An Applied Interlanguage Experiment into Adult Learners' Phonological Misperceptions

PAUL TENCH

Centre for Language and Communication Research, Cardiff University, Wales

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Abstract The aim of the experiment described here was to attempt to measure adult learners' perceptual interlanguage in phonology. The implementation of a methodology involving context-less lists of English words selected for their potential phonological problems is described, and the way in which learners process words they are listening to is discussed. The results of 13 Korean adults' perceptions and misperceptions are analysed: the most misperceived vowels were /O:/ and the short vowels /Y,ç,I,E,Θ,{/; consonants were mainly misperceived in word-final position, but /T,ϖ,β,π,ρ/ were misperceived to some extent in any position, and /s,j/ before the vowel /ɪ:/; consonant clusters involving /f,l,r/ were particularly subject to misperception. These findings have implications for the design of English pronunciation teaching materials for Koreans.

Key words interlanguage, phonology, perception, Korean learners

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It is very encouraging to see a noticeable rise in interest in the phonological dimension of interlanguage studies in the decade or so since the publication of Ioup & Wertheimer (1987). However, it is also very noticeable that phonological studies of interlanguage have concentrated on learners' productive competence – how accurately and/or intelligibly they can pronounce – to the neglect of learners' perceptive competence – how accurately or efficiently they can decode the phonetic signals they receive from others. This discrepancy is found even in James (1998: 141): 'we have dealt with only two of the four types of substance errors: we have not discussed misperceptions nor miscues at any length'. Perhaps, this is because less research has been directed to these types of errors. What is reported here is an attempt to describe the misperceptions of one group of adults learning English.

The question that this experiment attempts to address is: how well does a learner interpret the phonological encoding of someone else's utterance – how well do they 'hear'? Efficient interpretation of an utterance heard depends on a multiplicity of factors: the hearer's level of competence in the syntax, lexis, discourse, pragmatics of the language (and culture, and situational context) involved, and the amount of exposure to, and experience in, that language. But it also depends on the hearer's level of phonological competence – not just of productive competence (saying) but also of processing competence (understanding). Thus the perceptive dimension of interlanguage phonology is a relevant issue in the language teaching/learning enterprise.

In a natural (ie non-experimental) language situation, interpretation of someone else's utterance engages the hearer's competences in every component of language. If we are to investigate specifically a hearer's *phonological* competence – as, for instance, in other contexts we isolate their *grammatical* competence – then a technique needs to be developed that isolates a learner's competence in phonology and does not involve any contribution from their competence in the other components of language.

One such technique might be to use nonsense items that capture a range of phonetic and phonological features in a systematic way. Its disadvantage is the sheer artificiality of the event.

The experiment reported here used real English words, but in isolation, with no context. Very often in a natural language event, the context supplies sufficient clues for the learner to overcome phonological deficiencies – which is fine! But to continuously operate with phonological deficiencies is inefficient – the hearer needs extra processing time to arrive at a suitable interpretation, and the learner will make

mistakes, such as confusing *colour* with *collar* in an utterance like *We have shirts with this kind of colour, or with no colour at all (!).*

The selection of words in this experiment was the result of a contrastive analysis (CA). The phonology of Korean was contrasted with that of British (RP) English (Ahn, 1997), which yielded a list of phonological items likely to be problematical to Korean learners of English. Thus, for instance, the vowel / I / was identified as a potential problem – not only in production, but also in perception – because no equivalent vowel is found in Korean, and the English contrast with / i: / is not matched by any similar contrast in Korean. We hypothesised that Korean learners would have difficulty in distinguishing between *heat* / hi:t / and *hit* / ɳIτ /. That was certainly borne out in the experiments that Ahn conducted into Korean productive competence; the 25 Korean learners achieved only a 65% rate of success in convincing British judges that they were attempting to pronounce a word like *hit* rather than *heat* (Ahn 1997:155). In this way, Ahn was able to investigate actual competence of phonological production. If she had used *hit* in a context like *You hit the egg with a spoon*, and the learners had pronounced *hit* as / hi:t /, the British judges would have used the contextual clues and would no doubt have succeeded in 're-interpreting' / hi:t / as *hit*, knowing that spoons do not *heat* eggs!

Ahn also conducted a small 'pilot' experiment into the Korean learners' perception of a set of English words articulated by an educated British speaker with a near-RP accent. The following 36 items were chosen to test their ability to interpret correctly the phonological features detailed in Table 1.

The table also indicates the measure of success of the three subjects who participated; **bold** indicates a failure to interpret correctly.

