

# Speech and language therapy (SLT) students' production and perception of cardinal vowels: a case study of 6 SLT students

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## 1 Introduction

Speech and language therapy (SLT) students studying for a qualifying degree in the UK take one or more modules in practical phonetics and are usually expected to learn to recognise and produce at least cardinal vowels 1 – 11, 13 and 16. Recent research by Whitworth (2008) suggests that English-speaking SLT students generally find producing and transcribing primary cardinal vowels easier than producing and transcribing secondary cardinal vowels and front vowels are seen as easier than back vowels. This study looks at the perception and production of cardinal vowels amongst 5 SLT students on a qualifying BSc course and 1 SLT student on a qualifying MSc course at the University of Reading who were enrolled in a relevant practical phonetics module in the academic year of 2008/2009 who volunteered to take part in the study. The students enrolled in the aforementioned module were approached via e-mail; it was a requirement that participants be monolingual speakers of Southern Standard British English who had received no phonetic training prior to commencing their SLT course at Reading. All participants are female. The research questions are as follows:

1. What are the most common problems in producing cardinal vowels 1 – 16 for the 6 SLT students having completed the practical phonetics module?
2. How well can they recognise these vowels in a perception test?
3. Do the participants perform better on sounds they feel more confident about in comparison with sounds they claim to feel less confident about?

In this paper, I report on preliminary findings based on my analysis of my first set of data collected three to eight days before the students' end-of-module practical phonetics examination in March 2009.

## 2 Method

First, participants completed a questionnaire where they were asked to rate on a scale of 1 - 4 their level of confidence with regards to producing and perceiving each individual vowel, where 4 refers to 'very confident' and 1 to 'not at all confident'. Participants were then recorded as they performed the vowels in a sound-treated room; the data was sampled at the rate of 44.1 KHz. Instrumental acoustic analysis of the speech data was carried out using *Praat* speech analysis software (Boersma and Weenink 2009); F1 and F2 values were calculated by the programme's algorithm, read off the spectrum display and recorded on Excel spreadsheets. The mid-point of each vowel was used for measurement unless the articulation appeared to be diphthongal, in which case the starting- and endpoints were measured to establish the nature of the glide. The data was normalised using Lobanov's (1971) method for vowel normalisation and the participants' vowels compared to those of their models, i.e., the lecturer who taught participants 1 – 5 and the lecturer who taught participant 6. Both lecturers are phonetically trained native speakers of English. The participants lastly did a perception test which involved playing Ladefoged's (2006) cardinal vowel sound files in randomised order and the participant writing down the IPA symbol they thought most appropriate for each

cardinal vowel sound played. The participants were told that all vowels were cardinal and each vowel was played three times with short pauses in between.

### 3. Results

#### 3.1 Production

For the production test, a mark between 0 and 3 was awarded for each production: one mark was given for getting the frontness/backness of the vowel right, one mark was awarded for getting the vowel height right and a third mark was given for getting the roundedness right. An average score was then calculated for the participants' performance in relation to each vowel sound. This involved adding the participants' scores for each vowel and dividing the sum by the highest possible score. The scores obtained are shown in percentages in the second column in Table 1 below while the third column shows the distribution of marks awarded for each sound; the number of participants given a particular mark is shown in brackets. A full mark was given for a criterion when the production was judged to be perfectly acceptable with respect to the criterion in question; half a mark was given where the production appeared to be almost, but not quite, correct, and a mark of zero was given if the production was demonstrably incorrect e.g. when the plotting revealed that the vowel was produced in a way that includes characteristics associated with another vowel sound. Column three in Table 1 shows the degree of confidence reported by participants in the questionnaire on the scale of 1 – 4; the number of participants reporting a particular degree of confidence is given in brackets.

Vowel	Production Test Score (%)	Distribution of marks	Perceived confidence as reported by participants
i	100	3 (6)	4 (6)
e	67	2 (6)	3 (2), 2 (4)
ɛ	97	3 (5), 2.5 (1)	4 (1), 3 (2), 2 (3)
a	75	2.5 (4), 2 (1), 1.5 (1)	4 (2), 3 (2), 2 (2)
ɑ	92	3 (5), 1.5 (1)	3 (3), 2 (3)
ɔ	75	3 (2), 2 (3), 1.5 (1)	3 (1), 2 (4), 1 (1)
o	78	3 (2), 2 (4)	3 (2), 2 (2), 1 (2)
u	86	3 (3), 2.5 (1), 2 (2)	4 (2), 3 (3), 1 (1)
ɣ	78	3 (2), 2.5 (1), 2 (2), 1.5 (1)	3 (3), 2 (2), 1 (1)
ø	81	3 (2), 2.5 (2), 2 (1), 1.5 (1)	2 (3), 1 (3)
œ	69	3 (1), 2.5 (1), 2 (3), 1 (1)	3 (1), 2 (2), 1 (3)
ɶ	58	2.5 (2), 2 (1), 1.5 (1), 1 (2)	2 (3), 1 (3)
ɒ	78	3 (3), 2.5 (1), 1.5 (1), 1 (1)	2 (3), 1 (3)
ʌ	72	2.5 (3), 2 (2), 1.5 (1)	3 (1), 2 (3), 1 (2)
ɤ	42	2 (1), 1.5 (3), 1 (1), 0 (1)	2 (1), 1 (5)
ʊ	58	3 (1), 2 (3), 1 (1), 0.5 (1)	3 (3), 2 (1), 1 (2)

