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PRONUNCIATION AS CATEGORIZATION: THE ROLE OF CONTRAST IN TEACHING ENGLISH /r/ AND /l/

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Abstract

This paper reports an experiment designed to test the effectiveness of explicit use of contrast in teaching the distinction between /r/ and /l/ to Asian learners of English. The experiment uses computer-based training modelled after Lively, et al. (1994), in which users hear one word from a minimal pair (e.g. “fruit/flute”) while simultaneously seeing both words on the screen, then respond with a keystroke to indicate which word they think they heard. The present experiment compares the effectiveness of two different kinds of feedback. In Condition 1, after giving their response, users hear the correct word once (as in Lively, et al. 1994), while in Condition 2, they are able to hear both words as many times as they like, under their own keyboard control. Results suggest that Condition 2 produces greater improvement in perception, and that this improvement translates to production, even though production has not been explicitly trained. These findings are interpreted within a Cognitive Linguistics framework, with notes on their relevance for teaching within a communicative or socio-cultural approach.

Keywords

pronunciation, TESOL, r and l, minimal pairs, categorisation, Cognitive Phonology

About the author

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1. Introduction and literature review

For many years, the difficulty adults have in learning second language pronunciation was explained with reference to the Critical Period Hypothesis—the belief that adults cannot learn new phonological contrasts, perhaps due to physiological changes in the brain around puberty (Lenneberg 1967). This idea was in line with the contemporary theory of Generative Linguistics (Chomsky 1965), which took the view that language learning is achieved by an innate Language Acquisition Device which operates below the level of consciousness so is inaccessible to explicit teaching. It was also supported not just by the individual experience of many teachers (Macdonald 2002), but also by studies which appeared to demonstrate that explicit instruction in pronunciation was ineffective (Macdonald, et al. 1994). For these reasons, pronunciation was given little attention in English language teaching during these years (Celce-Murcia, et al. 1996), and the belief that new contrasts could not be learned became a self-fulfilling prophecy, challenged only by a few dedicated teachers (Baker 1981, Rogerson and Gilbert 1990).

Since then, the Critical Period Hypothesis has come under scrutiny from various angles (Gass and Selinker 2001). In relation to pronunciation, it was found that the age at which a language is learned is not necessarily the best predictor of the degree of foreign accent (Flege, et al. 1995). As well, experiments by Pisoni, Bradlow and colleagues (discussed below), by successfully training monolingual Japanese adults to discriminate the notoriously difficult English r/l contrast (as in “rice” vs “lice”), demonstrated that at least one new phonological contrast could be learned. Since then, several classroom studies have also demonstrated that second language learners’ pronunciation can be improved through explicit

teaching (Couper 2006, Munro 1998). These studies provide a sharp contrast with earlier evidence, mentioned above, for the ineffectiveness of teaching pronunciation, suggesting that it is not the fact of teaching that matters, but the kind of teaching.

The question is, then, if it is not ‘Critical Period’ that holds learners back in pronunciation, what is it? Currently, progressive language teaching favours communicative, task-based and socio-cultural approaches (Ellis 2003, Lantolf 2000). However, pronunciation is still given relatively little explicit attention (Levis 2005). Perhaps learners would benefit if there were a way to bring explicit pronunciation teaching into more central focus, within a generally communicative style of teaching.

An important question to be explored then is: “What are the principles governing the effectiveness or otherwise of second language pronunciation teaching?”. The present research seeks to investigate one such principle, the use of contrast in teaching pronunciation, through consideration of results of a study modelled after the experiments by Pisoni, Bradlow and colleagues mentioned above.

2. Research Questions

In seeking to challenge the Critical Period Hypothesis, as described above, Pisoni, Bradlow and colleagues conducted a series of experiments using computer-based training to demonstrate that adults can learn new phonological contrasts. The experiment of present interest (Lively, et al. 1994) used recordings of 68 minimal pairs with r/l in 5 different phonological environments, produced by 5 English speakers (their previous experiments having shown use of real voices to be more effective

than synthetic speech, and multiple speakers more effective than just one). These recordings were incorporated into a program which cycled through the minimal pairs four times, for a total of 272 randomised trials per session over three weeks of daily sessions. Participants were 19 randomly selected monolingual Japanese adults with minimal exposure to English. On each trial, they heard one word from a minimal pair (e.g. “belly/berry”), while simultaneously seeing both words on the computer screen. Their task was to indicate with a keystroke which of the two words they thought they had heard. If they were right, their score incremented and they were automatically moved on to the next trial. If they were wrong, they heard the word again with the correct answer highlighted, then were moved on with no score increment.