	Word	Phonological features being tested	Subjects' responses		
1	hit	perception of / I / in contrast to / i: /	hit	hit	hit
2	mass	/ { / in contrast to / ε /	**must**	**nuts**	mass
3	spot	/ Θ / in contrast to / O: /	spot	**sports**	spot
4	bought	/ O: / in contrast to / ≅Y /	bought	Bought	bought
5	pull	/ Y / in contrast to / u: /	pull	Pull	**pool**
6	hut	/ ς / in contrast to / 3: /	**hot**	**Heart**	**hot**
7	contain	perception of / ≅ /	contain	Contai n	contain
8	coin	/ OI / in contrast to / αI /	coin	Coin	coin
9	waste	/ eI / in contrast to / ε /	waste	Waste	**whist**
10	bite	/ b / initially	bite	Bite	bite
11	found	/ f / initially in contrast to / p /	found	Found	found
12	clear	/ k / initially	clear	Clear	**clip**
13	rope	/ p / finally	rope	**Roof**	**loop**
14	kilt	/ t / finally	kilt	Kilt	-
15	duck	/ k / finally	duck	Duck	**duct**
16	bulb	/ b / finally	bulb	**Bold**	**board**
17	mad	/ d / finally	mad	**Met**	mad
18	vague	/ g / finally	vaig	**Day**	**bay**
19	perch	/ tΣ / finally	perch	Perch	-
20	badge	/ dZ/ finally	badge	Badge	-
21	tongue	/ N / finally	tongue	**Turn**	-
22	tail	/ l / finally	tail	Tail	tail
23	reed	/ r / initially	read	**Lead**	**weed**
24	pure	/ p / initially	pure	Pure	**pour**
25	strife	/ f / finally	strife	Strife	**strike**
26	vest	/ v / in contrast to / b / initially	vest	**Best**	**best**
27	faith	/ T / finally	faith	**Face**	**face**
28	breathe	/ Δ / finally	breathe	**Breeze**	**breed**
29	hiss	/ s / finally	**heath**	**His**	**heath**
30	buzz	/ z / finally	buzz	**Bus**	buzz
31	looser	/ s / intervocalically	**Ruther**	Looser	looser
32	sheet	/ Σ / initially	sheet	Sheet	sheet
33	leisure	/ Z/ intervocalically	leisure	Leisure	leisure
34	claps	/ k / initial cluster	claps	Claps	-
35	sphere	/ sf / initial cluster	sphere	**Sheer**	-
36	let's	/ ts / final cluster	let's	let's	-

Table 1

The subjects were played a recording of the 36 items and were asked to write down the word they thought they heard. In the case of no.1 *hit*, as it happens, all three wrote down the correct word, but in the case of no.2 *mass*, only Subject 3 interpeted it correctly, while Subject 1 interpreted it as *must* and Subject 2 as *nuts*. This was not regarded as a spelling test; hence the mis-spelling of *vague* as **vaig* still indicated an accurate case of perception. Homophonous spellings of *waste, reed* were also, obviously, acceptable. 'Invented' words like **Ruther* for *looser* are particularly revealing.

The sample is, of course, too small to generalize from, especially as Subject 3's failure to record 7 items would skew any attempt at doing so. Nevertheless, some patterns of perception and misperception do emerge: whereas all 3 perceived *hit* correctly, none of them identified *hut*, or *hiss*. However, before I venture into further discussion, and before I present the findings of a fuller experiment, it would be worthwhile reviewing the way a listener processes items from a word list.

Processing items from a word list

A word list is, admittedly, not a genre typical of natural, spontaneous, spoken discourse, except as a way, for instance, of checking or counting the presence of individual people, or such things as the availability of goods in stock; there are, thus, only occasionally, situations in which a list of individual words is an appropriate form of discourse. However, for the purposes of investigating phonological competence it is an invaluable tool, because the individual items in a list are divested of any meaningful context, so that an awareness of grammar, lexis, discourse management or any message cannot interfere with or distort the data. Orthographical interference can be reduced to a minimum by careful selection of the items.

Although the use of a word list in (non-experimental) spoken discourse may not be common, when it does occur, it does have a meaningful context, either formally (eg alphabetically) or semantically (the actual subject matter). But the kind of word list envisaged for phonological investigations must be seen as having no such meaningful context, ie it is composed solely on phonological criteria which are not revealed to the subjects.

If a listener's phonological competence matches that of the speaker who performs the word list, no problem with interpretation is expected - assuming also that there is no external interfering noise. Thus, for the sake of argument, an RP listener will be expected to have no phonological problem in interpreting a British RP speaker. Their phonological competence is identical: the system of phonemes, their realization, distribution and selection in specific lexical items, and word prosody.

If a listener's phonological competence does not match that of the speaker, the degree of intelligibility depends on the degree of divergence. The divergence may be systemic (eg presence/absence of /ç/), realizational (eg /u:/ as [u:], [Yu], [}:], [}u], etc), distributional (eg presence/absence of / j / in *beauty*), lexical (eg /{/ or /A:/ in *glass*), or prosodic (eg stress placement in *inquiry*). The listener's knowledge about the language variation possibilities is then engaged in the process of interpretation. A single point of divergence requires a minimal effort at interpretation; on the other hand, multiple points of divergence in a combination of all categories will produce an enormous hindrance to intelligibility. This latter situation is not infrequent even amongst native speakers of the same language who nevertheless employ very different accents. (Personal anecdotes will no doubt abound in the minds of many readers.)

If either the listener or the speaker are not native users of the language, then either perception or production is likely to be adversely affected by the phonological 'filter' of the native language(s). The degree of effectiveness is directly related to the level of phonological competence.

If neither the listener nor the speaker are native users of the language, two filters will be in operation. Jenkins (1995, 1996, 2000) provides excellent examples of this situation. One such is of Japanese and Swiss German learners of English engaged in a task in a language school, in which one sought to describe to the other the content of a single picture which the other then, on the basis of the given information, had to identify from a set of six similar pictures. They were of upper intermediate/lower advanced ability. On one occasion, the listener (Swiss German)

> had problems in completing the task successfully because the speaker told him that in her picture there were 'three / led / cars'. This was borne out by the follow-up discussion (also recorded), where the following exchange took place.
>
> A: I didn't understand the let cars. What do you mean with this?
> B: Let cars? [very slowly] Three red / red / cars
> A: Ah, red.
> B: Red / red /
> A: Now I understand. I understood car to hire, to let. Ah, red, yeah I see.
>
> This breakdown in communication occurred even though only one picture contained any cars, the cars were red and there was no evidence to suggest that they were for hire.
>
> (Jenkins 1996:36)

The Japanese phonological filter had produced [led] for / red / and the Swiss German filter had perceived the [led] as [let] - and this despite the context!