**Table 1** Results in the production test and participants' perceived confidence

### 3.2 Perception

As for the production test, a mark between 0 and 3 was awarded for each transcription for the perception test: one mark was given for frontness/backness, one mark was given for vowel height and one mark was awarded for roundedness. An average score was calculated for the participants' performance in relation to each vowel sound. This involved adding the participants' scores and dividing the sum by the highest possible score. The scores obtained are shown in percentages in the second column in Table 2 below; the different transcriptions offered and the number of participants who preferred a particular transcription is shown in the third column of the same table. Column four shows the degree of confidence reported by participants in the questionnaire on the scale of 1 – 4; the number of participants reporting a particular degree of confidence is given in brackets.

Vowel	Perception Test Score (%)	Transcriptions given (number of participants in brackets)	Perceived confidence as reported by participants
i	100	i (6)	4 (6)
e	78	e (4), y (1), ɣ (1)	4 (1), 3 (2), 2 (3)
ɛ	94	ɛ (5), e (1)	4 (1), 3 (4), 2 (1)
a	78	a (2), ɑ (4)	4 (2), 3 (2), 2 (1), 1 (1)
ɑ	50	ɔ (2), ɒ (3), o (1)	4 (1), 3 (1), 2 (3), 1 (1)
ɔ	72	ɔ (3), o (2), zero (1)	3 (2), 2 (3), 1 (1)
o	67	o (1), ʌ (1), ɣ (1), ø (1), ɔ (1), u (1)	3 (2), 2 (3), 1 (1)
u	78	u (2), y (2), ʊ (2)	4 (3), 3 (3)
ɣ	61	ɣ (1), u (3), ʊ (2)	3 (2), 2 (3), 1 (1)
ø	72	ø (3), y (1), œ (1), ʌ (1)	3 (1), 2 (3), 1 (2)
œ	44	œ (2), zero (3), œ̃ (1)	2 (4), 1 (2)
œ̃	28	œ (1), ɜ (1), e (1), ø (1), ʌ (1), ʊ (1)	2 (2), 1 (4)
ɒ	39	œ (2), œ̃ (1), ɔ (1), ʌ (1), zero (1)	3 (1), 2 (4), 1 (1)
ʌ	50	ʌ (1), ɣ (2), o (1), ɒ (1), zero (1)	2 (4), 1 (2)
ɣ	39	ɣ (1), o (1), ɔ (1), ɒ (1), zero (2)	2 (1), 1 (5)
ʊ	44	ʊ (1), ɣ (2), y (1), zero (2)	4 (2), 3 (1), 2 (2), 1 (1)

**Table 2** Results in the perception test and participants' perceived confidence

## 4 Discussion

In terms of research questions 1 and 2, the analysis of my first set of data suggests that, in general, the 6 participants were relatively skilled in producing and recognising the primary and secondary cardinal vowels at the end of the practical phonetics module. It is clear that some vowels were more problematic than others, however. In the production test, the cardinal vowels 1, 3, 5, 6, 8 and 10 were most unproblematic while the participants were most successful in perceiving cardinal vowels 1, 2, 3, 6 and 10; this shows that sounds that learners tend to be best at perceiving the sounds they are most successful in producing with only a few exceptions.

With regards to research question 1, it turned out that the distinction between cardinal vowels 2 and 3 was quite problematic in the production test with no participant getting cardinal 2 quite right; most participants produced a more open vowel similar to cardinal 3, although they tended to get this distinction right in the perception test. Cardinal 4 was also difficult in the production test with participants tending to produce too close vowels or vowels too far back. No participant got cardinal 5 right in the perception test even though they did well on this vowel in the production test; they tended to perceive it is a back rounded vowel. My analysis revealed that cardinal 7 was often confused with cardinals 6 and 8 in the production test. The participants were surprisingly good at producing cardinals 9 and 10 while cardinals 11 and 12 caused more problems; in the perception test, cardinal 9 was more difficult, however, with most participants perceiving it as a back vowel. The participants commonly perceived cardinals 11 and 12 as unrounded or back vowels. The back cardinal vowels 13 and 14 were particularly difficult in the perception test while cardinals 15 and 16 were both very difficult in both the production and perception tests with most participants getting these wrong. Some participants failed to categorise some of these sounds, i.e., cardinals 13 – 16 in any way in the perception test leaving the space for supplying the appropriate phonetic symbol blank.

In terms of research question 3, my data shows that the link between perceived confidence and the ability to produce cardinal vowels and the ability to recognise these in a perception test is evident, but there were some sounds that the participants felt overly confident about in relation to their actual performance and vice versa. Notably with regard to vowel production, participants seemed to feel overly confident about their ability to produce cardinals 2 and 4 while reporting less confidence with regards to producing cardinals 10 and 12 than was reflected in their performance. As far as perception is concerned, the participants were overly confident about their ability to perceive cardinals 13 and 16 while getting cardinals 3, 6 and 10 right much more often than one might expect based on their self-reported sense of confidence.

## References

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