INVESTIGATING LINGUISTIC PROSODIC ABILITY IN ADULT SPEAKERS OF ENGLISH

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ABSTRACT

The project examines prosodic ability in the normal adult population of speakers of southern British English. In the absence of documented normative data, a new test designed to cover the comprehension and production of the forms and some common functions of English prosody was administered to a group of people participating in the project.

It is intended that this test should provide a tool for the assessment of prosodic impairment in clients with speech and language disorders, and that the process of administering the test to a group of English adults without speech and language disorders should yield useful data on prosodic norms.

The test investigates the phonetic features of loudness, tempo, rhythmicality, pitch and pitch-range, pitch movement (its presence and direction), accent and silence within utterances, and the way they function phonologically to achieve aspects of communication which include topic-delimitation, focus and affect. It ascertains participants' receptive and productive ability concerning each of the elements, both in the manipulation of its phonetic form and at a phonological/functional level, i.e. how far it can be consciously used to infer and produce meanings in situations where other language factors are controlled. This initial sample has provided a guide to the ability that can be expected from normal speakers, and a contribution is made to the study of prosody in the form of indications about differences of prosodic exponency in various communicative functions.

The test has furthermore been used to assess the prosodic ability of three speakers with aphasia. Two of the speakers have non-fluent aphasia, the third is fluent. Their results are compared with those of unimpaired participants. Conclusions are reached about the value of aspects of prosody testing, and about specific aspects of prosodic impairment and the ways in which they could affect the communication skills of speakers with aphasia.

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Muswell Hill, Christmas Eve, 1997.

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BACK POCKET:

Cassette recording of cuetape used in the PEPS test

1. Approaches to prosody and its assessment

1.1 Introduction: main aims of the study

This study had its genesis in the need for an assessment procedure for the prosody of speakers with aphasia in Britain. It was therefore directed towards the needs of adult British English speakers, having some consideration also for the fact that the majority would be both advanced in age and not entirely well. The variety of English examined in this study, and judged to be most useful for this purpose, is therefore standard southern British English.

There exist already several procedures which address the issue of prosodic assessment, and some of them are described in 1.9. Their existence demonstrates that there is (or has been) a need for prosodic assessment, and many of them contain useful approaches to the task, but until recently there has been a tendency to conduct such investigations only as part of assessments associated with particular conditions (such as dysarthria: Robertson, 1982, Enderby 1983); furthermore, the assessments tend to give partial pictures only of a client's prosodic ability. Regarding prosody as an aspect of language which deserves an integral approach is a relatively recent development.

One result of closer examination of the need for a prosodic assessment procedure was that while many of the existing procedures compared impaired prosody with that of controls, these were small groups, and there was apparently little data on prosodic norms in a large number of people, in terms of phonetically measurable parameters.

The study thus developed two main aims:

- to investigate the performance, in terms of phonetic-prosodic parameters, of speakers without impairment in their use of prosody for linguistic expression; and
- to devise a procedure for measuring the extent to which they use each of these parameters so that the resulting data will provide norms for gauging the nature and extent of disorder in speakers with aspects of language impairment, while the procedure itself can be used for assessing their prosodic ability.

The first aim, while it is of linguistic interest, has not been explored in full detail because the primary purpose of the study was to provide norms for assessing impaired ability, not to support an account of the functions of prosody in southern standard British English.

1.2 Outline of the study

The study first looks at the approaches that have been made to examining prosody in language, and then at some of the various assessment procedures that have been devised (chapter 1). From this there emerges a list of desirable criteria for assessment procedures to meet. The construction of a theoretical framework to encompass these criteria is described in chapter 2, and an account of the process involved in constructing tasks to meet them is given in chapter 3. A test incorporating the tasks was then administered to 90 participants, and the results are reported in chapter 4, with the statistical procedures used to establish their validity and reliability. The implication of the results, and points of interest that emerged in the course of testing, are given in chapter 5. The following chapter describes in some detail the performance on test of three participants with aphasia, and the implications of their results (chapter 6). The final chapter examines how far the criteria identified at the end of chapter 1 have been met and suggests some avenues for further research that emerged during the course of the study.

1.3 Problems of taxonomy

There is widespread terminological confusion in this field of study, and it will be seen that in considering approaches to prosody by various authors it is also necessary to clarify how their use of terms differs from how they are used in the present study. One problem is that the forms of prosody and their functions are prone to confusion; a prime concern of this study has been to preserve the distinction between form and function. This has given rise to the consideration of

- the domain of prosody as a set of phonetic features (prosodic 'elements') which denote the forms of prosody, and how taxonomies differ;

- a putative 'set' of communicative functions effected largely or solely by prosody (hereinafter called prosodic functions) and how they have been identified;

- how the prosodic elements have been associated with the prosodic functions in the literature.

The study needed to consider both how impairment of the forms of prosody might affect communicative function, and (conversely) how neurological impairment might affect linguistic function and therefore cause the forms of prosody (which might in themselves be unaffected) to be used misleadingly (in both interpretation and expression). This gave rise to the examination of some applications of prosodic theory, such as the transcription of prosody (for phonetic and linguistic analysis and such disciplines as conversation analysis) and the consideration of prosody in English language teaching and in child language development. It is shown that while prosody is considered to be important in these fields, the form-function confusion apparent in prosodic theory also pervades the applications, thus making it necessary to adopt a new approach, considering prosodic form and function as related but separate, for the purposes of assessing prosodic impairment.

Existing procedures for prosodic assessment are examined, and it is found that recent procedures recognise a need for the separate assessment of prosodic forms and functions, but not for relating the two. A list of the criteria considered necessary for the effective assessment of prosodic deficit is devised.

1.3.1 Prosody, intonation and suprasegmentals

The term "prosody" was used in the past to cover many aspects of articulation: in Classical Greek the term denoted high and low tonal accents, later represented by vowel length and stress distinctions, which gave rise to the sense of prosody as denoting metrication in verse. Firth (1948) included nasality, aspiration, palatality and retroflexion in the scope of prosody, as well as accentual and intonational features. There has recently been a tendency to use the term "prosody" in a phonetic sense, to designate the features of pitch, loudness and length, as the phonetic equivalents of the acoustic parameters of fundamental frequency, duration and intensity. The present study favours the use of "prosody" as the general term for the field, covering features that might extend over anything from a single segment to a whole utterance, including features of rhythm, loudness, tempo and pitch-patterns but excluding, on the whole, articulatory features.

"Intonation" is a term that has been used to mean pitch-features in general which have implications for units above the word, such as phrases, clauses, sentences and interactional sequences; and the phonological constructs that are associated with these pitch-features. The patterns thus formed have been the object of a vast body of study which, however, is little concerned, for the most part, with the interaction between pitch and other prosodic features such as loudness, rate and silence. Johns-Lewis (1986) mentions the considerable overlap between the terms 'intonation' and 'prosody', but suggests that the terms are both necessary because prosody covers some phenomena, such as silence and voice quality, that cannot be included in intonation as a system, although they affect the perception of the intonation system. In the present study, the term 'intonation' is used only when pitch-patterns constitute the main or exclusive vehicle of suprasegmental information.

"Suprasegmentals" has been favoured mainly by American scholars to refer to non-segmental aspects of speech, or sounds of language hierarchically above segments, and the term is used in this study by way of contrast with the segmental level. The basic unit in the study of suprasegmentals is the syllable, and the prime concern is the relation between syllables. Lehiste (1970) describes suprasegmentals as "features whose arrangement in contrastive patterns in the time dimension is not restricted to single segments defined by their phonetic quality." The definition, according to Lehiste, is hardly satisfactory because it defines something in terms of what it is not. As a definition, it does however point up a duality of meaning in the term "suprasegmentals": that it comprehends both the contrastive arrangement of the features and their multisegmental nature (in that they span more than one segment). The first aspect, the notion of contrastive arrangement, constitutes concern with the complementary distribution of features. These features can be manifested on one segment but the interest lies in how that one segment compares with another in the same utterance. As Lehiste points out, the stressedness of a syllable cannot be established without comparing the syllable with another in the utterance. It is however also true that while stressedness (or accent) is relative, its physical exponents can in fact be clustered on one syllable, and Lehiste points out that the features of pitch, stress and quantity, which she defines as the main carriers of prosody, do not fit comfortably into her definition of suprasegmentals precisely because they can be manifested on one segment. The second aspect of the term "suprasegmentals" (speech qualities spanning more than one segment) is reflected in a tendency to include in it all those characteristics of continuous speech, whether in free variation or in complementary distribution, that have a communicative effect and are not considered as part of the domain of other aspects of language.

1.4 The domain of prosody

This section reviews what has been encompassed in the domain of prosody, with a view to determining what aspects of prosody should be included in an assessment procedure suitable for a clinical population.

1.4.1 Intonational phonology

The model currently favoured for research in intonation is the autosegmental-metrical theory propounded by such authors as Pierrehumbert (1980)), Beckman (1986) and Ladd (1996). The autosegmental-metrical theory confines itself, however, to 'intonation' (i.e. pitch-patterns) and 'speech-rhythm' (distribution of accents) rather than with a broader view of prosody (taking loudness and length features into consideration), and a more inclusive view seemed appropriate for the study of prosody in impaired speakers. Furthermore, for the level of detail needed for the examination of intonation in this study, the framework of the autosegmental-metrical theory is not yet sufficiently well-established (for a review of some unresolved issues see Ladd 1996:102-111) and the work of British authors such as Crystal (Crystal 1969, Crystal and Quirk, 1964) and Halliday (Halliday 1967 and 1970), offered adequate modelling of intonation (including such features as pitch-range and pitch-movement) and of relevant features such as loudness and length.

Furthermore, the autosegmental-metrical theory concerns linguistic description: what intonational patterns can and do occur, and what rules may be formulated to account satisfactorily for their generation; it is not on the whole concerned with the different ways in which, once generated, the patterns can be used. The pitch-patterns are considered to have an effect on the range of meanings, but the ways in which meaning is affected is not a primary concern. There is however some indication that the attention of generative intonation is turning to the 'employment' of certain contours. The view that speaker beliefs determine the choice of intonation form can be seen in the account given in Pierrehumbert and Hirschberg (1990) of the meaning of intonation contours. Variation in intonational meaning is related to variation in choice of pitch accent, phrase accent and boundary tone; within this framework, it is thought, contours are chosen by speakers to convey relationships between utterances as they occur in sequence (relationships among current, prior and subsequent utterances), and to convey relationships between the propositional content of utterances and speaker and hearer's mutual beliefs. A subsequent study (Hirschberg and Ward, 1995), looks at a potential conflict of function, i.e. whether the 'high-rise question contour in English' is to be interpreted with respect to a subsequent phrase or rather to speaker or hearer's private beliefs. It is however doubtful, in my view, as to whether the autosegmental-metrical theory in its current form can be used for the analysis of the output of speakers with aphasia, given that their utterances often do not conform to the phonological conventions proposed in that model. To a lesser extent this difficulty has arisen in the attempt to apply the models of what Ladd refers to as the 'British school', and the systems in question have been duly modified.

The domain of prosody for this study has therefore been sought in (mainly British) literature that considers the whole area of prosody and intonation, relating prosodic function specifically to prosodic forms and taking into account the paralinguistic, as well as the linguistic, boundaries of prosody.

1.4.2 Linguistic, paralinguistic and extra-linguistic features

For Laver (1994) 'linguistic' denotes all that is coded by grammatical and phonological means, (elsewhere referred to as 'propositional'communication), 'paralinguistic' denotes affective, attitudinal, emotional and turn-taking features, while 'extralinguistic' is the residue of speech systems after the above aspects have been accounted for, e.g. clues to the speaker's identity as contained within personal voice-quality. For Ladd (1997), "paralinguistic messages deal primarily with basic aspects of interpersonal interaction - such as aggression, appeasement.... - and with the speaker's current emotional state - such as fear, surprise....They are non-propositional" (p.33) For Crystal (1969), however, the distinction between 'linguistic' and 'paralinguistic' is described as respectively 'grammatical' and 'semantic', and paralinguistic features are considered as vocal effects which are primarily the result of physiological mechanisms as well as the vocal cords. Examples are laughing, crying and whispering, which may accompany speech or be separate events and have some degree of pitch, loudness and duration but they are phonetically less discrete, they allow more idiosyncratic variation than prosodic features, and they are phonetically discontinuous in connected speech, whereas exponents of pitch, loudness and duration are always present. Cruttenden (1986) proposes a classification that is formal rather than functional: he distinguishes between prosodic, paralinguistic and extralinguistic systems, including in 'prosodic' systems the features of accent, intonation, loudness, tempo, rhythmicality and voice-quality, while he considers as 'paralinguistic' those features that interrupt phonation, such as pauses; and, as 'extralinguistic', features which are beyond a person's control, being characteristic of either the speaker's physiology or native language. In this study, the forms of prosody will be treated as phonetic entities, using terms as set out below, and, in the functions of prosody, the term 'linguistic' will be used to denote aspects of prosodic communication that cover propositional and grammatical meaning; while 'affective' will denote all that is 'semantic', (in Crystal's sense) or relates to the emotional or attitudinal ('paralinguistic' to both Ladd and Laver).

1.4.3 Descriptions of prosody

Few authors treat the subject of British English prosody as a whole. There is a fair amount of agreement on the main prosodic categories between three authors (Crystal, 1969 Cruttenden,1986 and Couper-Kuhlen, 1986) who do, but there is uncertainty about whether "fringe areas" such as vocal quality and paralinguistics should be treated as part of the domain of prosody. While all three give far greater attention to the role of pitch (in intonation) than to any of the other prosodic features, Crystal (1969) gives most attention to the matter of characterising systems which take account of loudness and length as well as pitch, and greater consideration is therefore given here to his characterisation of prosody than to the others.

Cruttenden (1986) considers prosody as comprising pitch, loudness and length, the perceptual correlates of the acoustic features of fundamental frequency, intensity and duration, but is primarily concerned with the interplay of pitch features in utterances longer than one word or one syllable, i.e. with intonation. He describes the forms of intonation in terms of *intonation-groups*, *pitch-accents* and *nuclear tones*, relating these terms to the way they have been used in generative theories of intonation (e.g. Pierrehumbert 1980). "Stress" is a term that can cause confusion (see Crystal 1969:113-120 for a comprehensive discussion), perhaps as a result of form-function conflation (see 1.7): for Cruttenden (1986) it denotes "prominence" however achieved, i.e. by any combination of pitch, length, and loudness, and concerns the characterisation of the rhythm of speech and of English speech-rhythm, and of citation-forms of word-stress; whereas he uses "accent", to denote prominence where pitch is involved. (cf Liberman and Prince (1977).

Couper-Kuhlen (1986), following Crystal (1969), defines prosody as subsuming 'at least' the auditory aspects of speech: loudness, duration, pitch and pause, with loudness as a component of "stress", duration as a component of "rhythm" and "tempo", and pitch as a component of "intonation". Individual voice qualities and temporary vocal modifications are classed as non-linguistic or paralinguistic. She distinguishes between stress as part of lexical specification and therefore not prosodic in that it does not have "an essentially variable relationship to the words selected" (Crystal 1969:99); and stress on a word as a rhythmic beat or taking pitch modulation in the context of an utterance, in which case it is treated as "accent" and deemed prosodic. Within prosody she notes a rhythm system, based on accentual and/or temporal features. She considers intonation to be nonlexical manifestations of melody in speech, as opposed to a broader view covering "not only pitch but also stress and pause phenomena on a suprasegmental level", or the narrower view taken by Bolinger (1958) of reserving the term intonation for gradient contrasts due to pitch, e.g. steep vs gradual pitch movement, type of melodic approach to the accented syllable and relative height of pitch peaks. Pitch movement, described here as 'tones' and 'tunes', is included in the consideration of speech melody.

Laver (1994) classifies the whole area of phonetics and states that "there are four perceptual domains available to the human auditory system...quality, duration, pitch and loudness" of which the last three are the concern of prosody, or, in Laver's terms, form the province of "temporal, prosodic and metrical analysis", although segmental duration and inherent pitch fall into the domain of segmental phonetics. Within prosody he subdivides temporal organisation into continuity (which includes consideration of pause in speech) and rate: prosodic organisation into pitch and loudness, including pitch-pattern and melody; and metrical organisation into stress, syllable weight and prominence, including consideration of rhythm and utterance-marginal lengthening. He includes consideration of 'multisegmental' settings and applications of setting-analysis under the headings of articulatory co-ordination and phonetic settings.

1.4.4 Prosodic systems

Crystal (1969) distinguishes between relatively consciously initiated use of vocal effects with a conventional, non-random relation to context, and physiologically or biologically determined behaviour which is not under the speaker's control. Considering the components of the communication situation, he identifies a personal physical setting which includes personal voice-quality as biologically determined, a set of vocal/auditory systems (segmental and verbal subsystems, vocalisations, and prosodic and paralinguistic subsystems) having a non-random relation to context, and non-vocal systems (visual, tactile, olfactory and gustatory), of which kinesics or visual systems would appear to be relevant to communication. His categories of prosodic features are defined in a more discrete way than Cruttenden's or Couper-Kuhlen's, and this discrete grouping has formed the basis for the devising of a set of prosodic elements for the test as described in chapter 3. They will be considered under their separate headings, along with some consideration of Crystal's reasons for excluding certain areas which could have formed part of the domain of prosody, and the contributions of other authors with regard to the specification of phonetic features that might have prosodic function. First, however, some of the rationale behind Crystal's prosodic categories is given. The relevance of this will be seen in 2.2 in theoretical reasons for deciding on what elements to test.

Crystal sets out a number of criteria for prosodic systems which are relevant to the present study. He hypothesises that: "there is a degree of systemic relation existing between most aspects of the non-segmental side of phonation quite comparable to....intonation, but that this systemicness is not of the same degree throughout"(p.129). He sets up a range of categories of phonological contrast, each of which can be referred to either in their phonetic or their phonological sense. He gives the following rationale for deciding on the status of a phonetic feature: "If a given phonetic feature's status is uncertain, a decision as to whether it should be included as a functioning part of a prosodic system or not can be reached by asking whether this feature's use can distinguish two otherwise identical utterances, so that linguistically untrained native speakers would consistently maintain the two utterances as being in some sense 'different' in meaning." (p.19). This criterion has formed the main basis for deciding on the inclusion or otherwise of prosodic features in the assessment procedure, see 2.3.1.

Crystal groups prosodic features into systems "on the basis of shared dominant phonetic parameters, each system covering a particular kind of variability that can be discussed independently of variations taking place elsewhere" (p.140); he continues: "there are of course tendencies for features to co-occur" but "one is not forced to select another feature simultaneously from another system." His systems comprise: tone, pitch-range, tempo, loudness, rhythmicality and pause. Tension of articulation is one group of features which he describes as partly prosodic and partly paralinguistic. He postulates that "the terms distinguished within each of these systems are all linguistic contrasts of some degree or other and that no further contrasts exist in English" (p.141).