The process of interpreting an item read out aloud from a word list relies very heavily on matching phonological competences; but other factors may come into play too, such as the listener's assessment of the likelihood of an item (eg "It sounded like *forced*, but I bet it was supposed to be *first*."), and the tendency to try and find some meaningful connection with other items in the list (eg if *chick* followed *chest*, a listener might be tempted to interpret [tΣIk^{h}] as "obviously meant to be /tΣɪ:k/)". These lexical, non-phonological interpreting processes show the importance of care in the selection and sequencing of items.

The listener receives the speaker's signal, interprets it according to their own phonological competence and attempts to match it to the mental spoken form of an item in their own lexicon. If the listener and speaker share a common phonology and lexicon, an interpretation can be confidently assessed as correct. A possible exception involves the case of homonyms and homophones: the signal /raIt/ might be interpreted as *right* (= not left) or *right* (= not wrong), or as *rite*, *write*, or *wright.* If, on the other hand, the hearer and speaker share a common phonology but not a common lexicon, the listener might either interpret a signal as an unfamiliar lexical item,eg "/mA:∀mO:rI≅l/? I don't know this word!"; or might attempt a re-interpretation to find a familiar item, eg "/mA:∀mO:rI≅l/? I suppose they mean *memorial*".

If the listener and speaker do not share a common phonology, but do share a common lexicon, the amount of processing depends on the degree of divergence, eg the signal /gl{s/ will be interpreted as /glA:s/, or vice versa. On the other hand, a signal like [flς4?n=] might not be comprehended at all.

If either the listener or the speaker, or both, operate an interlanguage phonology through the filter of their mother tongue, then the scope for misperceptions and misinterpretations increases; the extent of potential misperceptions depends on the level of the respective interlanguage competences. For example, a Korean beginner learning English might well fail to distinguish /T/ from /s/ at all; but an intermediate learner might have established the /T~s/ contrast in initial and medial position, but not yet in final position. The interpreting process, however, is likely to be hampered not only by phonological mismatching but also by a restricted lexicon. For example, the signal [ϖεIγ] is provided; the hearer's phonology might not recognize the initial / v / but perceives it as [b]; however, /βεIγ/ does not match anything in their lexicon, and as they puzzle over the wrongly perceived signal, they search for the nearest matching item and might find *bay.* If the search requires more than the critical period of the 5 seconds for which the brain can retain an accurate acoustic image of an unfamiliar item (Rivers, 1964:106, Dodson, 1967:19), then the processing loses the acoustic image and resorts to other strategies like guessing. In such a case, a segment

originally and clearly perceived as [g] is abandoned in favour of establishing a meaning to the item as a whole. However, sometimes the guessing by the language learner reveals a strategy akin to that of a native speaker who assumes that they have encountered a new unfamiliar word ("*Ruther"*? I don't know this word, but I suppose it must exist in the target language".).

Evidence of misperceptions in the trial experiment

In the trial experiment reported by Ahn (1997), there is evidence of phonological mismatching, re-interpretation within an interlanguage lexicon, the invention of unknown words, and judgment-refusal.

i) Vowels

The vowel /{/ was mistaken for /ç/ by two of the subjects. This might be because the phonetic realization is typically more open, [a], in UK than in USA, which is the accent more current in Korea. Not recognizing the closer, American, vowel might have led to a perception of a different vowel altogether. Furthermore, there is considerable evidence of indeterminacy in the judgements of all 3 subjects of /ç/ itself, cf. *hot* and *heart* for *hut*; *bold* and *board* for *bulb*; and *turn* for *tongue.*

For one subject, there is also a misperception between /Θ/ and /O:/, cf *sports* for *spot.*

Although all 3 subjects perceived /I/ in *hit*, there was clearly less confidence with the /I/ in *hiss*. The final /s/ may well have been a distraction; /s/ does not occur in word-final position in Korean.

One subject perceived /eI/ as /I/, cf. w*hist* for *waist;* but the overwhelming evidence in the rest of the experiment suggests that this diphthong does not usually cause a problem, cf. the all-correct perceptions in *contain, vague, fail* and *faith.* That same subject, alone, perceived /I≅/ in *clear* as [I].

One subject misperceived /Y/ as /u:/ (*pool* for *pull*) and two /≅Y/ as /u:/, but in the latter case, lexical re-interpretation may have played a role.

The evidence suggests that the main problems that the Korean subjects had in perceiving the vowels of British RP might be amongst the short vowels, particularly /ç/ and /{/ and to a lesser extent /I, Y, Θ/. There seems to be no problem with /E,≅/ and relatively few problems with long vowels and diphthongs.

ii) Consonants

The misperceptions of consonants in initial position were confined to /l, r, v/ and the clusters /pj, sf/. Initial /l/ was mostly well perceived, cf. *lets, leisure, claps* and *clear* and, for two of the subjects, *looser.* /r/ was slightly less well perceived: twice as /l/, once as /w/; in a cluster, there appeared to be no problem, cf. s*trife, breathe.* In fact the main problem was /v/: two of the three subjects misperceived it, mainly for /b/, on both occasions, the items *vague* and *vest.*

Of the clusters, one subject failed to recognize /j/ in *pure,* and two failed with /sf/ in *sphere*.