This rather gruelling practice produced statistically significant improvement in participants' discrimination of /r/ and /l/, with scores (averaged over five sessions) improving from 71% in Week 1, to 79% in Week 2, to 82% in Week 3 (see Figure 1). Subsequently, follow-up experiments using similar methodology (Bradlow, et al. 1995) produced similar improvements in perception, and further reported statistically significant improvements in production—scores rising from 68% to 73% (see Figure 2), with the improvement transferring to new r/l words, and retained after 3-6 months. Since production had not been directly trained, this was an important result, confirming a controversial link between production and perception (Strange 1995).

These results from the Pisoni/Bradlow teams (henceforth P/B) were good, and certainly made the point intended—new phonological categories can be learned by adults. But is this the best that can be done for language

learners? Even after three weeks of intensive training, participants still made around 20-30% errors in both perception and production of this simple contrast. This may be partly explained by the fact that the r/l contrast was being trained in isolation, rather than being taught as part of the language as a whole. However it may be worth considering another factor.

Many people who have experienced second language pronunciation as either a teacher or a learner would see an important limitation in the feedback given to participants in the P/B experiments: when they made a mistake, they were presented with the correct answer but were not able to explore the contrast between correct and incorrect answers, or even to hear the correct answer more than once.

The present experiment, run as a precursor to a larger project, speaks to the hypothesis that learners would improve more if allowed to play the two members of each minimal pair several times after their response was scored.

The method is modelled closely on P/B, but the experiment was conducted under very different circumstances. Whereas P/B used a rigorous experimental process with financial reward as an incentive to participants, the current experiment was run in a lively, sometimes noisy, Independent Learning Centre at an Australian ELICOS centre, with a group incentive of a dinner party for all those who completed the training.

3. Methodology

3.1 Procedure

Participants were first tested on their production of r/l, then asked to work through the computer-based training each day for three weeks, and finally tested again on their production. At each computer session they were asked to fill in a form recording their feelings about the training that day. At the end of the three weeks they were given their pre- and post-test production scores, shown a graph of their daily scores, and interviewed about their experience of the training.

Three conditions were run. Condition 1 used a training package very similar to that of P/B. When participants made a mistake they heard the same word played again, once, with the correct answer highlighted on the screen, and were then automatically moved on to the next trial. Condition 2 made just one small change. After responding and receiving the correct answer, participants were able to listen to each word in the minimal pair (e.g. 'crime/climb') as many times as they liked, under their own keyboard control, before moving on voluntarily to the next trial. Condition 3 made one further small change. If the participant scored correctly on all trials of a particular minimal pair in four consecutive sessions, that pair was dropped from the bank of trials (but given an automatic correct score so as to keep overall scores commensurate with Conditions 1 and 2), enabling students to concentrate on pairs they found challenging. Condition 3 was not fully completed, but is included for statistical reasons. Note that no control group is reported, as P/B had already demonstrated with a control group that the method of Condition 1 was more effective than no

intervention, and the focus of this experiment is on the relative effectiveness of the three conditions, rather than on absolute improvement.

3.2 Materials

The 68 minimal pairs were recorded by 5 native speakers of Australian English (3 female and 2 male). The speaking test used half the minimal pairs in the set (balanced for phonological environment), with 10 pairs differing between the pre-test and post-test. Participants were recorded reading words from a randomised list, repeating each word twice. The recordings were scored by a teacher-linguist not associated with the project and unaware of whether the recordings came from the pre-test or the post-test. A mark was given only if the student produced r/l correctly on both repetitions (other aspects of pronunciation were ignored).