1.4.4.1 Voice quality and articulatory settings

The considerable body of literature on voice quality and voice disorders will not be reviewed here. The term voice quality has been taken, following Crystal, to denote "the permanent 'background' speaking characteristic of the voice against which conventional linguistic patterns are identified" (p.104). Crystal notes that personal voice quality is normally completely uncontrolled and "we learn to discount a speaker's voice-quality as contributing nothing to the meaning of language as soon as we have recognised it for what it is" (p.100). This is not necessarily true of other languages (e.g. Hindi (Ladefoged 1982) and Chinese (Rose 1989 1990)), but it applies to the variety of English we are considering here, In general, voice quality is less central to expression than some other aspects of prosody, in that it is possible to speak without varying vocal quality. Those aspects of voice quality (such as breathiness) which are amenable to manipulation for effect are termed articulatory settings following Laver (1980). For consideration of articulatory settings as part of the assessment procedure, see 2.2.2. The term 'timbre', which has been used in the literature to suggest the linguistic use of vocal quality and in particular vowel quality, is not used here.

1.4.4.2 Pitch and pitch-range

Although it is well-established that segments have intrinsic pitch-characteristics (Lehiste and Peterson, 1961; Lehiste, 1970; Ohala, 1978), these can be regarded as microprosodic perturbations of the trend-line (moving average frequency) of pitch (Laver 1994), which is generally agreed to be the prime concern of prosody.

There have been continuing attempts to establish fixed scales for prosodic pitch-values in English: Cruttenden (1986) points out that American writers have preferred a 'levels' analysis, from four (Pike, 1946, Trager and Smith, 1951) to two (Pierrehumbert, 1980) where British writers (O'Connor and Arnold, 1973, Halliday, 1967, Crystal, 1969) have preferred a 'contour' analysis', in which the relative pitch-height of syllables contributes to the contour or melody, and the overall pitch-height (or level) of the contour is considered to be part of a different system, which may be broadly characterised as pitch-range.

Laver (1994) characterises pitch-range as being of four types: organic (determined by layngeal anatomy or physiology), paralinguistic (affective), linguistic (the range characteristic of certain languages) and 'pitch-span', which he describes as "the local range within which a speaker organises relative values of pitch for prosodic purposes" (p.458). In this study the concern is with the paralinguistic use of pitch-range.

Crystal considers pitch-range, in the sense of distance between two given pitch levels, as central to linguistics and frequently demonstrated as "a regular and most important means of emotional expression." (p.111); and that what is important for the linguist is the *relative* aspect of the pitch change within the range, the degree of pitch-movement and pitch-jumps, in relation to other significant points in a contour.

The term 'pitch-range' is used in this study to indicate not only the deviation in pitch-range from the "normal" (personal) level of "onset" (starting-pitch) across an entire (polysyllabic) utterance (the phenomenon also described in Crystal's taxonomy as 'width') but also the degree of pitch change on one syllable (as in 'angle of slope', Hargrove and McGarr, 1994).

1.4.4.3 Tone and glide

The term "tone" is used here to mean kinesis of pitch: an episode of pitch-movement. It is thus not used to denote systems of lexical or grammatical distinctions as in tone languages, nor is it used in the same way as in the autosegmental-metrical theory, where its phonetic status is unclear.

Crystal (1969) allows that the notion of kinesis of pitch is to some extent a functional abstraction, in that it is exemplified by both pitch-movement (when the syllable on which it occurs contains a relatively long vowel or vowel-like sound), and by pitch-jump to a different level on the following syllable (when the syllable contains a short vowel). It is suggested here that such a fusion of two phonetically different phenomena, and the creation thereby of a phonological entity, can give rise to the form-function confusion which occurs in the description of prosody, as described in 1.7.

One property ascribed to the phonological entity of 'tone' is nuclearity. This concept is fundamental to several authors in the field, such as Halliday (1970), Crystal (1969), O'Connor and Arnold (1973). (These authors are sometimes referred to as the 'nuclear tone school'.) The nuclearity of a tone is determined by a number of different factors, of which linguistic centrality (communicative function) is one and the presence of pitch-movement (phonetic form) another, together with (optional) features such as added loudness, marked pitch-height and lengthening.

The concept of the nuclear tone makes possible two paradoxical-sounding entities: the 'level' tone, where there is linguistic importance but no pitch-movement, and 'non-nuclear' tones, where there is pitch-movement on syllables other than the linguistically central one within the tone-unit. The functional importance of varieties of pitch-movement will be described further in 1.6.2.

Authors such as Brown,Currie and Kenworthy (1980) in a study of Edinburgh intonation have found the phonetic reality of nuclearity elusive. Autosegmental-metrical theory (Pierrehumbert 1980) deals in pitch accents, phrase accents and boundary tones, but does not subscribe to the concept of nuclearity, or to the idea of pitch-movement as an indicator of prominence. For the functional importance of the concept of nuclearity, see 1.5.2.

The notion of 'tone' is thus problematic. In this study, pitch-movement will be denoted, mainly for typographical economy, by the term "glide": not to be confused with the glides (e.g. diphthongs) of segmental phonetics. Glides can differ in direction of pitch-movement, and these will be described in the terminology used by the nuclear tone school and others, i.e. fall (where pitch-height diminishes over a syllable), rise (pitch-height increasing over a syllable), fall-rise (where it first diminishes and then increases over a syllable), and rise-fall (where pitch increases and then diminishes). The term 'tone' will (when it occurs) be used in the sense of 'nuclear tone'; it will not be used to mean lexical tone.

1.4.4.4 Tempo and Rhythm

The acoustic duration of a sound in prosody is the perceived length of syllables, or syllable-quantity. Length here is distinct from segmental considerations of length, whereby some vowels are deemed inherently longer than others. The importance of prosodic length is twofold. One aspect is overall tempo (rate or speed of utterance), where the absolute length of individual syllables is important: if several adjacent syllables are all shorter than usual for a speaker, that section of the utterance will be judged fast. The second aspect is differential, where syllables are lengthened or shortened relative to each other. The differential lengthening of syllables contributes to prominence, and prominence in turn is important both in rhythmicality (which depends on the impression of rhythmically-occurring peaks of prominence) and in the system of accentuation, whereby one syllable in an utterance is deemed to be more prominent than the rest (see 1.4.4.7).

The 'normal rhythm of English speech' has been the subject of much discussion, particularly with reference to its perceived 'isochrony': the presence of stresses in it at more or less regular intervals of time. Acoustic measurement of such intervals, timed by voice-onsets in syllables, seemed to suggest that isochrony was an illusion, but the discovery of perceptual centres of syllables or "P-centres" (Morton, Marcus and Frankish, 1976) as a better starting-point for measuring interstress intervals revived the idea that isochrony may yet be an acoustic reality, with functional implications for speech (1.6.6), although the influence of factors such as tempo, unstressed syllables and the role of linguistic boundaries in the auditory perception of temporal regularity are as yet unquantified. In this connection, English is described as a 'stress-timed' language, as opposed to other languages (such as French) which are 'syllable-timed' (Pike, 1946). The importance of this consideration in a clinical assessment procedure is that for English speech to sound normal it must have a degree of rhythm (to be described here as 'speech-rhythm', implying stress-timing or isochrony), which is to be distinguished from rhythmicality, which, according to Crystal, "accounts for those linguistic contrasts attributable to our perception of regularly occurring peaks of prominence in utterance, with the normal rhythm of speech taken as the baseline from which departures may be made: one perceives a more marked degree of rhythmicality than usual." (1969:161). Rhythmicality is thus clearly dependent on timing (i.e. the duration of syllables), but often accompanied by increased loudness and pitch-differences on stressed syllables; the postulation of the "silent foot" (Abercrombie 1964) also shows how pause (1.4.4.6) can be a component of rhythmicality.

1.4.4.5 Loudness

Authors are agreed in describing loudness as the auditory correlate of amplitude, and it is this term rather than 'volume' which is used here. Most phoneticians and linguists are also agreed that it is (with pitch and duration) one of the three main prosodic variables, although it has also been established (Moore 1982) that there is some discrepancy between the perceptual values of loudness and their acoustic correlates, and that the perceived loudness of syllables can depend on their segmental makeup; Goldsmith (1990) formulated a 'sonority hierarchy' of segments.

This can make a difference to the perceived weight of a syllable and consequently for the degree of stress that is attributed to it.

1.4.4.6 Pause

Crystal (1969) points out that pause is in a sense segmental, working in sequence rather than simultaneously with segmental phonology, and Cruttenden (1986), as already mentioned, excludes consideration of pause as prosody on these grounds. Crystal continues, however: "Its unamenability to phonemicisation, (...), along with its entering into the definition of such genuinely prosodic matters as juncture, and its attitudinal and grammatical functional similarity to other prosodic features, are three important considerations weighing in favour of a non-segmental classification of pausal phenomena" (p166). Butterworth (1980) equates "pause" with "delay in speech" and "a period of silence", and cites Goldman-Eisler (1968) as having developed a technique for measuring pauses (discounting those of less than 0.25 seconds as being necessary for purely articulatory considerations); he goes on to say that a criterion of 0.2 seconds (or greater) has now been adopted. The contribution of stop consonants to the notion of pause is considered further in 2.2.8. Garman (1990) includes pauses in consideration of non-fluencies, together with restarts, mid-stream reformulations, pause words and phrases and constructional switches; he examines pause distribution and charts the main within-clause positions where pauses occur; he also notes that "some pauses may actually correspond to no break in the acoustic record, being signalled instead by segment lengthening." (p126). This shows that the term "pause" can be used to designate an interpreted function rather than a phonetic event, and the term "silence" has therefore been preferred to "pause", on the grounds that silence is the phonetic exponent of pauses which is of interest in the present study.

1.4.4.7 Accent and stress

Whether considered as distinct entities or not, these elements of prosody have attracted an enormous amount of scholarship. Crystal (1969) defines his usage of the terms 'stress' and 'accent': 'stress' is "those variations in linguistically contrastive prominence primarily due to loudness" while 'accent' is "variations primarily due to pitch."(p 156), although he points out (pp 113-120) that there is ambiguity in the notion of stress throughout the literature, in that it often involves a matter of pitch-prominence or pitch-movement: means of achieving prominence include variation in the pitch-height of the start of the syllable, variation in the length of the vowel in the syllable, and the overall loudness of the syllable vowel; Fry (1958) established that pitch-height variation is relatively the most important indicator of prominence, with length the next most important. Ladd (1996) discusses the use of the terms in the autosegmental-metrical and in the IPO (Institut voor Perceptie Onderzoek) theories. An important distinction is between the notions of 'word accent' and 'sentence accent' ('stress' can be substituted for 'accent' in referring to either of these concepts). Phonetically, these refer to the relative prominence of accents in (respectively) words and sentences, and the fact that one accent is more prominent than others. The notion of 'accent' thus becomes phonological, or syntagmatically determined. Since word accent is largely determined by the lexical and syntactic factors of utterances, this study has concentrated more on the inferential resources of variation in sentence accent; in this sphere, 'accent' is (arguably) used more frequently than 'stress', and is the term adopted here. It should be noted that apart from pitch-height, length and loudness, the phonetic composition of sentence accent includes glide (pitch-movement).

1.5 Prosodic functions in general

1.5.1 The one-to-one hypothesis

The function of these aspects of prosody has been the subject of much discussion, centred largely on whether or not there is one-to-one correspondence between prosodic forms and the meanings they can convey. Couper-Kuhlen (1986) suggests that a strong version of such a hypothesis would claim "that a given intonational marking always occurs when a particular illocution is present and never occurs with any other illocution"(p.164), or (in the weak version) "that a given intonational marking is possible when a particular illocution is present, no matter whether it occurs elsewhere or not"(p.164). She cites the proposal by Liberman and Sag (1974) that a particular contour can be identified as a 'contradiction contour', and studies by Cutler (1977), Glenn (1977), Gibbon, (1976), Schegloff (1984), and Brown Currie and Kenworthy 1980). It can be seen that the one-to-one hypothesis is disputed, but other studies suggest that it is not the case that there is no correspondence between prosodic form and communicative function, merely that one to one correspondence is too simple to express the relationship between forms of prosody and meanings conveyed.

Weber (1993) points out that there are multiple factors relevant to the interpretation of an utterance and that the interaction of three factors - morphosyntactic form, intonation and sequential position is the problematic issue for linguists who wish to specify the relationship between form and function. Brown, Currie and Kenworthy (1980), while rejecting the one-to-one hypothesis, recognise that prosodic cues, such as pitch-patterns, can function in five different phonological systems simultaneously: an affective or attitudinal system, an interactional system, an illocutionary system, a focus system, and a system for indicating syntactic delimitation. Within these systems other prosodic (as opposed to pitch) factors would be operating with the pitch-pattern to convey the message, or to fulfil the language function. Furthermore, non-prosodic factors such as segmental, semantic, syntactic and pragmatic factors would be in operation as well. Similarly, Johns-Lewis (1986) notes that "the perception of 'the intonation system' is undoubtedly affected by phonetic and linguistic phenomena that fall outside the domain of 'rises and falls in pitch'; that if one considers the relative height and movement of pitch peak, one finds that it is relevant for several aspects of discourse, e.g. sentence and turn initiality, as well as for prominence within the sentence." Another example of such a "multi-functional cue" is length: segmental lengthening, along with pause and creak, is associated with the perception of information-boundaries, and length also plays a part in prominence.

This suggests that whereas long and complex prosodic structures do not equate well with the meanings conveyed by utterances, it may be worth investigating the function of small elements of prosody. Accordingly, the functions that each of the aspects of prosody so far distinguished can perform are reviewed, according not only to Crystal but also others who have written on individual prosodic parameters but not necessarily on prosody as a whole.

Crystal (1969) established a matrix of prosodic systems and investigated further their co-occurrence with grammatical structures and semantic systems (as opposed to their scope for conveying different meaning). This approach is appropriate for speakers to whom all forms of prosody are available, but the present study is oriented to the aphasic speaker who may not have all the prosodic forms available, and is thus more concerned with the functions that may be conveyed with a limited range of forms.

Experimental work identifying acoustic cues to communicative functions belongs largely to the decades of the sixties and seventies. The approach then was to select a function and identify its acoustic cues, whereas for this study the concern is to identify the several prosodic forms and to relate them to communicative functions in which prosodic features have an acknowledged and important role. At the same time, other language systems (including visual systems: non-verbal ones of gaze and facial expression, such as those described in Beattie (1980) which also play a role in the functions are noted.

1.5.2 Delimitation

Delimitation of spoken information is established as a function of intonation: the auditory 'chunking' of speech into information units has been proposed by most writers on intonation. Differing nomenclature has been used: Halliday (1967) divided speech into tone groups; Pierrehumbert (1980)describes utterances as ending in 'boundary tones'; Crystal (1969) used the term 'tone units'. A succinct definition of tone units is given in Quirk, Greenbaum, Leech and Svartvik (1985:1598): "Spoken English...is marked off into brief stretches, usually corresponding to units of information. These stretches we shall refer to as tone units. Tone units consist of a sequence of stressed and unstressed syllables, in a broadly rhythmic alternation, and with each unit containing at least one syllable marked for pitch prominence. The peak of greatest prominence is called the nucleus of the tone unit." Semantically, these units can be grouped together as topics, as in discourse analysis (Brazil, Coulthard and Johns, 1980). More recently, delimitation has been applied to conversational turns in conversation analysis, and prosodic features have been shown to have a role there (Local, 1992). Delimitation is also achieved by grammatical structures denoting clause and phrase delimitation.

1.5.3 Focus

It has been further shown by Halliday (1967) that points of information within tone-groups can be 'highlighted' (or 'emphasised') by prosody, especially when they constitute information that is 'new' (has not been mentioned before), and equally 'backgrounded' by prosody (Ladd 1980) when they are 'given' (have been mentioned before). For Halliday, Crystal and the 'nuclear tone school', the item on which the nuclear tone is placed constitutes the focus of the utterance, and this aspect of intonation is known as "tonicity". As with nuclear tones, tonicity is a notion combining the phonetic with the phonological; we identify the tonic by a combination of phonetic prominence and our knowledge of which word is or should be the object of focus. Systems which also operate in this function are lexicosyntactic, involving word-order (including devices such as fronting, clefting, extraposition, left- and right-dislocation (Quirk, Greenbaum, Leech and Svartvik, 1985) and choice of synonyms, and nonverbal actions such as head-nodding.

1.5.4 Illocution

Links between intonation and illocution (the categorising of utterances as sentence-types, traditionally declaratives, questions, exclamatives and directives) have long been posited. Again, grammatical devices (such as question-words and inversion) constitute the main other language system in operation here. It has been mostly in connection with illocution that the disputes mentioned in the opening paragraph of this section (1.5.1) about the role of prosody in conveying meaning have occurred. It is notable however that many of the utterances in the studies cited there which dispute the role of prosody may be described as being marked in some way, either morphosyntactically or pragmatically: they may be utterances with the syntactic form of questions which are functioning as requests. e.g. "Will you come here?" or utterances that include phrases such as "I don't know if..." which, while not syntactically questions, nevertheless invite answers and as such can be considered as performing a questioning function. It thus still seems possible that utterances such as "She's not in today", which can be genuinely ambiguous as to whether they are questioning or stating, can have their illocutionary force determined by the prosody uttered with them.

The functions of delimitation, focus and illocution as effected through prosody have been grouped together as the 'linguistic', 'grammatical' or 'propositional' functions of prosody by authors such as Crystal (1969), Laver (1994) and Ladd (1996), and as such are distinguished from the 'paralinguistic' (Laver, 1994 and Ladd, 1996) or 'semantic' and 'attitudinal' (Crystal, 1969) functions. It is notable, however, that whereas the functions 'delimitation' and 'focus' are relatively well-defined, 'illocution' is less so; for instance, various authors (Weber, 1993, Couper-Kuhlen 1986, Schegloff, 1978) find the category "question" dubious and elusive.

1.5.5 Attitude

The role of prosody in conveying the attitude of speakers, their emotions and affective states, has received much attention (O'Connor and Arnold,1973, Crystal,1969, Couper-Kuhlen, 1986) and there is no doubt that prosody does convey affect, but an established system of how this is achieved has not yet been devised. Crystal devotes a chapter to the "semantics of intonation" and points out that "the non-linguistic situation regularly provides information without reference to which intonation patterns are highly ambiguous" (1969:285). He also describes the difficulty of labelling attitudes: not only are the labels imprecise and not objective but "vary from person to person, and even within one person from time to time." (p.295). He describes an experiment in which the first step was to establish a measure of agreement on 20 labels used, where it emerged that "substantial disagreement over all but a few labels emerged from a relatively small number of informants, which suggests the existence of deep divisions of usage in these respects" (p.307). Furthermore, when asked to match the utterances with the labels, no participant obtained better than 60% correct identification, and when not provided with labels, correct identification dropped to 20% and nearly 100 new labels were introduced. He considers tone, i.e. glide-direction, and pitch-range to be the major indicators of attitude, together with virtually all other language systems: other prosodic systems, paralinguistic systems, grammar and lexis, voice qualities, kinesics (non-verbal systems), style of utterance and situational features.