Only one consonantal misperception was recorded in intervocalic position, but the data is unfortunately very slight.

The major problem was the final position. All six English plosives produced problems; but of the nasals, only /N/, and even that might have been the result of lexical re-interpretation, cf. *turn* for *tongue,* on account of a misperception of the vowel; but the fricatives were very poorly perceived, except when they combined with a plosive in a final cluster. The most serious problems were with /T,Δ,σ/; as noted above, the Korean /s/ does not occur in final position.

The evidence points unmistakably to obstruents in final position as the greatest problem for Koreans listening to English, and to a lesser extent to the liquids and /v/ in initial position.

iii) re-interpretation within an interlanguage lexicon

As described above, a non-native listener receives a phonological signal through a mother tongue filter and if the filtered perception does not immediately match an item in the current interlanguage lexicon, a second attempt at interpretation follows. Evidence of this appeared in this data. For example, the /{/ of item 2, *mass*, is perceived as /ç/; there is no /mçs/ in the lexicon, and so an alternative is sought. Final /s/ is particularly vulnerable to misperception, as we have seen, and so the indeterminate nature of its perception allows the listener a degree of freedom for re-interpretations. The result for one subject is a re-interpretation to *must*, and for another subject a re-interpretation that is even wider from the target, *nuts*. Presumably, in the similar case of *met* for *mad,* /{/ is misperceived as /E/; there is no /mEd/ in the lexicon, and so the final /d/ is re-interpreted as /t/; in universal terms, this /d/ is doubly marked (being both final, and voiced) and is thus vulnerable to re-interpretation.

This process seems to explain *turn* for *tongue*, *clip* for *clear* - there is no /klI/ in the lexicon, and so a final consonant was invented - and, more interestingly, both *roof* and *loop* for *rope*. The evidence suggests first a misperception of the vowel, leading to a first attempt at interpretation as /ru:p/ which fails, and then a second attempt; for one subject, the vulnerable initial liquid allowed an interpretation to /l/; but for the other, the vulnerable final obstruent allowed an interpretation to /f/, clearly a case of over-correction. Perhaps the prominent aspiration of English /p/ contributed, as quite possibly the prominent aspiration of /t, k/ lead also to interpretations of *spot* as *sports*, and *duck* as *duct*.

The actual order of this re-interpretation process is not always clear. In item 29, *hiss*, did the /I/ as /i:/ trigger the process, or the / -s/ as / -θ/? It is difficult to say as there is neither a /hi:s/ or a /hIθ/ in the lexicon. Indeterminancy between /θ/ and /s/ is evident also in the invented **Ruther* for *looser* (is that, perhaps, a Korean pronunciation of *Luther*?) and in the interpretation of *faith* as *face.*

Bulb, item 16, proved interesting too. The highly vulnerable /ɕ/ was perceived by one subject as /≅Y/; there is no /b≅Ylb/ (or even /b≅Ylv/) in the lexicon, so *bold* is chosen. The perception of /ɕ/ as /O: / led another subject to search for a non-existent /bO:lb/ and finally settle for *board*. The vulnerability of doublely marked final voiced plosives (in universal terms, viz /d/ above) is confirmed also by an interpretation of *vague* which ignores the final /g/ altogether.

iv) judgement-refusals

Subject 3 offered no interpretation of the items *kilt*, *perch, badge* and *tongue*, and the final three items *claps*, *sphere* and *let's*. There is unfortunately no opportunity for consultation with him, and thus one is left to one's own speculations. Maybe *kilt* was simply unknown to him. Maybe he lost concentration for a run of items (19 to 21) or even lost heart (the final three items)! But it is noticeable that six of the seven items contain vowels that a CA predicts as difficult, five contain clusters, which Korean does not in any case allow, and two contain affricates in a position, i.e. final, not permitted in Korean.

Evidence of misperceptions in a second experiment

The author conducted a similar experiment but with a much more comprehensive word list and a larger sample, 13 subjects, who matched the age and academic background of the subjects in Ahn's experiment. However, in this experiment, the word list was not recorded, but read out aloud in their presence; it was, however, the same speaker in both experiments, with an accent close to British RP. The speaker stood behind the subjects so that they could not see lip movement and thus gain a visual clue on labial and rounded articulations; in that way the subjects were

compelled to rely solely on their auditory impressions. One clue of a grammatical nature was offered in the case of the item *looser*; it was glossed as "That is, more loose".

There was, however, as noted above, a much more comprehensive list of words, extending the list to 63 items, in order to include every British RP vowel and every consonant in a variety of environments: initial, intervocalic, final, and in initial and final clusters. The experiment was conducted in two sessions; this reduced the strain on the subjects. (Regrettably, three subjects went missing in the second session, items 39 to 63; their absence is duly taken into account in the statistical analysis.)

The author took the precaution of obtaining a control on the intelligibility of the speaker's accent by having a native speaker but with a different accent (educated Welsh English accent) as an additional 14th subject. That subject's written responses tallied entirely with the speaker's word list. They are, obviously, excluded from the following analysis.