3.3 Participants

Participants in the present experiment were English language students from a variety of language backgrounds (Japanese, Korean, Chinese and Thai), self-selected on the basis of a desire to overcome their persistent problems with r/l. Different groups were used for the different conditions, and unfortunately it was not possible to control the mix of language backgrounds in each group. Numbers were as follows: Condition 1: 15 (10 female, 5 male; 6 Thai, 5 Chinese, 4 Korean); Condition 2: 27 (15 female, 12 male; 4 Thai, 8 Chinese, 15 Japanese); Condition 3: 7 (6 female, 1 male; 1 Thai, 2 Chinese, 3 Japanese, 1 Korean).

4. Results

4.1 Listening

Figure 1 shows the scores recorded by the computer program for each of the three Conditions—effectively a measure of listening discrimination—in comparison with the equivalent results from Lively et al. (1994). In all cases, scores are averaged over the 5 sessions in each week, to reduce the effects of particularly good or bad performance on any one day.

The starting scores in each Condition were statistically similar, and somewhat higher than the starting scores of P/B's monolinguals, presumably due to the current students' much greater exposure to English—though it is interesting to note how small the difference is, given that students in the present experiment had been learning English for 6-10+ years.

Each Condition produced a statistically significant improvement in scores in each week of training (in all cases $p < .002$). The important question is to compare the degrees of improvement in the different conditions. In Condition 1, equivalent to P/B's method, students, though starting from a higher base, improved less than P/B's participants, perhaps due to the different circumstances under which the training was undertaken. In Condition 2, improvement was greater, up to about the same level as P/B. The difference between Week 3 in Condition 2 and Week 3 in Condition 1 is statistically significant [$t(10) = 2.75, p = .02$] though the overall difference between Conditions 1 and 2 is not. In Condition 3, improvement was greater still, with the overall difference between

Conditions 3 and 1 being statistically significant ($p = .003$), though the difference between Conditions 3 and 2 is not ($p = .041$).

4.2 Speaking

Figure 2 shows the results of the speaking tests before and after Conditions 1 and 2 (unfortunately no speaking test scores are available for Condition 3)—again in comparison with equivalent results from P/B. The initially surprising result that P/B's participants had higher starting scores is accounted for by the different style of test used. P/B's less proficient participants were asked to repeat both members of the minimal pair after a model and were scored by native speakers listening to each word individually and making a forced choice as to whether the speaker had said the pair-member with /r/ or with /l/ (e.g. 'ram' or 'lamb'). The current experiment, as described above, required students to read individual words from a list and to pronounce r/l correctly in each of two repetitions.

In both Conditions 1 and 2, students' pronunciation of r/l showed statistically significant improvement ($p < .005$). Again the important question is the relative improvement in the two conditions. It is evident that improvement was greater in Condition 2 than in Condition 1, though this is not statistically significant ($p = .071$). It is also evident that in both Conditions, students' pronunciation of r/l improved more than in the P/B experiment, despite the more rigorous testing and scoring. This may be related to the fact that the training took place in the context of their ongoing learning of the English language as a whole. It is important to note however that teachers at the ELICOS centre were asked not to focus directly on r/l in their lessons during the training period (and later

confirmed that they had not done so), and that these students had volunteered for the experiment due to long-standing problems with /l/.

4.3 Questionnaires and interviews

All students in all conditions said they found the training useful, and this is evidenced by the fact they kept at it for the full three weeks (ethics approval naturally required that students were clearly informed that they could leave at any time with no penalty, but only a few dropped out). Most of the students also said they found the training interesting, and expressed gratitude for the opportunity to study in this way, which they felt helped them to overcome their long-standing problems with /l/. This was true also for Condition 1, though in this condition almost all students, without prompting, called for the program to be modified so as to allow them to hear both words several times.

Scores varied considerably from day to day, and students' daily notes showed these fluctuations tallied well with varying levels of distraction, tiredness, noise or computer/headphone problems during the sessions. It may be worth noting that these factors influenced Condition 2, which was run at a busier time of the term, more than Condition 1.