1.5.6 Index

Prosody has some role in indexical functions such as sex-identification (McConnell-Ginet. 1980) and age-identification (Local. 1982: Baken. 1987) and more of a role in socio-regional identification, since different regional varieties having strikingly different prosodic characteristics; see Cruttenden (1986) for review and the following studies for specific documentation: Knowles, 1974: Jarman and Cruttenden 1976: McClure. 1980; Local. Kelly and Wells. 1986: Wells and Peppé, 1996 and Cruttenden, 1995. Other language indicators of socio-regional variation are segmental characteristics (Wells, 1982) and lexical and syntactic factors (Trudgill, 1994; Quirk, 1995). Abberton and Fourcin (1978) demonstrate that voice-pitch (mean fundamental frequency) and intonation-contours provide important speaker-identifying information in the absence of all supraglottal features.

1.6 Communicative functions of phonetic features

It will be seen that the orientation of most authors is to what patterns are commonly used with which grammatical function or sentence-type, rather than to the identification of what functions are performed by which patterns when utterances are not lexicosyntactically marked for function. These two approaches are sometimes hard to distinguish. Cruttenden (1986), in saying (p.59) "there is no such thing as question intonation" sounds as though he is concerned with the intonational exponents that can make utterances function as questions, but he goes on: "although some tones may be more common on questions than others", showing that his preoccupation is with the intonational form of utterances which are otherwise (morphosyntactically, pragmatically, or conversationally) determined as questions. Brown Currie and Kenworthy (1980) and Johns-Lewis (1986), on the other hand, demonstrate the other concern in considering the many systems that prosodic features can operate in, as pointed out in 1.5.1

1.6.1 Tone (presence/absence of pitch-movement)

For the 'nuclear tone school', one primary function of pitch-movement (tone) is as a distinguishing feature of tone-units (see 1.5.2). Wells (1986) shows kinetic tone to be an active cue in marking intonational prominence in English, operating in parallel with tempo and loudness phenomena.. The 'tone-unit' is, according to Crystal, "the most readily perceivable, recurrent, maximal functional unit to which linguistic meanings can be attached" (1969:12); the function of the tone-unit is therefore to divide speech into 'chunks', with each unit having one peak of prominence in the form of a nuclear pitch-movement. It is possible however that non-nuclear on-syllable pitch-movement is more frequent as an unmarked form in regional varieties, and that this is one reason why Brown, Currie and Kenworthy (1980) found it difficult to identify nuclear tones in Edinburgh speech. There is, however, the question of the status and function of non-nuclear pitch-movement in utterances in the standard variety. Crystal found non-nuclear pitch-movement in certain intonation contours, such as pretonic 'glissando' (1969:221), functioning to signal particular emphasis, and in subordinate tone-units (1969:245), signalling alternative focus. Unless such a function is inferable from the context, however, the presence of multiple pitch-movements in an utterance tends to be heard as odd or inappropriate (Crystal 1982, Vance 1994).

1.6.2 Tonal contrasts (glide-direction)

Crystal considers several meaning contrasts effected by tone types. He notes that choice of tone types is sometimes dictated by the grammatical structure in which they occur, i.e. tone and grammatical structure are not independently variable; and that where different tone-types are viable with the same grammatical structure they often indicate variation in attitude (1969:284-5). Where the grammatical structure allows a range of tone-types, he finds a fairly frequent occurrence of clear-cut pairs of tonal contrasts, e.g:

continuative (rising) and final (falling), as in:

would you like g/in or wh/isky or t/ea
(implying: there are other options)
would you like g/in or wh/isky or t\ea
(implying: there are no other options)

questions requiring an answer (rising) and not (falling):

isn't it m/arvellous
(requires an answer)
isn't it m\arvellous
(does not require an answer)

[Transcription of intonation is based on Crystal and Quirk, 1964; Jefferson, 1984; and Ball, Code, Rahilly and Hazlett, 1994. For a complete list of conventions, see Appendix 19]

Quirk, Greenbaum, Leech and Svartvik (1985) concur with this, concluding that a rise is used to indicate that an utterance is non-final, or left "open and inconclusive…maybe because we are counting or listing and have not come to the last item; or because another clause is going to follow" (p.1599); furthermore, that rising tones are used to seek a response (but not by means of a *wh*-question), whereas falls mark utterance-completeness or finality, and that "it might be said that…a tone unit has a falling nuclear tone unless there is a specific reason why it should not."(p.1599): this applies to the southern British variety. They also suggest that falls are commonest on full sentences, on questions beginning with a *wh*-word, on one-word answers to questions and on words uttered in isolation.

Cruttenden (1995) says that syntactically there is a universal tendency for declaratives to have falls and polar interrogatives to have rises, and that attitudinally there is a universal tendency for certainty to be shown by falls and doubt by rises.

O'Connor and Arnold (1973), are concerned with the specification of tone-type for grammatical structures, i.e. which tunes are found with which structures (considered in terms of four sentence-types) and what attitudes they convey. This again will be useful when considering disorders of prosody, although as noted by various researchers (cited in 1.5.6) the unmarked form of tunes for sentence-type varies from region to region.

From a wide inventory of attitudes conveyed by tunes, O'Connor and Arnold (1973) concur with the general notion that rising tones imply continuation and falling tones finality, although they do not specifically consider how far a change of glide-direction would change the implication of an utterance not grammatically marked for sentence-type (e.g. one where inversion or a *wh*-word would mark it grammatically as a question). It appears, however, from their examples, that different glide-direction (as well as pre-nuclear pitch-pattern) has extreme effects on the attitudes conveyed by utterances: a *wh*-question-word uttered with a high fall is lively and interested (to take two of the six labels applied to it); when it is uttered with a low fall it is detached, flat, even hostile; with a low rise it is mildly puzzled or wondering; with a fall-rise it is interested and concerned as well as surprised; with a high rise it is calling for repetition or casual; with a rise-fall it is challenging or antagonistic. This suggests that glide-direction is very important.

Crystal (1969) O'Connor & Arnold (1973) and Halliday (1967) all distinguished a "level" tone among the types of glide called 'tones'. It was distinguished from the other tones by lacking pitch-movement, but qualified as a tone by being prolonged and occurring in tonic situations; its status was therefore that of nuclearity without pitch-movement. It was found to occur mainly in specialised use such as chanted speech. Quirk, Greenbaum, Leech and Svartvik

(1985) note that it is "used to suggest (often somewhat pompously) the exact predictability of what is to follow"(p.1600), and that since they occur in places where a rise might be expected, they should perhaps be regarded as variants of the rise

1.6.3 Pitch-range

As indicated in the previous section, Crystal's notion of pitch-range can be thought of as comprising more than one set of phonetic contrasts, and, as will be seen in the following chapter, it is subdivided in this study into separate element: range to denote width and pitch-height to denote different heights of onset. Although Crystal comes to no clear conclusion about functions specifically related to width, it can be seen from his examination of the semantics of intonation that wide pitch-range tends to correlate with utterances that were labelled "excited", "puzzled", "pleased", and "questioning". Narrow utterances tended to be assigned the labels "bored" and "grim". Although they consider pitch-range as a factor strictly speaking outside the intonation system, Graddol (1986) and Johns-Lewis (1986) established that conversation is characterised by a narrower fundamental frequency range than reading aloud, and that acting produces wider fundamental frequency range than reading aloud.

1.6.4 Pitch-height

Pitch-height has been established as a marker of utterance initiality after the work of Gårding (1983), Ladd (1983) Pierrehumbert (1980) and Lehiste (1975) and (1979). Crystal, when talking about the characteristic pitch-height of a speaker's 'onset' (the first prominent syllable of a tone-unit) states that occasionally a speaker begins a tone-unit at a distinctively higher or lower level than normal, for a particular contrastive effect. For example, the beginnings of paragraphs of news bulletins begin with a stepped-up onset, and a parenthesis in speech will tend to start with low onset (Local, 1992). High (usually rising) pitch has been sometimes, but not systematically, associated with questions (Crystal, 1982, Bolinger, 1989, Ladd, 1996). More recently, attention has been focused on the high rising tone (HRT); two such studies are Ward and Hirschberg (1995, cited in 1.4.1), and Cruttenden (1995). The latter study identifies a number of uses of the HRT, and notes that in the standard southern British variety (as well as in Pacific Rim countries) it is used primarily as a 'check', i.e. seeking validation of the speaker's comprehension.

1.6.5 Tempo

Crystal (1969) noted that tempo probably has the most highly discrete grammatical function of all prosodic parameters other than pitch, and mentions variations in length in connection with junctural or delimitative function. The finding that segments are typically lengthened in terminal position has been borne out by many studies, e.g. Klatt (1975) and Crystal and House (1982). Segmental lengthening has been found to be a feature of termination (Lehiste, 1975) and of pitch prominence (Fry, 1958).

1.6.6 Rhythm and rhythmicality

Much research has been done in the field of metrical phonology, concerned with the theoretical modelling of stress assignment to lexical items and the relative prominence of syllables within the phrase or sentence (Liberman and Prince, 1977, Selkirk, 1984) rather than with the role of rhythm to convey meaning. Crystal (1969) sees rhythmicality as corresponding to a relatively clear range of attitudinal patterns; in particular he cites rhythmic utterance as being used "to reiterate a point that is felt to be particularly important" (p.163). Couper-Kuhlen (1993) makes a case that cohesion of speech-rhythm in conversational exchanges exists and is used in the management of turn transitions, such that smooth rhythm across turnchange suggests affiliation between interlocutors and disrupted rhythm indicates a lack of sympathy. Since speech-rhythm is frequently disrupted in speakers with aphasia, this could have implications for their conversational turn-management.

1.6.7 Loudness

Laver (1994) notes that loudness "seems to be exploited by linguistic communication to a much smaller degree than pitch" (p.505). It has a role, but not as the sole feature, in pitch prominence and in rhythm, where it is apparent mostly at single syllable level. Resetting the loudness level can (with pitch) signal the start of a new topic within an utterance, and it can play a part in turnchange in conversation, being used at the start of a turn to claim the floor (French and Local, 1986). Loudness variation over several syllables of an utterance, whereby speakers switch to a louder or softer level of utterance, is usually found in response to situations where ambient noise levels require it, or to express certain emotions.

1.6.8 Silence

Garman (1990) following Goldman-Eisler (1972) recognises three functions: physiological (allowing the speaker to inhale), cognitive (allowing planning) and communicative (allowing the signalling of demarcations). Cooper and Paccia-Cooper (1980) have shown that duration of pauses correlates well with the strength of boundaries, while Jefferson (1989) notes that pauses of more than one second are infrequent in conversation and tend to signal interactional problems. Butterworth (1980), having found that silence tended to occur towards the beginnings of clauses, postulated a clause-planning and semantic planning function in hesitant speech, and suggested that in non-hesitant speech it may allow time for decoding by the listener. Of the eleven recognised positions for silence to occur within clauses (Garman, 1990), all can be accounted for as having a function which can be included in these categories. On the other hand, silences that occur outside these locations appear to lack communicative function, in that they are not susceptible to interpretation. They thus indicate that the utterance is not well-formed, and are frequently cited as a feature of dysprosody (e.g. Vance, 1994).

1.6.9 Complexity of prosodic form

It was determined above (1.5.1) that the forms of prosody could play a part in a variety of communicative functions, sometimes simultaneously, and were therefore "multi-functional". It was also suggested (1.5.4) that the relationship would be easier to define if the utterances they accompany were not lexicosyntactically and sequentially marked. Such utterances (e.g. remarks consisting of one lexical item only) may or may not be untypical of normal conversation, but occur frequently in clinical conditions.

Another problem with defining the relationship is the complexity of prosodic form. As was seen, in 1.4.4.3, if two forms (such as falling glide and lengthening) co-occur very frequently for a function (finality), the function becomes identified with the forms and one-to-one relationships are assumed, e.g. that a falling glide always signals finality and finality is always conveyed by a falling glide. The consequence of this is that when a function is achieved (i.e. a message or meaning is conveyed), those forms normally associated with that function could be deemed to have been perceived when instrumental analysis can show they were not present. This can lead in turn to a confusion of function with form. The relationship between form and function is important for this study because the assessment and diagnosis of prosodic problems is the basis for rehabilitation, where it must be clear whether functional or formal deficits are involved.

1.7 The form-function distinction in the teaching and transcription of prosody

Problems with form-function confusion were found in the teaching of English intonation, as well as in the prosodic transcription of spoken English. These areas of study were consulted for insights into the normal functioning of prosody and how it is viewed, as a preliminary to devising a prosodic assessment procedure for use with unimpaired speakers. A brief survey of these are included here in order to highlight the insidious nature of the confusion and the problems it can cause, and thus to provide a basis for the decision in this study to keep the distinction as firmly in view as possible.

1.7.1 Intonation in the teaching of English as a Foreign Language

As in many other fields of language activity, prosody or intonation lags behind other aspects (grammar, vocabulary, segmental phonetics) in the teaching of English as a foreign language. In addition, it is seen as 'difficult': "The average teacher is uncomfortable with intonation, treating it as a difficult subject; difficult to isolate, difficult to describe, and difficult to formulate rules for - rules which will allow students to generate appropriate examples for themselves. As such, it tends to receive little explicit focus in the classroom." (Woolard, 1993)

O'Connor and Arnold (1973), following earlier work by Palmer (1922) and Kingdon (1958) described the intonation of English in formal terms as tone-groups: six different glides (tones) that could be preceded by a variety of pitch-patterns. The functions of intonation, not grouped or classified in any way, are described in terms of the attitudinal effects of the various tone-groups when used with different sentence-types. The form or transcription used is interlinear tonetic, and the tone-groups have names (e.g. the 'high dive' and 'low drop') which refers only to the contour: the description was thus phonetic.

Halliday (1970) similarly uses tone-groups, with a tone-numbering system, and a description of the attitudes conveyed by them on different sentence-types. The association of tone-numbers with a variety of specific attitudes and grammatical functions constitutes an interpretation of phonetic form which once again risks confusing form with function.

Bradford (1988), following Brazil (1985) and Brazil, Coulthard and Johns (1980), selects functions such as telling, referring, highlighting, and contrasting, and gives examples of suitable pitch patterns for use with them. Prosodic form and function are not clearly distinguished: along with the functions mentioned above there is "low key function", i.e. a function described in terms of its form: material which in functional terms is information that is "backgrounded" (Ladd, 1980) or parenthetical, and in formal terms is pitched lower than the surrounding material. In all of these there is a tendency to look for "unmarked" intonation for certain kinds of utterances, classified either linguistically (i.e. according to sentence-type) or attitudinally, with a view to teaching the "norm" for standard English.

Cauldwell and Hewings (1996) contend that rules concerning some aspects of intonation as given in language-teaching textbooks "are inadequate as descriptions of what occurs in naturally-occurring speech." One 'intonation-rule' quoted concerns lists: rise for prefinal, fall for final (Bowler and Parminster, 1992). Another concerns the chunking of utterances into clauses: subordinate clauses end with a rise, main clauses with a fall (O'Connor and Fletcher, 1989). As far as questions are concerned, traditionally yes-no questions are deemed to end with a rise, *wh*-questions with a fall. The authors suggest that a discourse approach to intonation (as presented in Brazil 1994), in which intonation-choices are related to the context in which they occur, offers a way of explaining both the occurrence of examples which conform to the text-book rules and variations as found in naturally-occurring speech; in this approach, the formulation of a rule for questions is that falling tones in questions indicate that a speaker is 'finding out', while rising tone indicates that the speaker is 'making sure'; or, put differently, that speakers have the basic choice of saying something as if it is already known to their hearers, in which case they are likely to use a rising tone, or saying something as if it is news to their hearers.

This brief extract of views on the teaching of intonation shows some development from a preference for linking intonational forms with grammatical forms towards a recognition that grammatical (or linguistic) function can determine the choice of intonation. In an article describing investigation of the distribution of fall and rise in yes-no questions (found to be fairly even) Thompson (1995) finds that: increasingly, the focus of research into intonation has shifted away from a grammatical view to one which emphasises the relationship between intonation and the communicative intention of a speaker in a particular situation.

One advantage of such discussions is the change from rigid association of intonational forms with grammatical or propositional meaning and to the recognition that discourse context and the beliefs of conversational participants have a role in determining choice of intonation. They also bring into focus the difficulty of handling priorities of prosodic functions when relating them to the occurrence of prosodic forms, not to mention the difficulty of identifying the functions. While it has not been possible to construct procedures for the assessment of prosody in aphasia from these studies alone, such concerns support a contention that the interpretation of intonation varies according to context. The importance of this for the relation of intonational form to intonational function will be taken up again in chapter 2.

1.7.2 The prosodic transcription of English

As a prerequisite to analysing prosodic systems, it has been necessary to represent prosody in a visual medium. This has been done with transcription systems, condensing prosodic signs into written visual codes. When linguists transcribe prosody, however, there is again a tendency for "-emic/-etic" conflation.

1.7.2.1 Corpora of spoken English: conversational analysis

In Jefferson's transcription system for conversational analysis, pauses are described in tenths of a second, i.e. with a formal or measuremental approach, while glides are indicated by a variety of punctuation-marks such as periods, commas, and question-marks with such glosses as "*stopping* falls", "*continuing* intonation" "rising intonation *weaker* than that indicated by a question-mark" (Atkinson & Heritage, 1984 p.xi, my italics). There is nothing about the form of a glide that is inherently stopping, continuing or weak; this is its function as perceived by the transcriber. Kelly and Local (1989) describe this as "inconsistent and arbitrary", and note that the tendency to conflate form and function in prosody is pervasive and persistent even among those who aim to avoid it, as pointed out with reference to Pike (1946).

1.7.2.2 Corpora of spoken English: the Survey of English Usage

In the Survey of English Usage (part of which is published in Svartvik and Quirk, 1980) the prosodic transcription was based on Crystal and Quirk (1964), and broadly speaking it is partly phonetic and partly phonological. The form of some prosodic elements was transcribed with no gloss as to the functions they were performing: the transcription can thus be called phonetic (this applied, broadly speaking, to such elements as loudness, pitch patterns, range, silence, length, tempi, rhythmicality and voice qualifiers). Some functional aspects of prosody were however indicated in the transcription as if they were phonetically present. For example, information-groupings were identified as tone-units and had boundaries ascribed to them on the basis of their sense; glides (tones) were ascribed to/placed on syllables perceived as "tonic" although the phonetic realisation of the glide often occurred on subsequent syllables (as in the utterance "(than)k you", where the first syllable can be silent but deemed tonic, and the glide is apparent on the second syllable).