The results of the experiment are given in summary form in the table below.

Table 2 here

i) Vowels

The vowel /i:/ was represented in seven items: *reed, breathe, shete, zeal, seep, yeast, breezy*. Thus the perception of it was tested 79 times, i.e. 13 subjects heard each of the first three words and 10 each of the remaining four words. On only 7 occasions was the vowel misperceived, and so the accuracy of perception was 72/79 (91.1%).

The vowel /ɕ/ figured in five items: *hut, duck, bulb, tongue, buzz,* by 13 subjects, and *jug* and *dove* by 10; hence in 85 instances. Only 44 judgments were accurate; there were 9 judgments of it as /A:/, 9 as /Θ/, 8 as /3:/, 4 as /{/ and 1 as /O:/. In this case, accuracy of perception was measured at 44/85 (51.8%).

The vowel /Y/ figured in only one item. This might be construed as a regrettably low level of selection planning, but since the original intention of Ahn's research had been to test production, not perception, a single token was considered sufficient for that purpose. Thus there were only 13 perceptions available for the one item *pull*. It is significant, however, that only 6 subjects perceived it accurately (46.2%).

Despite the unevenness of the distribution of the vowels in the word list, it is of great interest to note the variation in the degree of perceptual accuracy, as in the table below.

Table 3 here

	Word	Correct Percept-ions	Misperceptions (with numbers of subjects)
1	hit	9/13	Heat (2), hats (2)
2	mass	3	Math (8), maps, must
3	spot	10	Sport (3)
4	bought	2	Boat (8), boat/bought (2), board
5	pull	5	Pool (6), full, fool
6	hut	1	Heart (4), hot (3), hat (3), hurt (2)
7	contain	13	
8	coin	13	
9	waste	12	Raised
10	bite	11	Bites, *vite
11	found	12	pound
12	clear	13	
13	rope	10	loaf (2), roof
14	kilt	5	guilt (3), cult (2), kelt, killed, keep
15	duck	6	dark (5), dock (2)
16	bulb	4	verb (3), *volve (4), valve, *Bauber
17	mad	10	*med, man, *muz
18	vague	12	*bage
19	perch	9	purg, *furch, *furture, punch
20	badge	11	buzz (2)
21	tongue	12	turn
22	tail	13	
23	reed	13	
24	pure	12	- (1)
25	strife	10	stripe (2), *stright/*strift
26	vest	7	vast (4), vat, best
27	faith	10	face (3)
28	breathe	5	Breed (4), bleed, breeze, grieve, *brive
29	hiss	3	heath (6), his (2), *hith, *het
30	buzz	9	Bus, *burse, verse, *vuzz
31	looser	5	Luther (5), *Ruther, *Rusa, loose
32	sheet	12	shit
33	leisure	12	*reiser
34	claps	4	collapse (2), clubs (4), *clabs, clasp, *crapse
35	sphere	3	spear (9), spin
36	let’s	13	
37	flute	11	fruit (2)
38	frame	9	flame (4)
39	goal	6/10	girl (2), gold, gull
40	thick	7	σick (2), seek
41	share	10	
42	zeal	9	Zero
43	those	9	Though
44	seep	0	Sip (3), ship (3), thief (3), seek

45	nought	1	Note (7), knot (2)
46	chart	10	
47	jug	4	Jog (3), John, jar, *zeck
48	robe	5	Rove (2), road, rude, rogue
49	dove	6	δuff, *durf, dub, dull
50	mesh	0	Mash (10)
51	beige	0.5	*bage(2),badge(2),*bedge,*veidge,*baze,*basy,*bazy(0.5),vain
52	yeast	0.5	East (9.5)
53	defend	5	Depend (5)
54	ladder	1	Rather (6), lather, leather, latter
55	anger	10	
56	stable	9	Steven
57	useful	9	Usual
58	rival	9	Live
59	breezy	2	Breeze (4), *bleeze, *breage, bridge, *reasing
60	bury	3	Very (3.5), vary (0.5), *barry (2), *bary
61	pilot	9	Tired
62	youthful	1	Useful (8), -(1)
63	composure	1.5	Composer (8.5)
* invented, non-English words, beyond recognition			

Table 2
Korean perceptions of an oral English word-list
(second experiment)

Vowel	Total no. of judgments	No. of correct judgments	Percentage Correct	Main Misperceptions (%)
i:	79	72	91.1	I (8.9)
I	49	33	67.3	i: (24.5), E (4.1), { (4.1)
ε	69	50	73.2	{ (26.8)
{	72	62	86.1	ς(11.1), ε (2.7)
A:	10	10	100	
Θ	13	10	76.9	O: (23.1)
O:	23	5	21.7	≅Y (69.6), Θ (8.7)
Y	13	6	46.2	u: (53.8)
u:	46	45	97.8	1 refusal
ς	85	47	55.3	Θ (15.2), A:(11.8), 3: (10.6), { (4.7)
3:	13	12	92.3	ς (7.7)
≅	56	56	100	
εI	98	94	95.9	{ (2.1)
≅Y	53	48	90.1	u: (3.8), 3: (3.8)
αI	46	46	100	
αY	13	13	100	
OI	13	13	100	
I≅	26	25	96.2	I (3.8)
E≅	10	10	100	
Y≅	13	12	92.3	1 refusal

Table 3

Perceptions and misperceptions of the English vowels

The following table identifies those English vowels that Korean listeners of English had most difficulty in perceiving accurately from an educated British speaker.