The data is not robust enough to analyse the degree to which factors such as language background affected student performance. The interviews suggested, however, that one important factor in how much they improved may have been metacognitive skill. Some students were able to use the materials to really focus on the difference between /r/ and /l/ in its different phonological contexts, noting the words that caused them most difficulty, actively trying to improve their score each day, and seeking

opportunities to practise to r/l in daily life. Other students were more prone to boredom or distraction, had less ability to reflect on their learning process, and spent less time playing the contrasting members of each pair.

5. Discussion

5.1 Findings

This experiment clearly supports P/B's findings that new phonological contrasts can be trained, and that perceptual training carries over to production. It also provides evidence in favour of the hypothesis that allowing students to explore the contrast between members of a minimal pair is more useful to them in learning to perceive and produce the contrast than simply telling them whether their response was correct or incorrect. This evidence is not statistically strong, due to practical difficulties in running an experiment like this under real-life circumstances. However, the weakness of the statistics is perhaps mitigated to some extent by the very obviousness of the hypothesis. Many adults who have learned a second language would confirm the experience of needing to explore the differences between words rather than just being told the correct pronunciation.

The question that really needs to be addressed, then, is not *whether* learners do better when they can hear both words, but *why* they do. Understanding the reason could help in developing principles for effective teaching of second language pronunciation. The remainder of this paper explores a possible answer to this question, drawing on insights from Cognitive Linguistics (Langacker 1967, Taylor 2002), a theory that has already been applied successfully in relation to other aspects of language

teaching (Putz, et al. 2001, Tyler, et al. 2005), and can also provide a useful framework for understanding pronunciation (Fraser 2006).

5.2. Pronunciation as cognitive skill

Difficulties in pronunciation are often attributed to difficulties with the physical production of sounds, with many teaching materials featuring diagrams or animations to help learners visualise articulation. Of course pronunciation does have a physical dimension, to a much greater extent than the other macro-skills. However articulation is not the whole story. This is seen particularly clearly in the case of r/l. Most learners can easily produce perfectly acceptable versions of both /r/ and /l/; they just can't do it "on demand". Their difficulty, then, is not so much in producing the sounds as in controlling their production in a way appropriate to the pronunciation of English words. This was very evident in the speaking tests for the current experiment, in which students were asked to produce each word twice. Frequently they produced what sounded to a native speaker like two different words (e.g. "rock, lock") rather than a repetition of a single word. However the students themselves were unaware of this difference, believing themselves to have said the same word twice.

Of course this difficulty in discriminating the sounds is readily explained with reference to the differing phonological structure of English and the learners' L1s. In English, /r/ and /l/ are separate phonemes, while in other languages they are allophones of a single phoneme. This, however, is a rather limited account of the situation. It can even give the misleading impression that the single phoneme of the student's L1 has two allophones [r] and [l], each equivalent to one of the English phonemes /r/ or /l/. This is far from true (Riney, et al. 2000). The single phoneme in each of the

students' L1s covers a wide range of allophones, some of which are somewhat similar to English /r/ and /l/, while others are very different. Indeed English /r/ and /l/ themselves each cover a wide range of allophones. Consider, for example, how different the two phonemes sound when produced in sets of words such as “rain, train, drain, through”, or “leak, look, clue, milk”.

One advantage of Cognitive Linguistics is that it explicitly focuses on the idea that each phoneme groups together a category of different sounds (Taylor 2003). Categories of sounds are much like any other categories (Rosch 1973). They have a central member or prototype, surrounded by a cluster of slightly different members, some close to the prototype and others shading gradually into adjacent categories. Colours provide a good example of how categories work. We speak of “blue”, “red”, “orange” and so on as if each referred to a specific colour, but actually each colour term covers a prototypical colour ('blue blue'), and a wide range of different colours (“sky blue”, “royal blue”, “baby blue”, “aqua”, etc), with the boundaries between one such “allocolour” and another tending to be somewhat “fuzzy”, and context-dependant (e.g. is aqua an “allocolour” of blue or green?).