1.7.3 The consequence of form-function conflation for aphasia

The problem with such form-function conflation becomes apparent when looking at disordered speech. Speakers with aphasia typically use truncated speech where, for instance, syntactic clues to demarcation of sense-groups may be absent. Prosody would normally provide parallel indications of sense-delimitation, e.g. as suggested, finality may be indicated by a falling tone. It might be therefore be assumed that where there is a falling tone, the speaker with aphasia has finished an utterance. If, however, as frequently happens with such speakers, almost every word is uttered with a falling tone (see D in the case reported in Vance 1994, 2.6.5), the lexical or semantic sense belies the finality implied by the falling tone: there is then a discrepancy between form and function which forces one to ask whether it is merely the form of finality or its function which was at work in those utterances which had been considered complete. The assessment of both the forms and the functions of prosody is therefore important in disordered speech, and furthermore of forms which are as far as possible the simple phonetic correlates of acoustic cues rather than complex phonological combinations of a number of aspects of prosody .

1.8 Approaches to the clinical assessment of prosody

1.8.1 Monrad-Krohn's taxonomy of prosodic problems

Monrad-Krohn (1963) characterised the nature of prosodic disruption thus:

hyperprosody (exaggerated values of phonetic variables);
hypoprosody (reduced value of phonetic variables);
aprosody (the absence of prosodic variation, particularly within pitch contours and accenting);
and **dysprosody** (inappropriate linguistic use of prosodic variables).

1.8.2 Crystal's phonetic and phonological systems

Crystal (1982) gives a table of phonetic attributes and the phonological systems with which they interact, given below, describing problems arising from phonetic attributes as 'dysprosody' and problems with 'phonological systems' as 'prosodic disability':

Phonetic Attributes	Phonological Systems
Pitch	Intonation
Loudness	Stress
Duration	Tempo
Rhythm	Rhythmicality
Silence	Pause

1.8.3 Brewster's approach to prosodic problems

Brewster (1989) notes: "occasional groupings and use of terms that are potentially misleading....doubtful equivalences of variables....suprasegmental tasks admixed with phonological ones" and other procedural anomalies. His version of the taxonomy is as follows. As previously mentioned, he follows Crystal rather than Monrad-Krohn in his use of the following terms:

dysprosody to describe phonetic-prosodic, not linguistic-prosodic, impairment;

prosodic disability to denote functional or phonological impairment which may be caused by neuro-physiological damage or developmental delay *and* may co-occur with phonetic impairment.

Brewster also identifies:

prosodic disturbance: disordered prosody resulting from problems on another linguistic level where patients *are not* in control; and

prosodic deviation (deviance to Crystal): evidence of 'adaptation' behaviour where patients *are* in control.

The italics are Brewster's; however, to describe any speakers, impaired or not, as being 'in control' of their prosody is to imply a knowledge about the workings of prosody on the part of the speakers which is at best semi-conscious and not explicit.

Brewster points out that several phonetic parameters may contribute to one phonological feature, and that the phonetic parameters of all prosodic variables are relative, not absolute. This second point gives rise to his observation that:

> "For example, utterances of patients with Parkinson's disease may involve smaller pitch excursions, less loudness, and more accelerated rates than are appropriate forthe context; patients with dysarthria may evidence slowed rates of utterance distortions.....*but nevertheless maintain essential prosodic contrasts and thus only appear communicatively inadequate* because the signal is weak and disjointed."

(Brewster1989:177, my italics).

To some extent, the appearance of communicative inadequacy is also a problem that needs to be considered, but actual failure to communicate is considered more important (see 2.3.1).

These observations of Brewster's suggest, however, that reduction in one phonetic parameter may not be crucial to related phonological functions, since these may be realised, albeit in reduced form, by other contributing phonetic parameters. This argues for the necessity of assessing the effectiveness of a client's ability to realise phonological functions, since if contrasts are being made, albeit weakly, these need not be a prime target for rehabilitation. At the same time, Brewster asserts that "any assessment must be underpinned by a detailed phonetic record of their performance to establish which variables are controllable." (Grundy, p.177.)

Although Brewster's taxonomy shows awareness of form-function distinctions and their importance, the majority of descriptions of disordered prosody in aphasia do not (see chapter 6 for bibliography of studies consulted).

1.8.4 Criteria for assessments

From this, it was possible to draw up a preliminary range of criteria to be met by a clinically useful prosodic assessment procedure as follows:

- The need for assessing a wide range of prosodic features, recognising that they interact, with the aim of finding out the extent to which they may be unavailable to language-impaired people.

- The relationship between prosodic forms (phonetic equivalents of acoustic parameters) and prosodic functions (linguistic and paralinguistic use of phonetic attributes), particularly as a consideration for targeting rehabilitation.

In addition, although not specifically mentioned by Monrad-Krohn, Crystal and Brewster, scrutiny of the literature had produced the following considerations to be sought in the assessment procedures examined:

- The necessity of establishing 'norms' provided by unimpaired participants on the tasks used to assess impaired participants' performance. This arose because the available literature and studies in the use of prosody did not provide such information being in the main concerned with the co-occurrence of certain forms with specified functions and with well-formedness of prosody more than with the variation in meaning that prosodic forms could produce (see 1.6)

- The need to evaluate prosodic disturbance in terms of communicative effectiveness rather than in terms of prosodic well-formedness. The reasons for including this last criterion are addressed in more detail at 2.3.1.

1.9 Prosody assessment protocols:

The first assessments discussed below are specifically directed at prosody. They are followed by others which form parts of assessments oriented to specific disorders.

1.9.1 Approaches to Specific Prosody Assessments

1.9.1.1 Dysphon

This test (Keller, 1990) is largely concerned with segmental features but also investigates phonation-time (breath support), speech rate and rhythm, and phonetic aspects of pitch and glide. Tasks involve held sounds, repeated nonsense syllables, consonant and vowel differentiation, consonant clusters, rhythm, intonation, simple words, simple phrases and questions. Linguistic function of these parameters is tested in a very limited way, with participants being asked to produce the utterance "Mommy" with "strongly exclamatory" or "strongly interrogatory" intonation. One technique employed here, that of repetition, points up the necessity of testing reception skills, since without a measure of these it is impossible to tell whether failure to repeat is caused by failure to understand or inability to express.

1.9.1.2 The Prosody-Voice Screening Profile

The PVSP (Shriberg, Kwiatkowski and Rasmussen, 1990)assesses "voice" (phonetic or formal attributes) and "prosody" (linguistic or functional use of these parameters)..It uses a "speech sample in which the examiner and the speaker exchange turns in the manner of a spontaneous conversation". There is an elaborate system of exclusion codes to ensure the sampling validity of the PVSP. The procedure constitutes a probably exhaustive and completely systematic way of evaluating prosody on an absolute scale, and would be useful for establishing definitively whether a participant habitually spoke, for example, at a rate faster than normal. It is not possible however to relate dysfunction of any of the prosodic aspects (phrasing, rate and stress) to a specific phonetic deficit (loudness. pitch and timbre). Performance is judged as being appropriate or inappropriate.

1.9.1.3 The Prosody Teaching Model Checklist

Attempts to treat prosodic disorder have attracted the following comment from Hargrove and McGarr (1994): "the lack of empirical support for prosody treatment approaches cannot be overstated", but they provide a comprehensive list of possible procedures for intervention. The Checklist (Hargrove &McGarr, 1994) is intended to provide guidance to clinicians by identifying aspects of prosody that may be in need of intervention. It consists of various aspects of various prosodic features or components: Pitch (height, slope/declination, direction and variation); Loudness (level and variation); duration (inherent and prosodic); Pause (intraturn and interturn) Tempo (rate concordance and phrasing) Intonation (onset, nucleus terminal contour, overall contour, cohesive devices and pitch agreement) Stress (lexical pausal and emphatic) and Rhythm (stress sequences. alterations and continuity). As with the PVSP, appropriacy judgements are made on spontaneous speech.

Formal and functional abilities are examined in comparable degree. but not with comparable tasks. Unusually, angle of slope is included in the examination of aspects of pitch: this is not tested elsewhere except as a secondary consideration in Crystal's PROP.

1.9.1.4 Diagnosis of prosodic disturbances: a protocol

The protocol by Robin. Klouda and Hug (1991) goes a long way towards fulfilling the criteria identified in 1.8.4. It considers reception as well as production, normal as well as disordered use, and aims to relate formal and functional aspects for the purpose of planning remediation in prosodic disturbance. Affective, illocutionary, focal and delimitative use of prosody are examined in the perception and production of sentences. The authors quote a number of acoustic measures for prosodic function from work by Cooper and Sorenson (1981), Eady, Cooper, Klouda, Mueller and Lotts (1986), Eady and Cooper (1986) and Colsher, Cooper and Graff-Radford (1987). As pointed out by Brewster (1.8.3), the problem with these is that although prosodic function may typically be represented by such absolute measures, it is not safe to assume that prosodic function cannot be effected by an individual except by use of these parameters. Thus although it is likely to be true, as Robin et al. say, that "in regard to emphatic stress (sentence focus) in normal speakers. stressed words are longer than the same words in neutral utterances", it is essential to relate these generalisations both to context and to individual speaker. As mentioned in 1.4.4.7, there are several different acoustic-prosodic resources for realising emphatic stress (variation of loudness, length and pitch-height on the focal item, placement of glide, relative steepness where two glides occur, silence before or after focal item), and it is quite possible that not all of them are needed on a syllable for emphatic stress to be attributable. This suggests that a speaker's own acoustic means of realising prosodic functions such as focus and contrastivity need to be assessed, in addition to well-formedness.

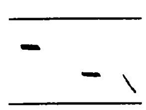
1.9.1.5 PROsody Profile (PROP)

The Prosody Profile, devised by Crystal (1982), and discussed below, goes a long way towards describing disordered prosody. Although older than many available assessment procedures, PROP retains currency. It is explicitly a measure of linguistic prosodic ability and concentrates on the linguistic use of pitch, since "it is intonation with which we are most regularly concerned, in clinical settings". A sample of conversation is recorded and analysed: tone units are identified and categorised as constituting grammatical structures (clauses, phrases and words; also as covering more and less than a clause) stereotypical utterances, imitative utterances, and indeterminate utterances. The type of tones used are noted, as well as appropriateness of tonicity and pitch-range. The profile has the advantage of being quick and easy to administer (although the analysis is more problematic) and of concerning itself with the client' spontaneous conversational speech. In common with most assessment procedures, it does not monitor reception skills, nor does it have any way of verifying that what is understood from the client's conversation is what the client wanted to convey.

A problem with the PROP analysis procedure can be seen in a sample from a project where it was used to ascertain whether a client with aphasia had retained his ability to use his intonation system contrastively for the purposes of turn exchange (Borrelli, 1995). In this case, a student therapist (T) is talking with a client with aphasia (K); T is not acquainted with K and asks him about his family and his past life. One exchange (transcribed in Fig. 1-1) runs as follows:

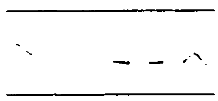
Fig. 1-1

T did you like growing up there?



K ə (.) fifties

T wasn't a good time ((laughter))



K yeah (.) fifty-two

T (laughter)

K (laughter) fifty-two (.) yeah=

T and what job did you do

In the PROP analysis, a one-word utterance produced with a fall is counted as a complete tone-unit. After K's first turn, it appears that T orients to K's utterance as complete, and therefore the fall on 'fifties' is judged to be nuclear, i.e. analysed as nuclear by the researcher and treated as such by the conversational partner. From his subsequent talk, however, it seems possible that K had intended to say "fifty-two" in his first utterance, but that he was unsure at first of which number he wanted to say. If this were the case, "continuative" intonation on "fifties" would have been appropriate to indicate that the utterance was incomplete. One possibility is that K was producing his realisation of continuative intonation at this point, and that his fall was not nuclear: to support this, there are several instances in his conversation of such falls occurring in mid-utterance, i.e. not counted as nuclear. This suggests that in this instance turnchange was signalled by other factors, such as the fact that 'fifties' could be processed by T as an intelligible utterance, whereas 'fifty-two', it turns out subsequently, could not: it is greeted first with laughter and then with topic-change. Furthermore, for K, 'fifties' would be a characteristic realisation of 'fifty', since he tends to add /z/ to the ends of words (see 6.5.3.4). It thus becomes clear that the interpretation of intonation in terms of nuclearity becomes circular: glides are nuclear if they can be interpreted as such and not if they cannot. The implication of this for the effectiveness of PROP is that the nuclear status of glides is dependent on interpretation. In speech as altered as this, PROP is therefore unlikely to give an adequately robust measure of the speaker's ability to delimit his speech.

A recent study of prosodic deviation in dysarthria (Vance, 1994) is examined below in some detail because it demonstrates that even with Crystal's taxonomy there is the potential for form to be mistaken as function, with a consequent overlooking of possible problems.

1.9.1.6 Vance (1994)

This study describes a man (D) with dysarthria and resulting reduction in breath-control and pitch-variation who shows evidence of adaptation behaviour in his prosody. The method of analysis used in Vance's study was Crystal's PROP. One strategy he appears to employ is that of including the first syllable or two of the next sense-group in the prosodic contour of the previous one, thus allowing himself to take extra breaths without inadvertently indicating that he is yielding the turn. He tends to employ additional accentuation for which no strategy is suggested. He also uses some tones (e.g. low falls, level tones) more frequently, some (e.g. high rises) less frequently than is usual for his native Ulster dialect (Jarman and Cruttenden, 1976); one explanation proffered for this is that the physical adjustment required for an upward pitch-movement is more difficult than for a downward pitch-movement (Cruttenden 1986). Thus far the description of his prosody is phonetic and suggestions for the way it is functioning are borne out by the examples: where tone-units are linked in the way described, subsequent talk shows that D. indeed has more to say.

The study contains, however, such statements as:"Both low and high falls were used for emphasis, the high fall to indicate personal involvement or humour" (p.71) and "D. seemed to reserve this [rise-fall] tone for instances when he wanted to signal marked cynical or sarcastic humour.....Once again D. widened this tone when aiming for an even greater degree of emphasis.....The high number of tones to mark this attitude is a reflection of the nature of the conversation which took place. An unusually high degree of sarcastic, mocking humour was expressed during this short sample" (p.72). The danger with these is the risk of circularity. No support is advanced for Vance's interpretations of D's use of prosodic features, and thus form-function confusion is again apparent. Such evidence as there is in the rest of the study indeed belies the assumptions. Vance concludes that the exploitation of pause and tone-unit boundaries proved effective and acceptable strategies, and that the system of tone-patterns "could be seen to cause some communication problems. The patient, in discussion of the communication difficulties, highlighted the fact that he was often distressed by the impression that his listeners did not take him seriously, in spite of the relative seriousness of the content of his utterance. This was not assessed as a problem in the present sample simply because of the fact that the content of D.'s communication [...] was non-serious and flippant in nature" (p.74)

Although Vance concludes that the adapted tone-patterns were problematic, she appears not to investigate the possibility of dissociation between the words or content of what D says and his intonation. A couple of examples of his speech reported in the study indicate that the content of at least some of those remarks which are quoted as uttered with "adapted" tones is not, in itself, "non-serious and flippant in nature":

(p.72) honestly and truthfully - and you think it's a big joke

(p.72) what else could it be described as - other than speech

It may have been the case that D was intending these to be taken humorously, but the reasoning for interpreting him thus is apparently circular: he is interpreted as being humorous because that is the way he sounds. No independent evidence for levity is adduced other than a description of the tones used, which constituted adapted prosodic behaviour. This study highlights another shortcoming of PROP in that it contains no procedure for verifying what the speaker intended and matching intention with interpretation.

1.9.2 Prosody assessment protocols: within assessment of specific disorders

Brewster (1989) notes that most approaches to the evaluation of clinical prosody are contained within the overall assessment of specific disorders and tend to focus on the facilitation of communication rather than on linguistic abilities.

1.9.2.1 Right Hemisphere Language Battery

This test battery (Bryan 1995)is specifically targeted at assessing those aspects of language which are likely to show deficits in right hemisphere damage and can be used to assess some aspects of linguistic prosody. It does not, however, aim to give a comprehensive view of prosodic abilities, but does tackle some aspects of semantics such as humour, and includes investigation of receptive ability.

1.9.2.2 Dysarthria profiles

Several assessment procedures for dysarthria include a component for examining prosody; examples are the Robertson Dysarthria Profile (1982), the Frenchay Dysarthria Assessment Enderby (1983) and the protocol by Ludlow and Bassich (1985). These include some assessment of non-intonational aspects of prosody such as phonation-time, loudness, ability to vary rate and maintain speech-rhythm. They also investigate formal ability and functional uses of prosody;

examples of tasks used include saying the months of the year at an appropriate rate and at an increased rate; imitating a given sentence which is repeated with varied accent-placement, and explaining how to make a cup of tea with appropriate rate, rhythm and intonation. The aspects of form and function are not closely enough related on such tasks to be able to ascertain whether the speaker's degree of phonetic ability bears any relation to the functioning of prosody.

1.9.2.3 An acoustic analysis of prosody in dysarthric speech

Many of the drawbacks of the tests mentioned above have been addressed by Leuschel and Docherty (1996) in their acoustic analysis of prosody in dysarthria, which was not published until after the test which is the subject of this study had been devised and data collection completed.

While Leuschel and Docherty's procedure is detailed in the demonstration of impairment or lack of normality, especially in terms of phonetic-prosodic features, it has no way of showing that this impairment actually prevents a person making contrasts, i.e. effecting prosodic function, while the current study is concerned to operate checks on whether prosody functions effectively in participants, both in reception and production. Another difference is in the number of controls: Leuschel and Docherty have twelve control participants, whereas a major concern of the present study was to test a large number of controls.

Leuschel and Docherty's procedure is in many respects complementary to PEPS, and the two procedures share similarities in their approach. Leuschel and Docherty recognise the importance of investigating a speaker's performance on a wide range of prosodic parameters (to maximise the potential for capturing any impairments) and the impossibility of investigating the whole range of possible speech tasks. The resulting compromise of including one structured and one unstructured task for all parameters is similar to the current study's proposal to examine a frequently-occurring communicative task plus an elicited form task for a comprehensive set of prosodic parameters. Leuschel and Docherty similarly distinguish between phonetic and linguistic aspects of prosody and include reception tasks. They recognise the need for control data and for scoring participants' performance in two ways on absolute acoustic measures and on the way their performance relates to the normative data from unimpaired speakers.

1.10 Conclusion: final list of criteria for prosodic assessment

It can be seen from this review that a number of concerns are being addressed in recently-devised procedures, especially those of Robin. Klouda and Hug (1991) and Leuschel and Docherty (1996) that were previously neglected. The current study seeks to build on the following aspects:

- The importance of assessing reception skills as well as production skills.

- The need for assessing a wide range of prosodic features, recognising that they interact, with the aim of finding out whether any are unavailable or diminished to language-impaired people.