Vowel	Misperception (%)
1. O:	78.3
2. Y	53.8
3. ς	44.7
4. I	32.7
5. ε	26.8
6. Θ	23.1
7. {	13.9

Table 4

The evidence largely bears out the result of the pilot experiment in that it is the short vowels (but not the weak vowel /≅/) that are the trickiest in perception terms. However, one unexpected difference was the degree of troublesomeness of the vowel /O:/. Only 2 of the subjects interpreted /bO:t / correctly as *bought*; 2 were undecided between *bought* and *boat* (i.e. 2 x .5 correct judgments); 1 interpreted the signal as *board*, but at least perceived the vowel correctly; and 8 perceived the vowel as /≅Y/ *(boat).* Only 1 succeeded in interpreting / nO:t / correctly; 7 perceived the vowel as /≅Y/ (*note*) and 2 as /Θ/ (*knot*).

The vowels /u:, εI, 3:, ≅Y, Y≅, I≅, ɪ:/ were very well perceived, there being only occasional isolated cases of misperception for each. All-correct judgments were recorded for /A:, ≅, αI, αY, OI /.

The evidence from the two experiments suggests that the major discrimination problems for Korean learners of British English are as follows, and that pronunciation pedagogical strategies need to be concentrated on:

1 /O:/ in contrast with /≅Y/
2 /Y/ in contrast with /u:/
3 /ç/ in contrast with /Θ, A:, 3:, {/
4 /I/ in contrast with /i:, ε/
5 /ε/ in contrast with /{/
6 /Θ/ in contrast with /O:/
7 /{/ in contrast with /E, ç/

(The difference in British and American accents no doubt accounts for 5 and 7 above, and may, possibly, contribute to 6 as well.)

It should also be noted, however, that the fact that the long vowels (except /O:/), the diphthongs and /≅/ posed no real problems in **perception** is no guarantee that they pose no problem in **production**.

ii) Consonants

The CA set up certain expectations, since

i) no equivalents of /f, v, θ , Δ, z, Z/ are found in Korean,
ii) [l] and [r], and [s] and [Σ], are allophonic variations of a single phoneme respectively,
iii) Korean [l/r] does not occur initially,
iv) English /b, d, g, dZ, s, r/ do not have identical articulatory characteristics with their nearest equivalents in Korean;
v) Korean final obstruents are limited to unaspirated/unreleased varieties of /p, t, k/ and
vi) Korean does not allow consonant clustering in final position, and only limited clustering with [j] and [w] in initial position.

The data is still not quite as comprehensive as we might wish, since evidence is lacking /k, Δ, tΣ, dZ/ in medial position. However, /k/ does not seem to present much of a problem in either initial or final position, nor the other voiceless plosives in medial position. The affricates do not appear to present much of a problem in either initial or final position, and interestingly, do not appear to be much confused with each other. /Δ/ is, perhaps surprisingly, not a problem in initial position, although it is easily confused with /d/ in final position; however, it replaced /d/ in intervocalic position in 80% of cases, and so it could possibly be argued that /Δ/ itself would not constitute a problem in that position. /h, j, w/ are not treated separately in medial position, since when they do occur there, they usually act as onsets to stressed syllables. A comprehensive review of the perceptions of single consonants appears in Table 5.

	Initial	Medial	final
π	87.2	100	69.2
β	81	90	50
τ	100	100	97.1
δ	100	10	90.6
κ	100	n/a	96.1
γ	100	100	80.8
ϕ	96.9	50	75
ϖ	81.3	100	60
θ	70	10	68.75
Δ	100	n/a	37.5
s (s + i)	40	69.2	21.9
z	100	80	80.8
Σ	100	n/a	100
Z	-	63.5	25
τΣ	100	n/a	87.5
δZ	90	n/a	93.75
η	100	-	-
μ	100	100	100
ν	100	100	100
N	-	100	87.5
λ	91.75	90	94.2
ρ	86.5	100	-
j (j + i:)	5	-	-
(j + u:)	95	-	-
ω	93.75	-	-

Table 5

Percentage of correct perceptions of single consonants
in all experiments

Clusters, it must be conceded, have not been handled as systematically as single consonants. Table 6 reviews the evidence from both experiments, but not all combinations have been tested, and fewer final consonants than initial. Nevertheless, some generalizations are included in the discussion below.

initial		Final	
st	100	st	97.6
sp	100	ps	62.5
sf	23.1	ts	100
br	84.6	lt	87.5
kl	90.6	lb	31.25
fr	69.2	nd	100
fl	84.6		
pj	87.5		

Table 6

Percentage of correct perceptions
of clusters in all experiments

One major pedagogical implication is the need to concentrate discrimination exercises on consonantal contrasts in final position. Table 7 clarifies.

initial	medial	final
87.75	78.91	71.28

Table 7

Percentage of correct perceptions of all single
consonants in all experiments

Detailed discussion now follows

a) plosives

The voice distinction in English plosives is well perceived despite the very different plosive system in Korean; the only troubles appear in final clusters: /p/ is occasionally mistaken for /b/ in /ps/, and /t/ for /d/ in /lt/. The major problem is the susceptibility of /p, b/ suffering from an over-correction tendency of some learners with /f, v/. Also, some learners have difficulty in hearing the presence of final /g/, and others over-react to the release of /p, t, k/ in final position, which sounds unduly prominent to Korean ears, yielding /ts/ for final /t/, for instance, in a word like *hit* (see Table 2).

