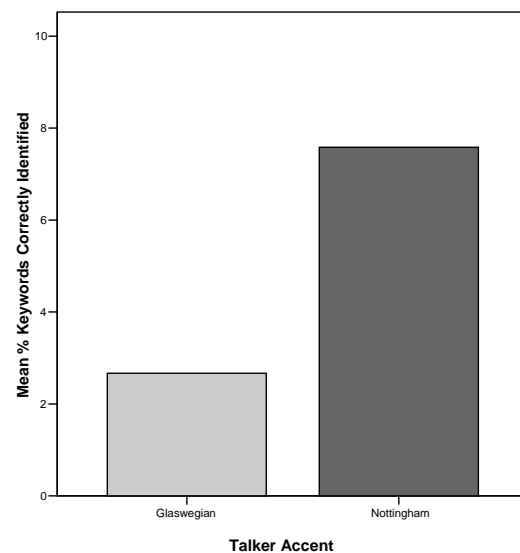
Each participant was seated at a table directly in front of the view screen, they were instructed that each talker would produce one sentence per video clip, which they were asked to watch carefully. Their task was to attempt to identify what the speaker had said and type their response into a response box. They were not required to understand the entire sentence, any word that was typed in was recorded.

The experiment consisted of 2 sections, firstly, each participant completed the speechreading measure, which consisted of 20 video clips presented in random order. Secondly, each participant was placed in one of two groups [12 Nottingham and 12 Glaswegian participants in each group] that would determine the order in which they would view the final 240 sentences spoken by the 12 talkers from Nottingham and Glasgow. Group 1 viewed the sentences in random order with the talker changing trial by trial. Group 2 viewed the sentences as 12 blocks, so the talker changed after every 20 trials. The order of the talkers for Group 2 was randomised.

#### 3.4 Results

The results indicated that the Nottingham participants were adversely affected by the Glaswegian accent when attempting to comprehend visual speech. Performance was significantly lower for the 6 Glaswegian talkers compared with the 6 Nottingham talkers [ $t = -5.698, p = .000$ ], as illustrated by Figure 2 below.

**Figure 2: A comparison of speechreading performance across two regional accents [Nottingham and Glaswegian]**



To ascertain whether this effect was true across all of the speakers a score for each of the talkers was generated. The results showed that speechreading scores for all 6 of the Glaswegian talkers were lower than those gathered for the Nottingham speakers. Thus, the highest score for a Glaswegian

talker [mean 2.54 keywords correct] was still lower than that of the lowest score for a Nottingham talker [mean 3.17 keywords correct], thus the distribution of scores did not overlap between the two groups.

The final step in the analysis was to compare the performance of participants who viewed the talkers varied on a trial-by-trial basis with those who viewed the talkers on a block-by-block basis. Surprisingly no significant difference was found between the two groups [ $p > .05$ ]. Performance levels were slightly higher for both accent types in the block-by-block talker variation group, but the difference was not significant.

#### 4. Discussion

The majority of research in the area of accent and speech perception has focused on the study of auditory speech. This research has shown that accent can have an impact on auditory speech perception, most often by an unfamiliar accent making perception of speech more difficult. The lack of previous research in the area of accent and visual speech motivated the research contained in this paper. The experiments conducted thus far indicate that, firstly, similar to auditory speech, accent can be discriminated using visual speech. Indeed, the ability of the participants to identify accent type based on visual speech, illustrates that the differences between the two accents used here are both distinct and obvious. Thus, the differences in articulatory movement produced by accent changes do seem to alter the appearance of visual speech, allowing observers to identify the accent type.

These visual differences not only allow participants to identify accent, they also impact the clarity of the visual signal for certain observers. In this case the Glaswegian accent made it more difficult for Nottingham participants to speechread. This result combines with our other finding that Nottingham participants also found the Glaswegian accent more difficult to comprehend when the sentences were auditory. Together, the results illustrate that accent has an impact on both the visual and auditory modalities of speech. This effect can alter the perception of speech by an observer, with certain accents making speech more difficult to understand.

Perhaps surprisingly, our results indicate that concurrent exposure to the more difficult accent [Glaswegian] did not have a significant impact upon this difficulty in comprehension. That is, when participants were exposed to the talkers on a block-by-block basis [the blocks were 20 sentences in length] there was no significant difference in performance when compared to trial-by-trial variation. It is possible that a longer block would perhaps increase the slight advantage seen in the results – by providing adequate exposure to a talker and thus perhaps allowing perceptual adaptation to occur. But at present it would appear that varying talkers on a block-by-block basis does little to improve speechreading accuracy or lessen the effect of accent.

The two studies detailed in this paper show clearly that accent can have an impact upon visual speech perception. However, it is still unclear as to whether this effect is caused by a lack of familiarity with the Glaswegian accent, or if the Glaswegian accent is simply more difficult to speechread. To answer this question further studies are planned using Glaswegian participants. An analysis of their patterns of speechreading ability will give a clear indication as to the cause of the detriment in performance illustrated here by the Nottingham participants.

#### 5. References

- [1] Pisoni, D.B. [1997] Some thoughts on 'normalization' in speech perception, pp. 9 -32 in Johnson, K. & Mullenix, J.W. [eds] [1997] *Talker Variability in Speech Processing*, Academic Press
- [2] Goldfinger, S.D., Pisoni, D.B. & Logan, J.S. [1991] On the locus of talker variability effects in recall of spoken word lists, *Journal of Experimental Psychology: Learning, Memory and Cognition*, 17, pp. 152 – 162
- [3] Nygaard, L.C., Sommers, M.S. & Pisoni, D.B. [1994] Speech Perception as a talker contingent process, *Psychological Science*, 5, pp. 42 – 46
- [4] Cohen, L.H. [1995] *Train Go Sorry; Inside a Deaf World*, Vintage Books, New York, Chapter 12, p. 195
- [5] Floccia, C. Girard, F. Goslin, J. & Konopczynski [2006] Does regional accent perturb speech processing? *Journal of Experimental Psychology: Human Perception and Performance*, 32, 5, pp 1276 – 1293
- [6] Labov, W. [1989] The Limitations of Context: Evidence from misunderstandings in Chicago, *Chicago Linguistic Society*, vol. 25, pp. 171-200
- [7] Nygaard, L.C. & Pisoni, D.B. [1998] Talker-specific learning in speech perception, *Perception and Psychophysics*, 60, 3, pp. 355 – 376
- [8] Mullenix, J.W. Pisoni, D.B. & Martin, C.S. [1989] Some effects of talker variability on spoken word recognition, *Journal of the Acoustical Society of America*, 85, 1, pp. 365 - 378
- [9] Ellis, T. MacSweeney, M. Dodd, B. & Campbell, R. [2001] TAS: A new test of adult speechreading. Deaf people really can be better speechreaders, *Proceedings from AVSP 2001 International Conference on Auditory-Visual Speech Processing*
- [10] Bench, J. Kowal, A. & Bench, J. [1979] The BKB [Bamford-Kowal-Bench] sentence lists for partially-hearing children, *British Journal of Audiology*, 13, 3, pp. 108 - 112