It is very much the same with phonemes. A very important difference between colours and phonemes, however, is that with colours, most people are aware of the “allocolours” (though they may differ in the degree to which they can name each one with a specific colour term, like “tangerine” or “ivory”), whereas with speech, people are generally unaware of allophones, and assume that a phoneme is pronounced identically each time it is produced. This is quite untrue—in fact, it is

more accurate to say that any given phoneme is pronounced differently every time it is produced (Ladefoged 2005). However speakers generally ignore these sometimes considerable pronunciation differences, focusing instead on those pronunciation differences that serve to contrast meanings. For example, most English speakers need some coaching before they notice any difference in pronunciation of /r/ in “rain” and “train”, even though phonetically this difference is of similar magnitude to the difference between the first sounds of “tin” and “chin”, which English speakers consider to be very obvious indeed.

An important feature of categories is that it is rather rare for the members of a category to be definable purely in terms of their physical characteristics. Consider the category “chair” for example. Chairs come in a huge variety of shapes, sizes, materials and other physical features—we could say the “chaireme” has many “allochairs”. It is hard to think of any set of purely physical features possessed by all chairs and by no non-chairs, that could be used as the basis of a purely physical definition of “chair”. Rather, chairs must be defined with reference to what people know about them, for example, their function, and the contexts in which they occur.

This reference to “what people know” brings the discussion into the domain of cognition (the science of what people know and how they acquire and use knowledge). The suggestion is that the thing that unites the category of chairs is the fact that (some) people have a concept, CHAIR, in their minds. It is this concept that allows all the physically different chairs to be categorised as “the same kind of thing”. Memory, reasoning and many other cognitive processes operate with respect to concepts

(Murphy 2002). For example, after leaving a room, one may remember that it had a chair in it, but have little memory for the physical details of that chair, and even that little memory will fade rapidly with time. Speech sounds can be seen in exactly the same way (Fraser 2004, Fraser 2001). On this view, it is not physical similarities that allow all the allophones of /r/ to be categorised as “the same phoneme”—as we have seen, the allophones can be radically different. Rather it is the fact that (some) speakers have a concept of /r/ which unites all those physically different sounds and makes them seem the same..

Concepts, of course, must be learned. Concepts such as chair are usually learned in childhood, through well-known processes involving errors such as over-generalisation and under-extension (Berko Gleason 2005). Concepts such as /r/ are also learned in childhood as part of the process of language and, especially, literacy acquisition. Speakers from different language and literacy backgrounds learn different concepts that encourage them to categorize speech sounds in ways quite different from those that seem obvious to English speakers. Learning to speak a new language means learning new phonological concepts—through processes involving errors such as over-generalisation and under-extension, very much like those that characterise learning of any other concepts (Fraser 2004, Fraser 2008). One crucial difference however is that, like English speakers, speakers of other languages have little awareness of allophonic variation in their own pronunciation of the phonemes of their L1. In fact, speakers from non-alphabetic literacy backgrounds often have little awareness even of phonemes (Olson 1994)—though these seem so obvious to English speakers they find it hard to imagine anyone not hearing “cat” as “c-a-t” (Fraser 2004). These observations suggest that concepts of allophones are

formed after concepts of phonemes, and concepts of phonemes after concepts of words. Elaboration of this idea here would take us too far from current concerns, but further discussion can be found in Fraser 2004), and see also Vihman and Croft 2007).

This change of perspective from sounds as such, to speakers' concepts of sounds, is valuable because rather than merely providing an explanation for why learners have problems with /r/ and /l/, it suggests a direction in which to seek a solution. If the difficulty is primarily conceptual rather than physical, it can be approached through methods of concept formation (Jaeger 1986, Mompeán 2004). Since helping students with concept formation is a task familiar to most teachers (Woolfolk 1998), this opens up methods for teaching pronunciation which are not only more productive than focusing on articulation, but also more congenial to teachers, as they do not require detailed knowledge of phonetics (Fraser 2006). In particular, since concepts are best learned in conducive sociocultural contexts, it bridges the gap that has unfortunately opened up between those approaches to language acquisition which focus on sociocultural context and those which focus on individual psychology (Zuengler and Miller 2006). Confusingly, the latter are currently often referred as "cognitive", due to the Chomskyan analogy between the human mind and a computer (Leiber 1991; Fraser 2007). Unlike the Chomskyan view of language as a system of computational processes inaccessible to consciousness, however, the concept-formation approach sees pronunciation as being learned, like other aspects of language, by a conscious, socially-situated agent. On this view, pronunciation can be taught communicatively, like "higher" levels of language, by taking into account of a few special characteristics of pronunciation (Fraser 2006, Fraser 2001, Fraser 2008).