b) affricates

Again, the voice distinction in English affricates is well perceived. Some learners show indeterminacy between /dZ/ and /z/ in initial and final positions. Again, some learners over-react to affricate release in final position, but in this case imagine an extra unstressed syllable.

c) fricatives

Generally speaking, the voice distinctions in English fricatives cause no problems. /f, v/ are not confused with each other but with /p, b/ initially, medially, finally and in clusters. Similarly, /T, Δ/ are not confused with each other, but /θ/ with /s/ (not /t/), in all positions, and /Δ/ with /d/ (not /z/) in medial and final positions; note the asymmetry. /s/ is confused with /θ/ (not /z/) in all positions, but also with /Σ/ in initial position before front close vowels. /z/ is perceived well in initial position, but in final position, some learners either do not hear it or confuse it with /s/; final unstressed /-zi/ causes considerable problems: for many the /i/ is treated simply as the completion of a /z/ or /dZ/ articulation.

/h/ causes no problem.

d) nasals

There are no major perception problems with English nasals.

e) liquids

/l/ and /r/ are generally distinguished very well by adults with some exposure to English. This, however, might be the result of intensive practice at school. In initial position, they are heard quite distinctly, with only occasional evidence of indeterminacy. In medial position - where Korean [r] occurs - English /r/ is no problem at all, and /l/ only occasionally. In final position - where Korean [l] occurs - English /l/ is no problem, although it may sometimes not be heard. The more significant problems in perceiving the distinction between /l/ and /r/ lie in their membership of initial clusters; the percentages for correct perception of /br, fr, fl, kl/ are noticeably lower than when they appear as single consonants. (British /r/ does not occur finally, either singly or in clusters; this eliminates a problem that might occur in the perception of North American final /l/ and /r/ ; however, Borden, Gerber & Milsark (1983, 1985) confine their attention to initial position only, even in a North American context.)

f) semivowels

The English semivowels /j, w/ are generally well perceived, although there may be occasional confusion between /w/ and /r/. However, there is a major problem when /j/ is followed by a front close vowel; it appears simply not to be heard at all.

(iii) re-interpretation within an interlanguage lexicon

The subjects in the second experiment also used the strategy of lexical re-interpretation as a result of segmental misperception: it is often the case that a single phonological misperception leads to a lexical re-interpretation that is a further remove from the original signal. Thus, as in the trial experiment, the perception of /{/ as /ç/ led one subject to imagine a closing /t/: *mass* heard as *must*; it led two to interpret *badge* as *buzz*, and another *mad* as the invented **muz.* /{/ was also perceived by one subject as /ε/: *mad* heard as **med*. The /ç/ was, again, perceived by one subject as /3:/ yielding *turn* for *tongue.* /I≅/ also, once again, was perceived by one subject as /I/: *sphere*, with the additional problem of /sf- / highlighted above, was heard as *spin*, with an imagined /n/. *Hiss* produced again the same varieties as in the trial experiment. *Rope* was interpreted as *roof* and *loaf*; in the trial experiment, as *roof* and *loop.*

There were also additional instances of re-interpretations. One subject perceived the final /-st/ in *waste* as / -zd /; since there is no /ωεIζδ/ in the lexicon, it was re-interpreted by switching the initial /w/ to /r/; such a substitution had occurred in the trial experiment, viz *reed* as *weed.* The /I/ of *kilt* was perceived by one subject as /ι:/; but since there is no /ki:lt/ or /ki:t/ in the lexicon, the vulnerable final plosive was re-interpreted as /p/ to yield *keep.*

The case of *grieve* for *breathe* is interesting. It appears that one subject interpreted the final [Δ] as [v]; however, /bri:v/ does not match anything in their (interlanguage) lexicon, and as they puzzle over the wrongly perceived signal, they match it with *grieve*. No doubt the initial /b/ was originally perceived correctly, but yields to /g/ under the pressure of seeking a matching lexical item. Another subject, however, interpreted *breathe* as *bleed*; this might have come about as a first attempt at /bli:Δ/, which does not match anything in their lexicon, and was then re-interpreted as *bleed*, since a good deal of indeterminacy exists over /bl/ and /br/ as initial clusters.

The case of initial /b/ in *bulb* and *buzz* is interesting. Apart from the case of *grieve*, the only alternative perception to /b/ in any of the items (*bought, bite, badge, breathe* as well as *bulb* and *buzz*) is /v/. However, no /v/ is perceived in *bought* or *badge*, presumably because there is no **vought/voard* or **vadge/vudge* possibility in the lexicon; in the case of *bite*, there is no **vite* either, although one subject invented it, presumably as a back formation from *vital* or *invite.* The /v/ alternative only emerges with *bulb*, where it does very strongly in initial position (8/13) and final position (5/13), and with *buzz* (2/13). The problem seems to derive from the vowel /ç/ in both cases; if /ç/ is perceived as /Θ/, a lexical search for **bolb* fails; a second search leads to a re-interpretation which yields **volve*, presumably a back formation from *involve* etc. The conjectured processes are displayed in the following table.