- The relationship between prosodic forms (phonetic equivalents of acoustic parameters) and prosodic functions (linguistic use of phonetic attributes), particularly as a consideration for targeting rehabilitation.

- The necessity of establishing normative data (on the prosodic parameters and abilities habitually employed to express prosodic functions) provided by unimpaired participants on the tasks used to assess impaired participants' performance.

Unlike the studies of Robin et al and Leuschel and Docherty, however, the current study will, for reasons discussed in 2.1.1, use perceptual as opposed to instrumentally-measured criteria.

It will also gain information from a larger body of unimpaired informants, since it appears from most of the studies examined here that the numbers of participants are hardly adequate to inspire statistical confidence.

Furthermore, the prosody assessment procedure proposed here aims to be more comprehensive in its treatment of prosodic features, and more systematic in its approach to prosodic forms and their communicative functions, and with regard to reception and production.

In addition to these criteria, it is proposed that the prosody should meet others that have emerged from the review of the approaches to prosody but appear to be only subliminally recognised as important for assessment goals, namely:

- The recognition of the role of other aspects of language, such as syntax and semantics (see 1.5.4), in determining prosody, and that these should be controlled for in assessment procedure tasks.

- The need for providing some means of ascertaining what functions the participants intended their utterances to have, in order to avoid circularity in the assessment of how prosodic form is being used, as illustrated with reference to Vance's study (1.9.1.6), and see also 2.3.2. and 3.6.2.

- The advisability of bearing in mind the phonetic and phonological aspects of prosodic features. This arose from the consideration that a 'phonological' feature such as 'stress' or 'tone' might be realised by any number of its prosodic components, some of which might be redundant, as indicated in the comments on Robin et al (1.9.2.3).

- The tasks used in the test should be relevant to the needs of everyday communication (these are discussed in more detail at 2.3.5)

A theoretical framework was devised to account for these criteria. Its evolution is described in chapter 2.

2. Evolution of theoretical framework of assessment procedure

It is clear from the review of literature in the field that the relation of phonetic form to prosodic function is highly complex. To test all forms and functions exhaustively for clinical purposes would be impracticable. For this test the aim is to establish a) that phonetic differences which can be seen, in the test, to perform some disambiguation function are made use of by each participant and b) that (at least) one of the functions of each phonetic parameter, as described in the literature, is made use of by the participant. The test is thus designed to sample prosodic ability.

The priority of this study was to devise a procedure for examining prosodic ability ultimately in a clinical setting. This consideration has produced some constraints and priorities on the design of the procedure, and in the selection of processing levels, elements and functions to test. This chapter describes how the test evolved in the light of theoretical and practical considerations that arose in the process of stimulus construction and pilot testing.

2.1 Selection of processing levels

Literature on the analysis of speech perception at a more basic level than prosody was consulted for approaches to the form-function relationship, and for the kinds of phonetic (or formal) differences to be investigated.

2.1.1 The minimal level

Psychophysics concerns itself with the smallest detectable differences of sound, and technological developments have facilitated experiments with tightly controlled environments and synthetic stimuli which produce insights into the mechanics of the inner ear and the neuro-electric functioning of the auditory nerve. As pointed out by Baker and Grundy (1995), this approach to speech perception tends to apply 'reductionism' to the sounds of speech, i.e. to break them down into simple units (forms) which are hypothetically passed up to the brain to be recombined into meaningful perceptions (functions).

In Householder's words, however,

"Machines don't hear like people because people hear things that aren't there; but the machines do hear very well all the factors which induce us to hear what isn't there." (Householder, 1957)

What has emerged from this is that both artificially simple and naturally-occurring complex sounds "are ultimately dealt with perceptually, not acoustically" (Baker and Grundy,1995:85), and the psychophysical approach is criticised for being distanced from the real world. For this reason, it was decided that stimuli composed of natural rather than synthetic speech would be more appropriate for the proposed study.

Bregman (1990) (quoted in chapter 4, pp89-90, Grundy 1995)argues that in the real world speech is perceived against a background of noise. He postulates two forms of categorisation: primitive stream segregation, i.e. an innate ability to perceive differences in sound (the building blocks for more complex perceptions) and schema-based stream segregation, which makes use of primary stream segregation but builds on it with experience of sounds and their associations. His model can account for the categorical perception of non-linear variable speech-sounds and suggests the necessity for considering the categorisation of form (as building-blocks) and function (as schema-based perception) as distinct but interacting processes. This suggests that examining either the phonetic forms of prosody or the ability to process meanings that are usually or in the main handled by prosody is not likely to give an assessment that will be adequate for clinical purposes, but that the interaction needs to be examined.

This led to a need to define the level of minimal natural stimuli to be tested, such that they would be capable of triggering perception of functional prosodic differences. Studies by Gussenhoven and Rietveld (1988), Ladd, Verhoeven and Jacobs (1994) and Rietveld and Gussenhoven (1985)show that the perception of accentual prominence is elusive, being affected both by the segmental structure of the syllables in which prominence occurs and by neighbouring pitch-prominence When these variables were controlled for, Ladd and Morton (1997) found that there was slender evidence for a classical categorical perception of the type that applies to phonemes, but that examination of listeners' judgements of the pragmatic force of accents did tend to produce abrupt shifts of a categorical kind.

This consideration is reflected in the decision to test participants' formal and functional ability for each element in parallel, and to make laryngographic recordings of the participants' responses so that instrumental measures of acoustic parameters would be available for comparison with perceptual judgements; in this way it can also be established whether the acoustic parameters believed to be responsible for prosodic effect are indeed present, but that perceptual judgements would be the main basis for decision-making .

2.1.2 Other processing 'levels'

In the original conception of the assessment procedure two other 'processing levels' were hypothesised: one at which differences could be not only distinguished but named (an 'identifying' level) and one which would be capable of processing long (as opposed to short) utterances.

It was, however, decided that in this procedure reception would be tested in parallel with production, in similar tasks, so that receptive and productive abilities could be compared.

2.1.2.1 The 'identifying' level

The identifying level was concerned with asking participants to classify prosodic features in phonetic terms, e.g. to say whether a sound was uttered with a rise or a fall; to say which of two sounds was higher or lower. As a result of early pilot testing of both impaired and unimpaired speakers (3.2.1) it was decided that this level tested a skill that was not, generally speaking, relevant to normal language use, but which could be investigated if problems were apparent at either the formal or the functional levels.

2.1.2.2 The 'extended utterance' level

The level for processing longer utterances was mooted in case it appeared that participants could process the minimal utterances used in the test but had difficulty with longer utterances. To establish this it would be necessary to compare test results with conversational prosodic skills. As that comparison was not undertaken as part of the present study, no strategy for testing the processing of longer utterances has been developed as part of this assessment procedure, but the possibility that it might be necessary as part of further investigation is recognised.

2.1.3 Processing levels adopted

For the final form of the assessment procedure, two levels only were adopted: the 'formal' level, which determines whether the phonetic aspects of the element are used by the participant, by means of tasks in which the element is varied systematically; and the 'functional' level, which determines whether the element has phonological value for the participant, and consists of tasks in which the element has a disambiguating function.

Each level is assessed with separate subtests for reception and production:

Reception subtests concerning prosodic form investigate the participant's ability to detect or perceive differences in pairs of utterances that are distinguished only by phonetic variation of the element being tested: a "same-different" task. Participants are required to indicate whether or not the utterances in a pair are the same or different, but not to specify the kind of difference. Reception subtests concerning communicative function require the participant to say which of two specified meanings is conveyed by a given utterance.

Production subtests concerned with form test the participant's ability to manipulate the phonetic element under test either to instruction or by imitation. Function production subtests test the participant's ability to express the function associated with the element under test by manipulating it in order to convey a specific meaning that has been selected in advance.

There are thus four sets of subtests for each element, and the procedures for each and how they were arrived at will be discussed in chapter 3.

2.2 Selection of test elements

2.2.1 Elements

The term 'elements' has a particular application in segmental phonetics that is not parallel with its use here. In this study it means the phonetic features of prosody that can have individual roles to play in the phonological function of prosody. The word 'element' is intended to characterise what can be thought of as the building blocks of prosody; rather as chemical elements can be seen as the building-blocks of chemistry. Continuing the analogy, the prosodic elements are seen as able to operate singly (as 'simple' elements, e.g. loudness, length, pitch: silence), as phonetic systems with functions of their own; it is, however, also useful to think in terms of them combining with each other in well established combinations, (as 'compounds', e.g. rhythm, accent). These combination (or composite) elements constitute the phonetic systems of speech which, by means of varying proportions of component elements, effect linguistic or paralinguistic functions of rhythm and accent (e.g. rhythmicality and focus): the precedent for thinking of composite elements as prosodic entities has been discussed in 1.4.4.3, 1.4.4.4 and 1.4.4.7.

2.2.2 Rationale for inclusion or exclusion of elements

Together, the elements were to comprise a complete set of prosodic resources. For clarity, their printed form in the study includes initial capitals. Prosodic forms were selected to be part of the set (the 'test set') if they fulfilled the following criteria:

- Each element was to be of the kind that is inherently part of speech, e.g. Loudness and Pitch, degrees of which are necessarily present in all utterances. Some of the elements (such as Rhythm and Accent) are accepted as part of prosody although they are arguably only present in utterances involving more than one syllable.

- Each could be identified as being on occasion solely effective in disambiguating some aspect of the meaning of an utterance. To see why disambiguation was deemed to be the effective measure, see 2.3.3. The need for an element to be capable of being an independent or sole disambiguator of utterances was considered to be criterial because of the aim of investigating dysfunction of individual phonetic parameters, in which case it was necessary to examine cases in which the elements functioned independently.

- No element in the set was to be a primary feature in other language systems such as segmental phonetics and phonology, semantics, syntax, pragmatics, non-verbal communication or voice-quality. It is, however, recognised that many of the elements operate in close conjunction with these systems, and that to some extent the boundaries are arbitrary, e.g. in excluding voice quality and articulatory settings.

2.2.3 Loudness, length and pitch

Three of the elements are the simple perceptual correlates of acoustic features intensity, duration and fundamental frequency, namely Loudness, Length and Pitch. Their phonetic basis is not in doubt. As disambiguating elements, they are probably more in evidence when combined with other elements, but see 2.3. They can have absolute values on one syllable and have relative significance suprasyllabically. In the test, Loudness is treated as a single element. The two aspects of Length identified in the literature as 'tempo' (or rate) and differential syllabic 'length' (see 1.4.4.4) are treated as one element. Four different aspects of Pitch have been distinguished as separate elements. These represent combinations of pitch and duration (length), and are recognised as simple elements since all of them can be apparent on one syllable as well as having significance in their intersyllabic relation , as detailed in the following four paragraphs:

2.2.4 Pitch(-height)

The first is pitch-height, which can be given an absolute phonetic value, in Hz, and is significant for its relative value, the relative pitch-height of syllables. This, because it represents pitch on its own without involving length and movement factors, is the simple element Pitch referred to in the test-set. Various functions of pitch-height were mentioned in 1.6.4.

2.2.5 Range

Secondly, there is the element of pitch-range. This is, broadly speaking, based on the notion of pitch-range expounded in Crystal (1969), from which it takes its name; it relates to the amount of a speaker's pitch-range which is covered in an utterance, which can be wide or narrow. This constitutes a steep or shallow slope between pitch-heights within the utterance, the angle of which can be measured (the 'angle of slope' referred to in Hargrove and McGarr, 1994). As will be seen in 3.4.2, angle of slope is more criterial than pitch-range over short utterances, so that this element should strictly speaking have been designated Slope rather than Range. There is warrant for it as a disambiguating function in the literature (Crystal, 1969; Hargrove and McGarr, 1994) and it fulfils the other criteria of being necessarily present in all utterances and not being treated in other disciplines.

2.2.6 Level

"Held pitch" or absence of pitch-movement, is designated (mainly for economy) 'Level' in the test-set. This term needs some explanation, since it does not denote the 'level tone' of the nuclear tone school (described in 1.6.2). The level tone has been excluded from the test-set (where it might be included as a variant of glide) because it did not have a "phonetic" basis: it appeared to be heard as tonic not by virtue of the amount of length associated with it but more because the speech-content warranted its designation.

The presence or absence of pitch-movement, however, is the phonetic basis of tonicity (Halliday 1967), and nuclearity (Crystal, 1969; O'Connor and Arnold 1973; Quirk, Greenbaum, Leech and Svartvik 1985)), and is deemed to have significance for the delimitation of speech into "chunks" (see 1.5.2 and 1.6.1.) For the purposes of the test-set, the element Level therefore denotes presence or absence of glide (pitch-movement).

2.2.7 Glide(-direction)

The fourth aspect of pitch distinguished in the test-set of elements is the different directions that Glide (pitch-movement. 1.4.4.3.) can take. It has been thought useful to consider simple and complex pitch-movement. i.e. rises. falls. fall-rises and rise-falls. but not compound tones (e.g. fall + rise). In the literature. (Cruttenden. 1986). there is discussion of the disambiguation of utterances by means of complex versus compound pitch-patterns. in such instances as

Example 2-1

I ~like chocolate

spoken with fall-rise, which is likely to be treated as heralding a further comment starting with 'but', and

Example 2-2

I \like /chocolate

spoken with fall + rise, which is likely to be deemed complete (Sharp, 1958. Informal trials suggested that the phonetic basis for this distinction depended on pitch (high pitch seemed more likely to convey reservation), range (wider range implied lack of reservation) or voice quality (creak conveyed reservation). Compound glide-patterns thus suggested too weak a phonetic basis to warrant testing.

The rise-fall is described by Quirk. Greenbaum. Leech and Svartvik (1985) as a "persuasive variant of the falling tone. used to express a genuine or sarcastic warmth or on the other hand a feeling of surprise or shock."(p.1600). In autosegmental-metrical theory a fall is typically represented by the sequence LH*L, which suggests that in this system a fall is viewed as usually preceded by a rise. Ladd (1986) suggests. however. that the distinction between fall and rise-fall is a categorical one. and as such its omission from the test-set is admittedly somewhat arbitrary. It can be defended by the fact that it occurs less frequently than the fall, the rise and the fall-rise, and that aspects of pitch-movement are well-represented in the test-set by the inclusion of pitch range and the fall and rise (Glide). In the following table (Table 2-1), are figures for the frequency of occurrence of tones in a British English corpus (Quirk, Greenbaum, Leech and Svartvik,1985:1602):

Table 2-1: Frequency of tones

Falling	51.2%
Rising	20.8%
Fall-rise	8.5%
Rise-fall	5.2%
Level	4.9%

2.2.8 Silence

As was established in 1.4.4.6, one phonetic and non-segmental exponent of pause, namely silence, is to be considered in this study, and therefore the phenomenon of "filled pause" (Butterworth 1980, Garman 1990) is not included for consideration.

As a feature of plosive consonants, silence has an important part in the domain of segmental phonetics, and undoubtedly the segmental function of silence interacts with its prosodic function. In the articulation of stimuli for testing (see 3.3.2) these were avoided, so that any prosodic effects could be said to have been produced by Silence as the sole disambiguator. It is however clear that 'non-segmental' Silence has a role in linguistic communication, and several functions were considered for testing. Furthermore, speech disorders frequently exhibit more and longer breaks in phonation than unimpaired speech, which makes the testing of the existence and function of silences in speech highly relevant to the current study.

Except when it takes the form of aspiration as in the release of stop consonants, silence is apparent at the juncture of syllables and thus cannot be said to be manifested on one syllable. In this it is different from the other elements described so far. This is true of the two following elements, Rhythm and Accent, which also only become apparent as relational features, although the phonetic components that effect them are apparent on single syllables.

2.2.9 Rhythm

Components of this composite element are the phonetic elements of stress or accent (see Accentuation, below) and a separate element of length, or duration. Silence also plays a part (Abercrombie, 1964). Rhythm features widely in the literature on prosody and is not treated elsewhere in speech sciences. Furthermore, since arhythmic speech and sometimes syllable-timing are often features of disordered speech, as in foreign accent syndrome (Blumstein, Alexander, Ryalls, Katz and Dworetsky,1987 it seemed advisable to include some testing of rhythm in the assessment procedure.

As explained below, (2.3.6.7), several attempts were made to devise a test using speech-rhythm as a disambiguating function, but since they were not successful the element tested is more precisely described as rhythmicality, although the designation 'Rhythm' has been kept.

2.2.10 Accent

As mentioned in 1.4.4.7, accent or stress is one of the most well-attested phonological elements of prosody in the literature. In accordance with Wells (1986), and Wells, Peppé and Vance (1995) 'accent' rather than 'stress' is the term given to this many-faceted composite element. It comprises the elements usually ascribed to it: those of increase in loudness, syllable-length differentiation and variation in the initial pitch-height of the accented syllable. Additionally, for the purposes of this test-set, it includes the feature of glide: word-accent does not necessarily include glide, but in sentence-accent glide has been judged to be part of the specification (as in the nuclear tone, or in the notion of tonicity), and, as will be seen in 2.3.6.9, it was decided to use the placement of sentence-accent, rather than word-accent, as the function for the test.

2.2.11 Phonetic features not included in test-set

Articulatory settings such as tension of articulation (1.4.4.1) were considered for inclusion but discarded. It would be possible to create paralinguistic tasks in which tension would be the sole disambiguator; but whereas many of the other elements interact closely with each other in many prosodic functions, tension does not integrate so much.

Aspects of voice quality such as laryngealisation and huskiness were also considered for inclusion. Some of these are considered to have prosodic function: for example, Lehiste (1975) found that laryngealisation contributed (with lengthening) to the perception of juncture or delimitation, but it has not been found to be a sole indicator. Moreover, such voice qualities as are controllable tend to be the province of voice studies, and can be assessed using Wirz and Mackenzie Beck (1995).

2.2.12 Summary of test-set elements

Nine prosodic elements were decided upon: Loudness, Length, Pitch, Range, Glide, Silence, Rhythm, Level and Accent. The assessment procedure was named "Profiling Elements of Prosodic Systems (PEPS)", and is referred to as such in subsequent chapters.

2.3 Selection of prosodic functions

This section describes the process of the selection of prosodic functions from the ones featured in the literature in chapter 1. The first three sections describe selection criteria that address those problems which receive little recognition in existing approaches, as summarised in 1.10. The fourth section relates the functions selected in general terms to prosodic function as outlined in 1.5. In the paragraphs that follow, describing the selection of functions associated with specific elements, some of the functions and tasks that were considered for the test but discarded are outlined, with the reasons for discarding them.

In using the selected functions in the test, it was recognised that there was a need to verify that control participants indeed used specific elements to effect specific functions as indicated by the literature. With this in mind, scoring was conducted in such a way as to clarify which elements were used for which functions in participants' production tasks.