Interestingly, some of the activities developed by successful pronunciation teachers (e.g. Kenworthy 1987) can be seen as incorporating concept-formation principles. Setting successful activities within a concept formation framework may enable them to be understood and extended in productive ways.

One very important principle of concept formation is the need for contrast. As Wittgenstein (1958/1974) famously pointed out, concepts are not learned through positive examples alone, but require negative examples as well, to allow the learner to become aware not just of the prototype but also of the boundaries of the category. For example, to teach a newly-arrived Martian the concept of CHAIR it would surely be necessary to provide examples not just of chairs, but also of things which, while similar to chairs, are not chairs: sofas, stools, tables, etc.

Bearing in mind then, that recognising phonemes requires categorising sounds according to concepts, and, that concepts are learned through processes that depend on contrast, consider again the design of the present experiment. Condition 1 shares the (unstated) assumption of P/B that participants have clear, though subconscious, concepts of the allophones [r] and [l], but need practice in assigning individual allophones to the appropriate phoneme /r/ or /l/. Condition 2 takes a quite different view. It recognises that the reason participants cannot readily identify /r/ and /l/ in English words is that they do not yet have clear concepts of these phonemes, much less of the individual allophones categorised by those concepts. They therefore find it difficult not just to recognise which phoneme occurs in a particular word, but even to remember the sound they

have just heard long enough to compare it with the correct response when it is given.

What they need, then, is help in learning the new concepts of English /r/ and /l/. They can be helped in this by contrasting examples which, though they sound “the same” to the learners, are categorised as “different” by native speakers, and vice versa. This helps them to learn the English prototype, and to understand how the category boundaries relate to the prototype in different contexts. This is an inherently interesting task for most motivated mature learners, which they undertake naturally and fruitfully if suitable materials are provided to them. Unfortunately suitable materials are often not provided when pronunciation is taught only “implicitly” through communicative or task-based approaches.

6. Conclusion

This experiment has provided evidence of the value of using contrast to help improve perception and production of /r/ and /l/ by learners of English with L1s which lack this distinction. Recognising that the results need to be confirmed and amplified by follow-up studies, discussion has interpreted the findings within a Cognitive Linguistics framework, suggesting that the concept formation approach is a fruitful one for teachers, and worthy of further development. In closing, a few remarks on the relationship between the experimental method tested here, and classroom teaching, are appropriate.

The training method used here is very much a psycholinguistic experiment. Its intention is to isolate one principle of teaching which, once its effectiveness has been demonstrated, can be integrated into a

communicative and culturally sensitive style of teaching that suits the circumstances of particular classrooms. While such teaching might profitably include opportunities for students to practise with computer-based materials similar to the ones used here, these should be supported by appropriate pre-teaching, including guidance on the metacognitive skills needed for effective use of the materials. Also, the training should be refined to provide more interesting exercises graded into sets reflecting the stages through which the relevant phonological concepts are learned. Ongoing research in the current project is seeking to establish those stages of phonological concept formation, which may differ for learners from different language backgrounds, to enable more specific recommendations to be made.

The focus on minimal pairs in the current experiment was determined by the need to compare the results with those of P/B. Minimal pairs have a long and chequered history in pronunciation teaching (Celce-Murcia, et al. 1996). The concept formation approach certainly encourages the use of minimal pairs in appropriate circumstances, for example, where students frequently confuse members of a pair in spoken communication. Rather than old-fashioned “drilling”, however, the aim is to assist learners with guided exploration of the contrast, to help them establish an appropriate phonological concept in perception, and allow it to become embodied via production practice (these two stages need not be as strictly separated as in the current experiment). It is notable that in the present experiment production scores showed a greater percentage increase than perception—even though it was perception that was directly trained (cf. similar observations by Couper, 2006). This could be because the prototype is learned before the category boundaries (cf. McCandliss, et al. 2002), but

again, a great deal more research is needed to fully establish the incremental stages of phonological concept formation.