Perception of /ç/ as	Failed first lexical search	Re-interpretation	Number of cases
/Θ/	*bolb	*volve	4
/3:/	*berlb	verb	3
/{/	*balb	valve	1
/3:/	*berz/se	Burse/verse	2
/ç/	buzz	*vuzz	1

Table 7

One can only speculate that in the last case in the above table, that either the one subject did not know the English (onomatopoeic) lexical item or had always interpeted the onomatopoeia as **vuzz*.

Seep was interpreted by three subjects as *thief,* by one as *seek*; *ladder* by 6 as *rather* and by one as *leather*; *stable* by one as *Steven*; *breezy* by one as *bridge*; and *pilot* by one as *tired.* There is of course no **thiep, *theek, *stavle, *breedge* or **pired* in English, and presumably no *lather* or *larder* in the restricted lexicon. Nevertheless, a number of other items were invented, which are useful evidence in interlanguage phonology.

iii) judgement refusal

In the second experiment there were only two refusals to commit to a judgement. One was against the item *pure*. This appears surprising as all the other subjects interpreted the word correctly, and it was not one of the items avoided by Subject 3 in the trial experiment – although he did misinterpret it as *pour*. An initial consonant+/j/+vowel is a common sequence in Korean; one can only guess that the vowel /Y≅/ misled the subject, who might possibly have expected an American final /r/ to guide him to the right interpretation.

The second case was against the item *youthful*. Having correctly interpreted *useful* in item 19, one subject was reluctant to commit himself to any interpretation of the signal *youthful* in item 24, presumably because, although he might have heard it as *useful*, he considered it most unlikely that that item would be repeated.

Conclusions

The overall rate of success by these 13 adult Korean students in interpreting the British RP accent was 62%. This figure naturally includes the cases where there was 100% success, eg in interpreting /kOIn/ as *coin*, and where there was little success, eg in interpreting *bought* and *nought*. The figure also includes the occasional refusals, but more importantly, the cases of interpretations of lexical items where one phonological problem led to a further re-interpretation of another phonological item.

The detailed discussion of pedagogical implications shows the value of conducting educational research into learners' perceptions of the pronunciation system of a target language. Perception tests are not only valuable tools in the classroom for diagnostic purposes (see, for example, Bowen & Marks, 1992, Dalton & Seidlhofer 1994, Celce-Murcia et al, 1996) but also as a research tool for establishing a current state of interlanguage phonology, with implications for the design of teaching materials. A teacher cannot really expect good production of sounds without good perception of them: "faulty perception leads to faulty articulation" (Tench, 1981: 46).

The design of a perception test - whether for research or classroom exercises - is based on a thorough contrastive statement of the phonologies of the two languages concerned and on (even casual) observation of learners' attempts in the target language. The value of the latter, a kind of error analysis, is in supplementing the evidence from a contrastive analysis. Learners' strategies in target language pronunciation might involve issues that a phonological contrastive statement might miss, e.g. reference to orthography, choice of substitutions - some learners of English substitute /T/ with /t/, others with /s/, for instance - use of either reduction or epenthesis in coping with unfamiliar clusters, and of paragoge in coping with unfamiliar codas.

What emerges from the contrastive study and the observation of errors is a list of problematical segments together with their most likely alternatives. It must be borne in mind, that some segments are not problematic in certain environments, but are so in others, e.g. English /j/ for Korean learners, but only before front close vowels. A list of minimal pairs is drawn up, matching the problematic segment with their alternatives; a list of items is thus drawn up which contains the problematic segments. Depending on the scale of the testing event, a number of parallel lists might be advisable, as Tench (1996) and Ahn (1997) have done. Furthermore the items must be carefully selected to avoid the risk of learners finding a semantic link between the items, and the risk of confusing spellings; for instance, if you choose *bow* /bαY/, you have no way of knowing from the testee's written response whether /αυ/ or /≅Y/ was perceived. Also, the items selected must be reckoned to belong to the (interlanguage) lexicon of the learners. This reduces the risk of multiple re-interpretations which inevitably distort the evidence of the real phonological competence; for instance, *seat* would certainly have provided more satisfactory evidence in Experiment 2 than *seep* did, being a more familiar word which still has the potential for confusion with /Σ/ + /i:/.

The perception test can be administered as described above; each item is given twice, from a point where lip action cannot be detected, with a control subject present. The analysis is most revealing! As is often the case in the classroom, what the teacher presents is not always what the subjects perceive – and this is true in phonology too! In the data presented above, the author was quite unprepared for the revelation that most people mistook *mass* for *math.* Allowing for cases of re-interpretation within

the interlanguage lexicon, the results are a clear indication of the current state of receptive phonological competence, which thus provides the basis of the design of necessary remedial discrimination procedures.

It should be noted, too, that this evidence of phonological interlanguage is both general and individual. The above pedagogical discussion could lead to a review of the design of classroom materials, but for an individual very specific practice can be organized. Subject 1 in the pilot experiment needs practice in medial and final /s/, to distinguish it from /θ/, and in the distinction of the vowel /ʂ/ from /Θ/; Subject 2 needs much more.

Naturally, the larger the sample, the more reliable the evidence, which might lead to the publication of discrimination exercises for specific groups of speakers: in the case reported in this study, adult Korean learners at an upper intermediate/lower advanced level in a professional setting. Such evidence, along with the kind of intelligibility evidence reported in Ahn (1997), would also inform the design of articulation exercises. The two kinds of material - perceptual and productive - would thus carry a strong guarantee of effective development of the phonological competence of those that are trained by it.

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