2.3.1 Anomaly and ambiguity

As pointed out by Cutler (1980), and as suggested in O'Connor and Arnold (1973) and Crystal (1969), prosody can be anomalous or ambiguous. In utterances said with anomalous prosody the prosody is not helpful, but is unlikely to cause misunderstanding. It may suggest a reading that cannot, for syntactic, semantic or pragmatic reasons, be applied to that utterance, but this does not prevent interpretation: in practice, the utterance is interpreted in spite of the prosody, which tends to be discounted. An example is the misplaced accentuation in the following (authentic) utterance, cited in Cutler (1980):

Example 2-3

> she had many cups but the one SHE gave me leaked

Accentuation is placed inappropriately on a 'given' item. Accent would perform the function of enhancing the speaker's meaning only if it were applied to 'me', thus:

Example 2-4

she had many cups but the one she gave ME leaked

In the first sentence, there is no alternative interpretation, or alternative function of the accenting, that would make sense of the accentuation of the second 'she', so the prosody can be described as anomalous or ill-formed and can be discounted. This does not render the sentence unintelligible, although it probably delays the processing of it. It is however possible for variation in accent-placement to produce two utterances capable of (different) interpretations: this will be described as prosodic ambiguity. The following sentence (from Stoppard's *Indian Ink*, 1995) is an example of this:

Example 2-5

Queen Victoria's ball came off last night

can be produced either as:

Example 2-6

Queen Victoria's BALL came off last night

or as:

Example 2-7

Queen Victoria's ball came OFF last night

Both versions are prosodically well-formed; the first invites the interpretation of 'come off' as an event verb , (Quirk, Greenbaum, Leech and Svartvik, 1985) meaning 'to take place', while the second turns the event verb into a phrasal verb meaning 'to detach itself'. Both interpretations are therefore available to the listener.

2.3.2 Ambiguity in aphasia

In the above example, there is a point of reference (the play) which can decide which interpretation of ambiguous utterances is most appropriate. This is likely to be true of most cases where prosody is propositionally or grammatically ambiguous: that there will be another system (lexis, segmental phonetics, syntax) that provides disambiguation, or the context makes reference clear. Problems are likely to arise when there is no such point of reference, or where a person's other language systems are also affected.

Similarly, when prosody fails to express affect, the deficit may be supplied by facial expression and body language; but may not, if the person has paralysis or dystonia. Ross (1982) suggested that when patients speak of their depression in an unemotional manner, the clinician may disregard the complaint. People with Parkinson's disease may express enthusiastic sentiments with such flat prosody that a lack of enthusiasm is attributed to them (Scott, Caird and Williams, 1985, and Johnson and Pring, 1990). An instance of a similar phenomenon has been quoted in connection with the Vance (1994) dysarthria study in chapter 1 (1.9.1.6). In such cases it is a possibility that, for the researchers, prosody carried conviction rather than the words, and utterances were reinterpreted to harmonise with the impression conveyed by the prosody. This was recognised to some extent in a replication (Caekebeke, Jennekens-Schinkel, van der Linden, Buruma and Roos, 1991) of Scott, Caird and Williams (1985) in which objective measures of the Parkinsonian participants' attitudes suggested that they were not so demotivated as they sounded. This demonstrates an important reason for investigating prosodic disorder, since it can be an invisible problem.

There may be a willingness on the part of hearers to interpret utterances in any meaningful way. It is worth reconsidering the literature on the HRT (Cruttenden 1995) at this point. What is certain about the HRT is that listeners hear a distinctive prosodic form. The studies relating to the HRT (Guy and Vonwiller, 1984; Allan, 1984; Ching, 1982; Britain, 1992) suggest that listeners are not agreed on a communicative function for this form (candidate interpretations include seeking reassurance, expressing uncertainty, deference, etc; and that it is merely a characteristic of narrative speech), but the interest suggests perhaps a willingness and even an anxiety to do so: since the form is being used systematically (its occurrence is not seen as anomalous), listeners assume it must mean something. In general, the studies seek to ascertain how widespread the form is and the meanings attributed by listeners, rather than the intention of the speakers. Cruttenden, however, notes that there is "to some extent a mismatch between speaker's intention and listener's reaction, a situation not uncommon in language." (p.164). The relevance for this study is that this is further evidence of both the willingness to assign meaning to intonation (which, as pointed out in the preceding paragraph, carries a risk of mistaking meaning) and of the need to provide some means of ascertaining the speaker's intention. (see 1.9.1.6 and 3.6.1)

It is worth considering how likely ambiguity is to occur. Ambiguity as neat as that produced by the utterance in Example 2-5 is likely to be highly infrequent. The prosodic elements needed for an utterance of this length are many and unlikely to combine by chance into alternative well-formed contours. The crucial factor here is the length of the utterance: the shorter the utterance, the more likely the possibility of ambiguity. Impaired speakers may well rely on the production of isolated, i.e. "syntax-free" noun phrases (in telegraphese and truncated sentences) and one-word utterances for their communication, so for them the likelihood of ambiguity and consequent misunderstanding as a result of disordered productive prosody increases.

2.3.3 Anomaly

Anomaly has its importance in the clinical situation. Ill-formed or anomalous prosody in a speaker with other language problems (word-finding, articulatory difficulty, agrammatism etc.) makes the task of understanding yet more difficult. Given this, well-formed prosody might appear to be a reasonable goal for prosodic rehabilitation. Identifying anomalous prosody, however, involves appealing to established norms. Such a project faces several problems. One is that what is well-formed prosody for the variety of English that has received most attention (southern British standard) may be anomalous or ambiguous in other regional varieties (see the research cited in 1.5.6). Another problem is a lack of objectively verified norms in terms of a consensus as to the functions of intonation and prosody (e.g. whether it is actually the case that most people using rising intonation for questions). A further problem is that prosodic norms, in common with other aspects of language, are subject to change.

Furthermore, it was thought to be useful in a clinical situation to have a means of discovering how disordered prosody was likely to cause unwitting misunderstanding, as in the cases quoted in 2.3.2. It would appear from these cases that the participants were producing systematic (i.e. not apparently ill-formed) prosody, since it was capable of interpretation and not discounted, but that they were either incapable of achieving the necessary prosodic contrasts, or were mistaken in their prosodic function strategies. It was thus thought desirable to establish what 'within-subject' phonetic-prosodic variation was required to produce prosodic contrasts adequate to perform prosodic functions, and to discover what prosodic function strategies were employed by individual participants, and to compare the success rate of impaired participants in such disambiguation tasks with the success rates of unimpaired speakers. Another concern, as mentioned in 1.9, was to assess participants' understanding of prosodic function. In a task for testing receptive prosody, it is easier for listeners to make judgements about a contrast of meaning (as occurs in ambiguity) than about the acceptability of an utterance.

For these reasons, ambiguity of prosody rather than anomaly was selected as the yardstick for ascertaining prosodic function, which in turn influenced the choice of prosodic functions for testing purposes.

2.3.4 Length of utterance

It might appear to be more appropriate to consider this aspect under methodology, but is considered here because it has a bearing on the selection of prosodic function. Prosodic function on short utterances has been chosen for the following reasons:

In language impairment, it is often the case that speech is effortful and that short utterances are all that the impaired person produces. The combination of problems generally found in aphasics (word-finding, dysarthria) means that the fine tuning of intonation in production is likely to be problematic, while in reception tasks there is the consideration that short-term memory might be impaired. Prosodic anomalies, ambiguities and misunderstandings which become apparent in connection with long utterances therefore cannot be attributed with any certainty to primary prosodic disorder: they may be secondary effects of dysarthria and other problems. Only with utterances that can be produced with the minimum of word-searching and effortful articulation is it feasible to start ascertaining whether inability to process prosodic elements is in operation.

Many of the disambiguation tasks devised in studies of prosodic function involve long utterances and are extremely contrived (e.g. "Mary gave Jane and Randy Aull, your lawyers, good advice/Mary gave Jane and Randy all your lawyer's good advice": Price, Ostendorf, Shattuck-Nagel and Fong, 1991). Long utterances were used in pilot studies in sentences such as the following: "I took her a present, a bunch of flowers, and her diary" where 'a bunch of flowers' could be either a separate item or an expansion of 'present', and apposition could be signalled either by faster rate (2.3.6.2) or lower pitch (2.3.6.3). Disambiguation effected by only one element on these sentences sounded unnaturally contrived, particularly when such contrivances were repeated over a large number of examples; many other elements would normally also have a part to play in the clarification of meaning in an utterance of such length. Although unimpaired participants scored better than chance, response time was long, suggesting that even they found the task hard, and therefore inappropriate for the purposes of the assessment procedure.

Utterances of a syllable, a word, a phrase, or a short sentence are used in this test. Thus problems that might arise with the assignment of normal intonation-patterns to longer utterances are also not examined.

2.3.5 Selected functions should occur commonly and be easily explained

One concern was that the tasks should appear relevant to the demands of everyday communication. This is reflected occasionally in the literature: "Most theoretical and heuristically conjurable ambiguities never actually arise." (Schegloff, 1984:51); Sperber & Wilson (1986)) recognise that communication involves a claiming of attention; and Locke (1980) advocates production-relevance in testing.

Pilot tests suggested that disambiguation functions that occur infrequently and have little apparent relevance to everyday communication situations were unlikely to produce anything approaching natural prosody designed to effect communication. While it is recognised that all prosody produced under test conditions is liable to be different from what might occur in conversational use, the intention was to test prosody that would bear a clinically useful relation to the prosody that a client might use in everyday situations. Where possible, the choice of functions for each task was influenced by the likelihood that they might reflect real potential communication tasks for clients.

Trials also showed that the function should be capable of quick explanation in clear terms to elicit optimum responses from language-impaired clients. This not only influenced the format of instructions but in some cases led to the preferring of one task over another for the assessment of the functioning of a prosodic element.

2.3.6 Relation to general areas of prosodic function

It will be clear that the clinical considerations outlined in the foregoing paragraphs have to some extent restricted and pre-empted the choice of prosodic function. Of the general areas of prosodic function outlined in 1.5 the tasks chosen will be seen to represent

1. affective function in four cases;

2. linguistic function in four cases, comprising delimitation, focus and two kinds of illocution;

3. situational function in one case.

Linguistic function has generally been favoured in the devising of intonation and prosody tests, with the use of such distinctions as GREENhouse, green HOUSE (Bryan, 1995). Linguistic function has the advantage of making contrast of meaning clear in concrete terms, as seen in Example 2-6 and Example 2-7, and is thus desirable for creating tasks that are easily explained. By contrast, tasks dealing with the affective functions of prosody have traditionally been less specific than the propositional tasks: participants are required, on the whole, to distinguish between no finer shades of emotions than happy, sad or angry (Schlanger, Schlanger and Gerstman, 1976;Shapiro and Danly, 1985;Samuel, Couillet, Louis-Dreyfus, Azouvi, Roubeau, Bakchine and Bussel, 1996). Such categorising seems unlikely to reflect the variety of affective nuance that might be necessary in communication. On the other hand, it is perhaps precisely because the delimitation of reference for affect is unclear (Crystal 1969:295-6) that problems with affective prosody are more elusive: it is notable that the Parkinson's and dysarthric participants quoted in para (2.3.2) had problems of miscommunicating affect, not proposition. Crystal notes (1982:114) that it is "linguistic use of pitch.....with which we are most regularly concerned, in clinical settings". This could be, however, because "linguistic use", which can be equated here with propositional prosodic function, is more readily identifiable as problematic, by reference to semantic and syntactic factors, which therefore means that it is more likely to be the subject of clinical investigation than problems with affective prosody.

The resulting division of tasks therefore represents a compromise between the ease of explaining propositional tasks and the perceived need for assessing affective functions.

2.3.6.1 Loudness

The main function of loudness in speech is as a component of accent, and thus has a role as a pointer to focus and rhythm. Loudness can be a sole disambiguator in discriminating the overall loudness of a person's speech, a pragmatic function in response to a situation such as competition for a speaking-turn and an important skill as far as social context is concerned. The contrast used to test function in the test was the distinction between loud and quiet speech in short polysyllabic stretches.

2.3.6.2 Length

Like loudness, length, in combination with other elements, is important in a number of functions, such as delimitation and rhythm. On its own, however, length of syllables determines the tempo or rate of speech; although this can be idiosyncratic, variations in it will indicate whether the speaker is in a hurry or not. Crystal discovered other linguistic functions for rate, e.g. that phrases in apposition tended to be spoken more quickly than surrounding material. Local (1992) found that variation in rate was significant for types of conversational turnchange.

For the test, sentences were constructed with phrases that were ambiguous as to whether they were in apposition or not, such as:

Example 2-8

"I brought her a present, a box of chocolates, and a newspaper"

where 'a box of chocolates' said at a faster rate than the surrounding sentence would mean that the present was the box of chocolates, and said at the same rate would mean that there was a present as well as a box of chocolates. The task did not fulfil the requirements of the test, as outlined in 2.3.5, namely that utterances used in the task should be short and the meaning-differences easily explained. Instead, the task of indicating hurry (or briskness) was selected, the contrast being the distinction between presence of hurry and lack of it in the speaker.

2.3.6.3 Pitch

As a component of other elements, pitch-height is an important part of prominence and thus it has a role to play in the indication of rhythm and accent.

On its own, as established in 1.6.4, pitch-height can indicate the start of utterances, and is thus important for delimitation purposes. In the same way that fast rate could be used to indicate appositional material, as described in the previous paragraph, so could low pitch: the phrase 'a box of chocolates' could be said at a lower pitch instead of at a faster rate to indicate that the present was the box of chocolates. The ambiguous sentences that were constructed to test the function of Length were considered for testing the function of Pitch-height and discarded for the same reasons.

Instead a function of pitch-height to indicate checking was selected. A rise, when it is final, can suggest that there is more to follow (see 1.6.2) but (at least in Southern British English) it has this function (as well as acknowledgement or invitation to continue) only when it is low or midrange (O'Connor and Arnold, 1973). When a rise is high it sounds questioning (Cruttenden 1985), or more specifically, checking: i.e. when an utterance is repeated with a high rise by a conversational partner it can function as a request for repetition; when repeated with a low rise, as an invitation to continue. This contrast, using low- and high-pitched rises, was the function selected for the test.

2.3.6.4 Range

Crystal (1969) describes one of the functions of width as indicative of subordinate material in a tone-unit: the main item would carry the widest tone, while subsidiary items, usually expanding or rephrasing the main item, were uttered with narrower ones. Such a function would have involved long utterances.

According to Graddol(1986) another function of range is indexical: distinguishing reading aloud from conversation, but this too would have involved long utterances. A more relevant function dealing with shorter utterances derived from the association of width with a high degree of emotional involvement (Crystal, 1969) and "surprise" was selected as an easily describable aspect of emotional involvement that might well be associated with wide pitch-range, contrasted with the lack of surprise represented by neutral pitch-range.

2.3.6.5 Glide

The functions that have been claimed for different glide-directions are many and various, grammatical and semantic, depending largely on the sentence-type in which the glide is found O'Connor and Arnold (1973). From this it would appear that comprehensive testing of the functions of different types of glide-direction is warranted. Since, however, it did not seem as though there was taxonomic justification for making different glides into different elements, it was decided that within the test-framework one function for a broad contrast of glide-direction would be sufficient. Listing was considered, with the exponents being rise and fall and the contrast being the distinction between finished and unfinished lists; in pilot tests these were successful but lengthy. The attitudes implied by the rise-fall glide are distinctive but in pilot-studies it proved difficult to devise effective tasks for them. As stated in the opening paragraphs of this chapter, the test is intended as a sampler of prosodic ability, and if a problem with distinctions between complex glides is suspected, supplementary tests can be devised to investigate the extent of the problem.

An illocutionary function was selected for the test, with a contrast between statement (using falling glide) and question (using rise or fall-rise), on utterances that were not grammatically marked for sentence-type.

2.3.6.6 Silence

Silence before and sometimes after the focused item can play a part in the indication of focus (Quirk, Greenbaum Leech and Svartvik, 1985), and this was borne out in pilot studies on the communication of focus. A further function of silence is to mark the end of 'phonemic clauses' (Laver, 1994), i.e. to delimit chunks of speech. Crystal thought there was a very slight pause after every tone-unit (1969:206). Beattie (1980) found that there was significant tendency for pauses to occur between syntactic clauses. Pauses have been the subject of study in conversation analysis, where for instance the length of a pause is significant in turn-taking, planning, as an indication of problematic interaction, etc. (Jefferson, 1989). Rather than as an indicator of focus, which was deemed a more appropriate function for accent, or as an indicator of delimitation (reserved for Level), the function chosen for silence was the indication of hesitant attitude. The contrast devised for this was that the attitude of a speaker with regard to the making of a choice had to be distinguished as certain or uncertain, as indicated by the presence of silence before main lexical choices in a sentence.

*2.3.6.7 **Rhythm***

As explained above (2.2.9) the element tested is more precisely described as rhythmicality.

In chapter 1 (see 1.6.6) it was mentioned that Couper-Kuhlen (1993) had found the maintenance of speech-rhythm across speaker-turns was a characteristic of smooth unproblematic turn-taking in conversation, but it was difficult to devise a task to exploit this function.

The material for the formal testing of Rhythm changed several times, according to what was deemed to be the best aspect of speech-rhythm to test, e.g. rhythm or rhythmicality. In one trial, participants were asked to give a same-different judgement on two different phrases said with the same or different rhythms. This produced problems in that stimuli with differing syntactic structures (e.g."Up and down the City road: How to win a million pounds"), pronounced with the same rhythm, tended to produce a judgement of 'different'. Furthermore, it was not clear what communicative function this discrimination could perform. Another version was to produce speech-rhythms as a series of taps, as in the Seashore Measures of Musical Talents (Seashore, Lewis and Saetveit, 1939), but this produced more rhythmicality than even rhythmical speech normally has, and thus seemed to be testing an aspect of musicality rather than of linguistic ability. The same was true of a task in which participants were asked to tap the rhythm of stanzas of poems as they were read out. At one point, the test took the form of distinguishing between syllable- as opposed to stress-timed utterances, with the disorder of foreign accent syndrome (Blumstein, Alexander, Ryalls, Katz and Dworetsky, 1987) in mind, but it proved impossible to make cues which differed only in being syllable-timed or stress-timed and not in the segmental specification.

As mentioned in 1.6.6, Crystal cites rhythmic utterance as being used "to reiterate a point that is felt to be particularly important" (p.163), and this has been taken as the function used in the test, with the contrast being the distinction between something that is being said for the first time and something that has been repeated many times by the speaker. Quirk, Greenbaum, Leech and Svartvik (1985) suggest that an insistent regularity may also be used for emphasis, especially when one is implying repetition of something which ought to be accepted without argument" (p.1598).

2.3.6.8 Level

As established in 1.6.1, one of the functions of presence of pitch-movement or kinetic tone is as an indicator of delimitation; absence of pitch-movement is, by extension, taken as having the function of indicating incompleteness of delimitation. The contrast was thus the distinction between presence and absence of information-boundary.