Minimal pairs are only one type of contrast, however—albeit one which appears very salient to native speakers. Indeed, segmental contrasts, even those, like r/l, with a high functional load (Brown 1988), are not the most important aspect of English pronunciation for intelligibility (Fraser 2003, Hahn 2004). The general principle of using contrast for concept formation is not restricted to minimal pairs, however. The concept formation approach focuses more on the contrast between a correct (or appropriate) pronunciation versus an incorrect (or inappropriate) pronunciation within a particular communicative act. This is called Critical Listening, discussed further in Fraser (2000), Fraser (2001) and (Couper forthcoming), and extends readily to suprasegmental aspects of pronunciation (Fraser 2001, 2006).

Even the best of the three conditions in the current experiment achieved a mean accuracy of only 88% after three weeks of work. Although this is a significant improvement by the students, informal experimentation suggests that even better results can be obtained by incorporating the explicit use of contrast, along with other concept-formation strategies, into communicative and culturally sensitive teaching. Further research is underway to confirm this observation formally. Recent models from the teaching of grammar (e.g. Mochizuki and Ortega 2008) may prove valuable in guiding this research.

Figures

Figure 1. Comparison of results of P/B discrimination training, with the experiments described in the text.

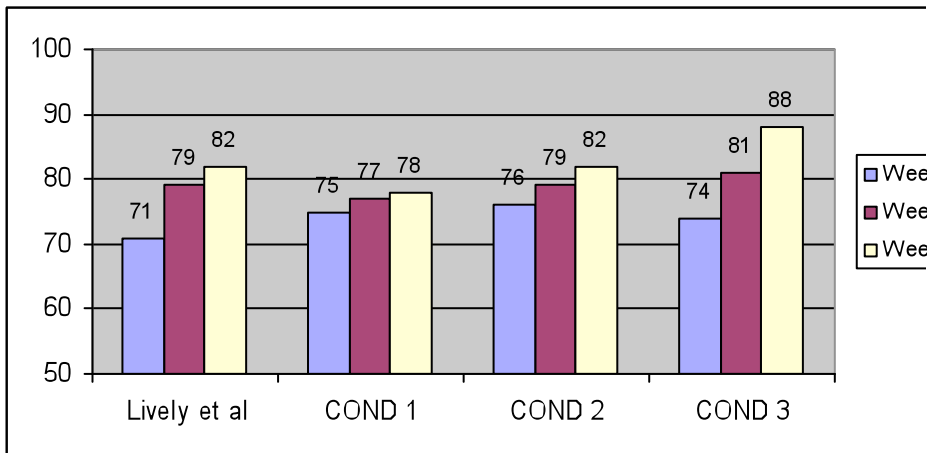
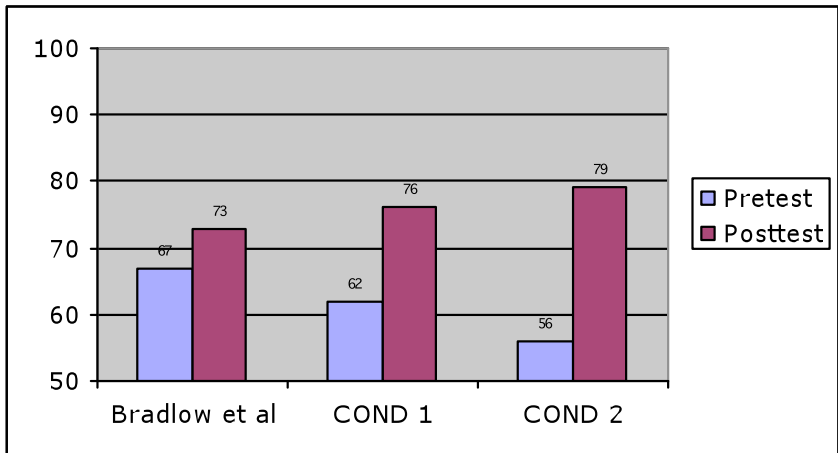


Figure 2. Comparison of the effect of discrimination training on speaking in P/B and the Conditions described in the text.



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