One task in early trials featured a variety of 'garden-path sentences' (Sperber and Wilson, 1986), e.g. "As I often play the violin is quite comfortable under my chin." On hearing these utterances as part of a reception task, participants were to judge them as either well-formed or anomalous, and to read out similar ones. The task was discarded on grounds of being lengthy and contrived, requiring large amounts of explanation, and not in keeping with the decision not to involve anomalous prosody.

Another task involved lexical distinction, between different functions (classes) of words such as "right" and "now": "I'm impressed. Right. Now. Let's get on" vs "I'm impressed right now. Let's get on." where the task was to say how many 'phrases or sentences' (i.e. tone-groups) had been said: a major problem with this in pilot-studies was the lack of a satisfactory lay designation of 'tone-group'.

Another way of doing this was to use titles of nursery rhymes which could be said either sounding like the title or sounding like the first line. The problem with this was the methodological one that if the utterance were indeed a first line, it would have been disambiguated by the presence of a second one succeeding it, as well as by the prosody.

This gave rise to the third task, where another utterance followed the "finished" one but two readings were possible, as evidenced by two ways of saying sentences such as "He considered, walking round the building" and "He considered walking round the building". This clausal format was discarded on grounds of requiring lengthy explanation, but the principle was retained in the final form.

The task that was finally selected involved lexical distinction of items that frequently co-occur in the same context in a list, using the distinction between two simple nouns (delimited by glide-presence on both, e.g. "ice, cream") and a noun-compound (consisting of the same two nouns with glide absent from one of them, e.g. "ice cream). In practice the difference would normally be distinguished by the introduction of "and" between the two simple nouns, but not if they were followed by a third; a third noun was accordingly included, e.g. "ice cream and honey".

2.3.6.9 Accent

The function of lexical specification was considered, using word-accent, with the contrast being the distinction between compound-noun and adjective-noun combinations, such as 'blue bell' and 'bluebell'. This was considered to be not a particularly relevant function since the contexts in which both tokens might occur would not arise frequently. Noun-verb distinctions such as 'incline' (n.) and 'incline' (v.) were rejected on the similar grounds that grammatical environment would be more likely to perform the disambiguation than accent-pattern, as would segmental distinctions of full and reduced vowel-forms in many such tokens.

The function of accent that was chosen for the test was focus, using contrastive sentence-accent. The distinction was between items that formed the focus of information (cf Crystal's nucleus, Halliday's tonicity) and those that did not. One early version of this task required the client to spot the focus of an utterance (where at least two items were potential foci) and to react by contradicting it, thus:

Example 2-9

> Cue: "You keep your glasses in the RIGHThand drawer, don't you."
>
> Response: "No, the LEFT"

The problems of explaining this task and of likely difficulty with word-finding proved insurmountable, but it gave rise to the interactional format which was retained in the final task.

The final task was to select one focal item from three equal contenders, distinguished from the two non-focal items by the presence of a fall-rise on it. Lists of similar-sounding items in everyday use, in which individual items might be singled out for query or verification, were sought. The digits in telephone numbers were one possibility, but numbers do not have such segmental similarity that they are often confused in reality, whereas letters do. The numbers and letters in postcodes were finally settled on.

2.3.7 Table of selected functions

Table 2-2 shows the tasks that were finally decided upon for each element.

Table 2-2: Elements and function tasks

Element	Function	Task: how the speaker sounds
Loudness	pragmatic	talking with extra energy or not
Length	attitude-indicative	brisk or relaxed
Pitch	illocution	requesting repetition / continuation
Range	attitude-indicative	surprised or not
Glide	illocution	questioning / confirming
Silence	attitude-indicative	hesitant or certain
Rhythm	attitude-indicative	saying repeatedly or for the first time
Level	delimitative	listing two items or three
Accent	focus	identifying a particular item in a set

How the functions were transformed into tasks for a clinical assessment procedure is the subject of chapter 3.

3. Evolution of test: procedures and scoring

The test evolved through a cycle of devising, pilot testing, evaluation and revision to the final version. Many of the early decisions about assessment were the result of informal trials; two formal pilot studies are reported here. Of the evolution of the assessment decisions, there will be detailed only those variations that at first seemed promising but which, after trials, indicated misleading or inconclusive results. The purpose of describing these is both to explain why certain approaches were not adopted and to alert subsequent researchers in the area to the problems that might be involved in following these lines of enquiry.

Procedures for the first pilot study were radically altered after it, and are not described in their original form. This chapter will therefore begin with the outcome of the first pilot study and the resulting decisions that were taken concerning the design of the test- procedures and the content of the test-stimuli.

3.1 First pilot study

For the pilot study, participants were mainly people who had no speech, language or hearing difficulties, with some who did. All but one of the unimpaired participants were adults at university with no formal training in phonetics, who spoke English as their first language with a standard Southern British English accent. The purpose of limiting participation in this way was to restrict the number of independent variables (such as regional accents, developmental factors, and educational weighting) which might affect the outcome, while giving some indication of whether the test was viable. Eight participants had no speech or language impairment and three were impaired. Of the unimpaired participants seven were English female first-year speech and language therapy undergraduates. The eighth was a female Chinese graduate teacher of English. Six of the undergraduates were aged between 18 and 22, the seventh (a native English speaker) and the Chinese teacher were in their mid-thirties.

Three participants had aphasia following a stroke: two male, one female, one male with fluent aphasia, the other two with non-fluent aphasia and mild articulation difficulties. The impaired participants were all older than the unimpaired. Nothing is known of their educational level.

Participants showed a range of abilities, summarised here in their percentage overall scores on the entire test. One of the English undergraduates scored near ceiling, with 97.7%; three scored around 94%, and the others ranged down to 87.5%. The non-native speaker scored 72% and had difficulty in understanding the tasks. The aphasic speakers found the test tiring; the two non-fluent ones scored 81.6 and 84.9%. The fluent speaker had difficulty in understanding or relating to the tasks, and the test was abandoned; he scored 34.6% on the completed tasks. The test emerged as a procedure that participants could respond to, but with scope for refinement. The tests were too loosely constructed, and results could have been invalidated by interference from both intra-prosodic and non-prosodic language factors.

3.1.1 Modifications indicated by pilot study

This section demonstrates the streamlining of the test, with a balanced range of tasks for all elements, forming a core of prosodic ability tests with a range of possible supplementary tests. Reference to prosodic well-formedness was avoided, and tasks were limited to disambiguation only.

3.1.1.1 Degree of prosodic differences: measurement of baseline skills

Although latency of response was not strictly calculated, some of the participants, both impaired and unimpaired, responded with speed and accuracy to all the prosodic differences in reception tasks. This raised the question of the level of difficulty to be set in the tasks.

If prosodic deficit were to be detected in impaired speakers, the level of difficulty needed to be such that they would fail where unimpaired speakers would succeed. It therefore appeared that the differences exploited in the pilot tests were coarser than was necessary for determining receptive skills. The differences were therefore reduced, but not drastically. For clinical purposes, it would be more useful to have a test that would give a wide range for impaired speakers to score in and a narrow range for unimpaired speakers. The differential ability of unimpaired speakers was therefore of less interest that their baseline abilities. A level of difficulty was aimed at that would give unimpaired speakers a good chance of scoring at ceiling, ceiling effects in unimpaired speakers being more desirable than floor effects on impaired speakers. Consequently, the final version aspired to a level of difficulty where half the items would attract immediate judgements and half would a require a small amount of consideration, producing hesitation. It was thought that hesitation in more than 50% of the examples would firstly be tiring and secondly be an indication of differential prosodic ability as opposed to baseline skills.

3.1.1.2 Length of test

The procedure in the pilot study format was too long for practical clinical use. Ways were sought in which the best use could be made of time. Two levels of processing were regarded as less useful diagnostically than the other two, and for reasons given in 2.1.2.1 and 2.1.2.2, the identifying level and the 'extended utterance level', were omitted from the final version.

3.1.1.3 Number of choices

In reception tasks for some elements, participants were asked to distinguish between three as well as two items. For reasons outlined in 3.2.3, the final version of the test used binary options for all elements.

3.1.1.4 Importance of segmental content

Segmental content within items varied greatly in the pilot study. This variation made it difficult to know whether the receptive skills exercised in the task depended on segmental or suprasegmental properties. As a result, the items were redevised with the segmental content controlled, as detailed in 3.3.2., so that prosodic functions could not be attributed to segmental factors.

3.1.1.5 Production tasks not included

Several tasks and functions not included in the final format are available as supplementary tests. They are listed here with reasons why they were not selected for the final format of the assessment procedure (where their suitability is discussed elsewhere, paragraph-references are given):

Reading aloud: It emerged from the pilot-studies that variation in several prosodic elements was appropriate for reading aloud. This variety was apparent in (among other things) the use of different glides, the placing of information-boundaries, and the use of silence (pauses). This made it inappropriate for use in the test. Furthermore, judgments about a participant's ability to read aloud were made by reference to well-formedness, and very seldom to ambiguity. It was also noted that proficiency at reading aloud was as much a measure of educational attainment as of a participant's prosodic ability.

The task of tapping in time to the beat of poems, and tapping out rhythms of phrases was discarded as a non-linguistic task (2.3.6.7): impaired and unimpaired speakers could both do this, with varying ability.

Several tasks designed to express mood or attitude (defensiveness, indignation, reservation) were discarded because they involved lengthy situation-setting, but are potentially supplementary tasks.

3.1.1.6 Instructions and numbers of items

The instructions were informal and lengthy. Like the examples and practice items, these were produced by the tester on an ad hoc basis; only cues were recorded. The numbers of examples in the pilot study were not standardised, nor their distribution over the various elements, although at least fifteen items were included in all reception subtests. As a result of this, briefer, clearer instructions and all examples were recorded on the final version of the cuetape, and the numbers of examples were standardised at sixteen for reception tasks and eight for production tasks. For the reasons for choosing these numbers of items see 3.6.5.

3.1.1.7 Ascertaining participant's intention

Where the function production of an element was tested, the participants were given eight items, each consisting of short utterances that were syntactically and semantically capable of carrying two diametrically opposed meanings (for the decision to use binary options and the meanings proffered, see 3.2.3.3) Participants in the pilot study gave no indication of which meaning they had in mind before producing the utterance: the tester told the participants which meaning had been inferred from the utterance and asked the participant whether the judgement was correct. This gave participants an opportunity to revise their intentions in the light of feedback from their own responses (which may or may not be reliable, see 5.8); and it was thought this may have been influenced by a wish to concur with the tester. Studies in the assessment of language in children show the possibility of such a 'response bias' (children prefer to respond positively to the experimenter's questions: Paris 1978, cited in Badzinski 1991), and it was thought likely that a similar anxiety might well operate in impaired participants. As a result , the procedure whereby participants committed themselves to one of two meanings before producing the utterance was devised (3.6.1).

3.1.1.8 Rises as questions and falls as statements

The stimuli in the function reception task in the pilot study were uttered with rises (questions) and falls (statements) over the same section of the speaker's voice-range (i.e. rise = mid-low to mid-high, fall = mid-high to mid-low). The participants had difficulty in assigning meaning in this task, and it was decided that contrast between rise and fall alone was insufficient to distinguish question and statement. Authors agree that rises suggest a lack of completeness (see 1.6.2), and it appears that this form does not necessarily attract the judgement "question" when the choice given is 'question' or 'statement' Accordingly, stimuli were constructed in which the contrast of form was between a simple and a complex glide, i.e. falls and fall-rises, the latter being identified with "enquiry" by Halliday (1970).

3.2 Design considerations

For a complete account of the items used in the test for the final study, see Appendix 1.+ Appendix 3.

Some of the literature on the assessment of phoneme perception in children attests to the need firstly for production-relevance in testing and secondly for presenting repeated opportunities for perceptual decisions to be revealed (Locke, 1980). There is also the importance of establishing accurately how well a child perceives the sounds that need to be produced (Bird and Bishop, 1992); and the consideration of how disordered phonetic realisation can lead to mistaken diagnoses of disorder either in perception or in the phonological constructs determining production (Macken and Barton, 1980). These principles were taken as applicable to the construction of the prosodic assessment procedure.

3.2.1 Same-different tasks and phonetic identification: formal reception

One problem was to determine how participants were to indicate their judgments in these tasks. In the following description of how decisions were made, examples are taken from the test for Loudness.

One format was to ask: "Which of these two utterances is louder, the first or the second?" The appropriate response was "First" or "Second". This involved the need for the participant to retrieve the impression of the first utterance after hearing the second:, and this was thought undesirable in terms of memory load. Another choice was involved in choosing this format, i.e. which phonetic term to use: whether it was better to ask: "Which of these two utterances is louder?", or "Which...is quieter?" For some elements one option is more prominent (loudness is more prominent than quietness) but for some, prominence is less obvious (rising tone versus falling tone, for example). This made for potential confusion by the listener as to which utterance to listen for. The risk of such confusion would be small in the case of controls, but might be greater in impaired participants.

A second format was to ask the participant: "Which of these two utterances is louder/quieter?" in which case an appropriate response would be: "The second is louder." This produced a dual task-load: one task to decide which utterance to describe (the first or the second) and another to assign the appropriate phonetic term to it. A variation of this was to ask about the second of the two utterances: "Tell me about the second utterance: is it louder or quieter than the first?" The second, as the one most recently heard, seemed a better item to enquire about than the first. This format still had the problem of how to be certain that the participant was attaching the appropriate phonetic term in giving the answer.

A third format was to ask the participants to classify the utterances in the order they heard them, e.g. "loud-quiet" or "quiet-loud", which would involve handling two phonetic terms for each task.

With all the tasks involving such identification there was the problem that, for elements other than Loudness, many of the distinctions were hard to classify: the terms involved were often technical, and in words the distinctions sounded far removed from what the participants were hearing: "stress-timed" "rhythmic" "wide" "narrow", "level pitch" "moving pitch". This was countered by making picture-cards to show the distinctions, but in practice it was difficult to make satisfactory pictorial representations, and still the problem of being sure that the participant had assigned the classification as intended was present. The introduction of the motor skill of pointing was a potential disadvantage for some impaired participants.

A fundamental question raised by this format was whether it was valid to test ability to apply phonetic classification correctly as part of a person's prosodic ability, since such conscious identification does not appear to form part of on-line language-processing. It was therefore decided to sacrifice indications of how the participant perceived the differences in favour of asking participants only if they heard a difference between the two utterances in the given cue or not: i.e. to give a Same-Different judgment.

"Same-different" tasks have been criticised in the assessment of children's phoneme perception on the grounds that a child may not understand the difference between the two concepts. (Baker and Grundy, 1995). 4AX, 4BX and 41AX tasks have been developed (Locke, 1980; Pisoni 1971) to refine the task. In the case of the present study it was felt that the extra stimuli that these procedures involved would be confusing rather than clarifying, and that the process of establishing exactly what was meant by "same" and "different" would be better served in this context by giving examples of "same" and "different" stimuli in adequate numbers. One example of each kind of difference that would be tested was given, together with a corresponding "same" example. If participants showed any doubt at all about what constituted difference, the examples were discussed and rerun, but in both pilot tests and the main study examples tended to be greeted with vigorous nods, as though the participants were perfectly clear about what was being demonstrated.

There was also the possibility that aphasic participants would have difficulty in producing the words “same” and “different”. There was available to all participants a card illustrating “same” and “different”, i.e. two pictures: one picture showed two glasses of water, the other showed two glasses, one of orange drink, one of lemon drink.

There remained the question of how to be sure that participants had given the judgment they intended, since it was noticed in trials that participants were capable of responding with “Same” and then immediately saying they had intended to say “Different”. Participants were advised that if they said something by mistake they should correct it, but it remains a possibility that some of the answers given in the study were not intended.

The policy of not asking for or expecting understanding of phonetic classification was applied only to “technical” phonetic terms, such as ‘width’, ‘glide’, ‘rise’ and ‘fall’. “Lay” phonetic terms for speech, such as “loud”, “quiet”, “fast”, “slow”, “high” and “low” were used, as were the labels for meaning-distinctions, after ensuring that the meanings were understood.

It can be seen that many levels of task emerged from this evolution of test procedure. One purpose of outlining the steps taken to reach the decision in favour of this task is to make clear that the design of this test excludes many skills that may be relevant to prosody and that could be examined in the event of apparent inability to perform any of the tasks. Examining the ability to classify prosodic distinctions remains as a potential further investigation.

3.2.2 Scalar and non-scalar elements

The object of testing the elements is to discover whether variation in the values of the element is discernible, and whether the element is consciously varied by the participant. Elements were divided into two types for testing purposes: scalar and non-scalar. Some of them are necessarily present in any utterance, however short (authors are agreed that any monosyllabic utterance has some degree of loudness, length, and pitch-height; if it has pitch-movement, this will be either wide or narrow): for testing these, a **scalar** approach was suitable, making use of the degree to which the elements were present in the test-utterances. "Scalar" elements are thus Loudness (difference in degree of loudness) Length (difference in degree of length) Pitch-height (difference in degree of pitch) and Range (difference in degree of width).

The other elements are not necessarily present in an utterance, and for these the phonetic level of testing was a question of establishing whether the elements could be perceived as present or absent (reception), and whether they could be included or omitted as appropriate (production). "Presence/absence" (or **non-scalar**) elements are: Silence (whether there is silence, causing a perceptible gap in an utterance, or not), Rhythm (whether stress-timing is present in an utterance or not), Level (the presence or absence of pitch-movement) and Accent (the placement or not of accent on specific syllables). Glide is also included as a non-scalar element since the difference to be detected is not one of degree but of kind.

In the binary form of cues that was decided upon (see 3.2.3) this decision to use Same-Different judgments meant that:

For "scalar" elements, in items requiring a Same response, the same degree of the element was present in both stimuli of the cue; in items requiring the answer "Different", each stimulus in the cue displayed different degrees of the element. For "non-scalar" elements, the stimuli in each cue either both displayed presence of the element, or both absence (requiring Same response); or one stimulus displayed presence and the other absence.

For decisions as to the content of items see 3.3.1. For the order of presenting items (cue-order), see 3.6.5 and for the effect of cue-order, chapter 5.

3.2.3 Binary choice for reception tasks and function production tasks

3.2.3.1 Functional reception

In the final version of the test, this task was related specifically to the speaker's idiosyncratic mode of expression: the participant was told that the examples recorded on the cuetape demonstrated expressions of surprise, hurry, etc for that particular speaker. This had two advantages: firstly, there was no need to appeal to norms for the expression of attitude. Secondly, the task of inferring meaning from the individual modes of expression of strangers on the experience of hearing only a few utterances is one that relates to everyday experiences. For clarity, however, the choice of descriptive label for the task was forced by being restricted to binary options e.g. either surprised or not surprised. Sometimes participants said they thought the utterance in the example sounded surprised but also questioning; at which point it was established that both aspects were present but that surprise was the feature to look for.

The meanings were depicted on cards as described in 3.2.3.3. The cards were available for all participants to point at, should they prefer to do this rather than to indicate the meaning in words. In practice all the participants, including those with aphasia, used words.

*3.2.3.2 **Formal reception***

An early version of this task was to give participants three stimuli, and ask them to say which of the three was the loudest, etc. This produced an undesirably heavy memory load, and was irrelevant for non-scalar elements (see 3.2.2). Although it could be argued that in normal conversation such multiple ranking is done (cf Crystal's allowing for tone-units to be ranked as ascending or descending (Crystal 1969:151), and,equally, subordinate tone-units are classified with degrees of pitch-height (Crystal 1969:244-252), the conditions necessary to reproduce this in test circumstances would have been too elaborate.

Another version was to present one item and ask about it. This involved relating the item to the previous one for scalar elements (3.2.2) i.e. asking a question such as: "Is this louder (or longer, higher, wider) than the previous one?" The drawbacks to this were: potential confusion about which item was being referred to, the reference to technical terms, an unacceptable amount of memory load. The system worked better for non-scalar elements, e.g. "Is there a gap in this sentence?" but this required a "Yes/No" answer which is not always well-distinguished by impaired speakers, and furthermore involved explicit appeal to classificatory systems, which had been decided against (3.2.1). Eventually the format was rejected for both types of element.

The final choice was to give two stimuli in succession and ask participants to make a same-different judgment about the pair: this minimised the memory load while retaining a task which would indicate ability to hear prosodic differences. In the final format for form reception subtests participants were thus asked to distinguish:

For scalar elements:

- different degrees of loudness, length, pitch-height and range on a stimulus said twice

For non-scalar elements:

- Glide-direction: 'same' cues: an utterance produced twice with the same glide-direction; 'different' cues: an utterance with one glide-direction followed by the same utterance with a different glide-direction.

- Silence: same cues: an utterance produced twice in the same way (with or without a gap); 'different' cues: an utterance produced with a gap plus the same utterance produced with no gap (in varying order)

- Rhythm: 'same' cues: an utterance produced twice in the same way (with or without rhythmicality); 'different' cues: an utterance produced once with and once without rhythmicality (in varying order)

- Level: 'same' cues: an utterance produced twice in the same way (with or without pitch-movement); 'different' cues: an utterance produced once with and once without pitch-movement (in varying order)

- Accent: 'same' cues: an utterance produced twice in the same way (with the accent on the same syllable); 'different' cues: an utterance produced once with the accent on one syllable and once with the accent on the other (in varying order).

3.2.3.3 Function production

Participants were given a binary choice for how to produce utterances. This was determined for two reasons: partly for the clarity of the concept, which made it easy for the tester to explain and for participants to grasp, and partly because although affective utterances (in particular) can be thought of as gradient (having degrees of meaning, e.g. greatly or mildly surprised), categorisation is involved in making them a binary choice (e.g. surprised or not surprised). The binary choices were displayed mainly on flash-cards, gestures being used instead in one task. The choice-cards (see Appendix 3) showed either symbols denoting respectively:

- '?' and '✓': question and statement in the Glide subtest,

- '2' and '3': the lists in the Level tasks;

- '/' and '////': 'first time' and 'many times' in the Rhythm subtest;

the cartoon faces depicted the following emotions:

- hurry and no hurry (Length subtest)

- surprise and no surprise (Range subtest)

- certainty and uncertainty (Silence subtest);

For 'loudly' and 'quietly' gestures (hand to ear, finger to lips) were used.

No suggestions were made to the participants as to how they should use their prosody to convey the meaning, although since the production task followed the reception task, all participants had the example of the tester's mode of expression. For how the choice was made see 3.6.1.

3.2.4 Phrases, words, number of syllables

The unit of prosodic organisation of prosody is generally agreed to be the syllable (Laver, 1994), and it had been decided to use short utterances in the test (2.3.4). The decision was therefore taken to use a minimum of syllables as test-items. In general, monosyllables were appropriate for the simple elements, polysyllabic utterances for the composite elements, but sometimes the form or function of the elements selected for the test dictated otherwise, as follows:

3.2.4.1 Syllabic format: formal level

- For reception (the same-different judgment tasks) of all the simple elements (i.e. Loudness, Length, Pitch, Range, Glide), and for Level, monosyllabic words were selected as the vehicle of prosodic variation.
- For reception of Accent, two-syllable words.
- For reception of Silence and Rhythm, short polysyllabic phrases.
- For the production of simple elements (apart from Loudness), single letters of the alphabet.
- For production of Loudness and Accent, two-syllable words.
- For production of Level, pairs of letters (e.g. "A A").
- For the production of Silence and Rhythm short polysyllabic phrases.

3.2.4.2 Syllabic format: functional level

- For reception of Length, Pitch and Range, monosyllabic words.
- For reception of Loudness, Glide, Silence, Rhythm, and Level short phrases of three or four syllables.

- For Accent, parts of postcodes (3 syllables).
- For production of Loudness, Length, Pitch and Range, monosyllabic words.
- For production of the remaining elements, short polysyllabic phrases.

3.3 Content of test-items:

3.3.1 Semantic and syntactic content

Items were chosen to be lexicosyntactically neutral, following Crystal's experiment for determining attitudinal labels, in which sentences were all statements attitudinally as neutral as possible so as to avoid suggesting one attitude more than another (Crystal 1969:298). This necessitated ensuring that the words and phrases were not at odds with the task nor likely to predispose the participant to one of the two meaning-choices given. While avoiding these, the item had to be appropriate for the task. In carrying out the test, however, some participants said they found it impossible to produce some of the stimuli in the ways required; for instance, one participant said she couldn't say "Ah" and sound surprised; another said the phrase "Be quiet" would never be said loudly. This suggests that in some cases the test was unsuccessful in convincing participants that the stimuli could be said in (at least) two different ways.

Three tasks needed particular care in their design:

- Rhythm: a phrase such as "I just can't help it", a candidate for the Rhythm function task, lends itself to sounding as though it has been said many times before. It therefore had to be ensured that the items did not in themselves express semantic extremes that might call for matching prosodic judgments, and the particle 'just' was excluded, as being likely to cause this type of bias. Similarly, utterances with a positive construction, when uttered repeatedly, would be expected to have the full form of the 'do'-auxiliary, thus containing a syntactic-segmental clue to their interpretation; to avoid this, many of the items were syntactically negative.

- Level: as mentioned in 2.3.6.8, in this task, lists of three items were used instead of two. Although the third item in the list was of no interest, its presence ensured that no syntactic connective ('and') would be expected between the first two nouns when interpreted as two single rather than one compound noun. The first lexical item in such a compound had to be a mass noun, thus requiring no article if interpreted as a separate item ("toy", as in "toy cars", would not be suitable, because as a separate item it would syntactically require "a" or "the") and the second had to be either a mass noun or a plural countable noun for the same reason.

- Accent: postcodes were used. The first two letters of the stimuli constituted existing postcodes. The letters and numbers selected were those which are frequently confused: M for N, S for F, P for B, T for D, L for O, 2 for 3, 1 for 9 (professional telephonists were consulted for this information).

Items used for the various subtests, with differences for reception and production where relevant, are listed below (and in Appendix 1):

- Loudness: Reception: phrases such as "How are you?"; Production: numbers 1-10, loudly or quietly
- Length: Reception: words such as "Sure", "How?"; Production: monosyllabic names, quickly or slowly
- Pitch(-height):: "m" said high (to indicate "repeat please") and mid-to-low (to indicate "continue please") in response to cues such as months of the year (reception) and "pea(k),", "ganch", "ro(t)e" (production) (see Appendix 1.)
- Range: Reception: letters and numbers; Production: "oh", "ah", "fine" "good" etc with steep slope (to indicate surprise) or shallow slope (to indicate lack of surprise)
- Glide-direction: Reception: words such as "Monday", "okay"; Production: clock-times (e.g. "three o'clock"), said with rise (questioningly) or with a fall (as a statement)
- Silence: phrases such as: "I'll have a .... one" said with pause (to indicate certainty)or without (to indicate uncertainty).
- Rhythm: phrases such as: "I don't like tea" said with rhythmicality (to indicate having said it many times before) and without (to indicate saying it for the first time)
- Level: lists such as: "chocolate biscuits and tea" said with a glide on the first item (to indicate it is a separate item, i.e. three items in the list) or no glide (to indicate it is combined with the second item, i.e. two items in the list)
- Accent: parts of postcodes, e.g. "BS6", said with accent on B or S (to indicate which is the focal item). At least two out of the three possible loci had to be a plausible candidate for focus.

3.3.2 Segmental content

Initially, on the grounds that suprasegmental considerations can operate independently of segmental ones, the two stimuli in a same-different task consisted of different words. Stimuli were thus likely to differ segmentally and syllabically, and the first rationale was to emphasise this difference: stimuli were chosen to present a complete contrast, to make it clear that segmental and syllabic factors were irrelevant. There was however the problem with the phonological length of vowels, which interfered with perceptions of suprasegmental or prosodic length. There was some evidence from pilot studies - in the form of hesitations, more than wrong answers - that these differences produced confusion as to what the task was. Another option was to make the stimuli segmentally close but not exactly the same, but this produced similar evidence of confusion. In the final version segmental differences were avoided, and the stimuli in each cue for all formal reception subtests are segmentally (and thus lexically) identical. One drawback to this is that in such a task attention is unnaturally focused on suprasegmental cues in a way that seldom occurs in a natural language situation; so the test may not give a true impression of a participant's ability in natural conversation. This however is no different from many other aspects of assessing language by using a test, and still has the benefit of ascertaining whether the underlying ability is there or not.

In selecting stimuli for the formal reception subtests of Loudness, Length, Pitch, Range, Glide and Level the influence of the acoustic properties of segmental factors had to be allowed for. Stimuli were selected from available English monosyllables, matrices for which can be found in Appendix 2. All the stimuli within a subtest conformed to a similar phonetic configuration concerning class of initial consonant and length of following vowel, and, where relevant, phonetic class of final consonant. The aim of this was to avoid variation in the suprasegmental specification of the phonemes in the stimuli: the differing intrinsic fundamental frequency associated with different vowel-qualities can affect perceptions of relative pitch-height (Lehiste, 1970, Couper-Kuhlen 1993:21) One exception to the use of standard words should be noted: the use of the vocalisation "m", which was included because it occurs very frequently in conversational use, with several meanings mostly conveyed by prosody. Apart from this all cue-items were checked to ensure they were high-frequency (Kucera and Francis, 1967)

3.3.2.1 Silence reception tasks

The Silence task required special segmental consideration. The problem of silence as a feature of plosive consonants has been mentioned (2.2.8). Many consonants vary in their realisation according to whether they are followed by another phoneme or not, and if so, what type of phoneme. This can be seen in the realisation of the last consonants of "ten", "six" and "eight" in the following examples: *10 green bottles, 10 _ green bottles; 6 old tomatoes, 6 _ old tomatoes.* When such consonants occurred before a pause, it was thought that their segmental realisation would help signal whether or not a pause followed, thus detracting from the role of silence. For this reason the words on each side of the pause were selected so that the initial and final phonemes differed as little as possible whether a pause followed or not, e.g. 'in the lounge' 'in - the lounge' and 'in the - lounge' can all be said with minimal segmental variation, although the complete exclusion of it was neither possible nor desirable.

The same considerations applied to some extent in the selection of cues in function reception tasks for Rhythm and Level.

3.3.2.2 Rhythm-form reception task

In the form reception subtest items for Rhythm (lines from poems) care was taken to select phrases where a rhythmical rendering would not produce significant changes in vowel quality.

3.3.2.3 Accent-function reception task

In the Accent function reception subtest, the task was to distinguish which letter or number of the postcode was being singled out in the cue for verification. The digit was uttered in its correct form, not a 'sound-alike'wrong form, i.e:

Participant	BS6 2PE
Tester	B<u>S</u>6?
Participant	Yes, B<u>S</u>6

rather than:

Participant	BS6 2PE
Tester	B<u>F</u>6?
Participant	No, B<u>S</u>6

The purpose of this was to ensure that no segmental information would be available to identify the focus in addition to prosodic information.

3.3.2.4 Accent form reception task

Stimuli for Accent form reception were two-syllable words that could be accented on either the first or second syllable without change of vowel quality, either for reasons of emphasis (e.g. given-new contrast, outSIDE/OUTside) or for change of word-class (imPRINT/IMprint).

Formal production featured two-syllable words which could sound similar to another word if the stress-pattern was wrong, e.g. 'written' and return'.

3.3.2.5 Pitch function production task

For the Pitch function production task, items were selected where the final sound could be ambiguous: either two-syllable words such as 'hammer', which with a shortened final vowel could be mistaken for 'hammock', or monosyllables such as 'rate' which, with a glottalised final consonant, could sound like 'rake', 'rape' or 'ray'. These words uttered with shortened vowels and glottal closure proved in trials likely to elicit "m?" as a request for repetition.

3.4 Prosodic variables in cues

3.4.1 Reception tasks: between stimuli

This section describes the prosodic options that were available in the making of the cuetape; which ones were chosen and why.

One question was whether to keep all stimuli in formal reception tasks level in pitch, or whether to include pitch-movement. When pitch-movement was excluded in trials, the stimuli sounded unnatural, as if chanted (thus resembling a test of musicality), so it was decided to include pitch-movement in all subtests; the glide-direction was the same within pairs.

Some prosodic variation in function reception tasks was included. This consisted of variation in elements that were not thought to be part of the decision-making process. This had two advantages: one was to mitigate boredom; the other was to offset any tendency for a participant to identify a function by automatic reference to the prosodic form. In all subtests, therefore, half the cues featured rising glides, half falling; except in those subtests which treated discrimination as to glide-direction. In the glide-direction task half the cues were high-pitched and half were low-pitched, with surprising results (see 3.5.1). Different kinds of prosodic variation (not tried) would be to make some of the cues loud and half quiet, some slow and some fast, some wide and some narrow.

3.4.2 Reception tasks: within stimuli

The reception cuetape was made with the aid of a laryngal microphone feeding into an oscilloscope. This ensured that the input of loudness, length, pitch and angle of slope for each cue could be visually monitored and corrected for constancy while it was being made.

It was difficult, when making the cuetape, to avoid intra-prosodic interference: e.g. to sound loud without at the same time widening the pitch-range, raising the starting-pitch, doing a noticeable intake of breath and changing the timbre. Although such clues might be present in normal conversation, they are not necessarily so, and it was of interest to know whether the elements could be perceived without them. Particular prosodic strategies had therefore to be adopted, as detailed in the following paragraphs. They apply in the main to formal reception tasks. Where relevant, different strategies for function tasks are also mentioned.

At formal and functional levels for cues showing difference in Loudness, care was taken that on the oscilloscope they registered the same starting-pitch; noisy breath intake was avoided; and the same angle of slope, length and timbre were maintained.

For Pitch, the inverse routine was adopted for the formal level: for the higher item, care was taken not to introduce extra loudness; and equal range and length were maintained. In the function task, which was on-line (see also Function Reception for Accent) the same audial caveats were observed, and in addition visual cues such as eyebrow-raising for the question function were avoided; it was noticeable that many participants looked towards the tester as if expecting visual clues, but eye-contact was avoided.

For Length, there was the option of maintaining the same range of pitch-movement over utterances differing in length, which would produce a difference in the angle of slope of the utterance, or maintaining the same angle of slope, which would entail an utterance that covered more of the voice-range Since angle of slope was (essentially) the phonetic difference tested in Range (see 2.2.5), the option of maintaining the same angle of slope in Length stimuli was preferred. The differences can be seen in Fig. 3-1 and Fig. 3-2:

Fig. 3-1 Alternative realisations of variation in length of utterance : vary angle of slope

b				b				}
	e				e			}maintain range,
		a				a		}vary angle of slope
			d				d	}
short				*long*				}

Fig. 3-2 Alternative realisations of variation in length of utterance : vary range

b	b	}
e		
a	e	}vary range,
d		maintain angle
	a	}
	d	}
short	*long*	}

For **Range**, care was taken not to vary starting pitch-height or glide-direction within a pair of stimuli, and to vary the angle of slope rather than the length of the utterance. Particular care had to be taken not to make steep glides louder. In the function task, it was noticeable that while the oscilloscope had shown a satisfactory shape for the utterance on screen, the ends of steep rises tended to be hard to hear on the audiotape.

For **Glide-direction** there was no variation in range or length within a pair, or for different glides in the function tasks.

For **Silence,** breaks in stimuli were placed where they would occur in hesitant speech, i.e. after articles or prepositions, not in the middle of words. The vowel of the syllable preceding the gap was given no lengthening or glide (although both would be likely in a natural speech situation, and did occur in the production items).

For **Rhythm,** the rhythmical items depended on timing (length) more than on loudness or pitch-prominence on the stressed syllables; non-rhythmical ones were given the stress-timing of normal speech. The stress-timed utterances tended to be quicker, having fewer 'beats'; this was countered by intentionally saying them slightly more slowly.

For **Level,** pairs that were different were level on one stimulus and had a glide (fall, rise or fall-rise) on the other. The steepness of the glides was mid-range with no variation in length or loudness within pairs. For the function tasks, there was no gap between the first and second item whether they were separate or compound nouns, and no lengthening on the first item.

For **Accent**: the differences were made as they would be in normal speech; there was pitch-prominence as well as glide on the stressed syllable, but no undue loudness or length. In the function reception items, there was only pitch-movement on the focal item: no pitch-prominence or increased loudness or length. This was the second of two function reception tasks delivered 'live' (see also Function Reception for Pitch): care was taken that there was no audible or visible intake of breath or energy push, e.g. by nod of head, on the focal item.

3.4.3 Hard items

Although efforts were made to maintain a constant level of variation within items and thus a consistent level of difficulty between items, a few items randomly dispersed through each subtest were harder, i.e. the amount of variation available to the participant for making distinctions was smaller. It was decided to keep these differences in variation in order to provide some indication of differential ability in the case of ceiling effects.

3.5 Pilot testing: the second trial

The second trial took place when the test was close to the form that was used for the main study. Five participants took part, all of them undergraduates aged between 18 and 22, two male and three female. They scored between 89.5%and 93.5%. No problems with understanding the tasks were expressed by the participants or noticeable from the results.

3.5.1 Modification of Glide function reception task

A further insight was gained from the second pilot study as to what could be considered functions of prosodic elements. Some responses from the Glide-direction task trials showed that high falls were interpreted as questions, not statements. This is not a function of falling glide that has been suggested in the literature. To investigate this further, the function reception task for Glide was modified: half the statement-items started at mid-pitch and half at high pitch. To balance this with a variation in the question-items, half of these were changed from fall-rises to high rises.

3.6 Test administration procedures:

3.6.1 Instructions: reception tasks

The instructions for reception tasks are similar to those used in other assessment procedures, e.g. PALPA (Kay, Lesser and Coltheart, 1992) Participants hear two examples of the task, demonstrating the options for judgments (in function reception tasks) and the differences and similarities that are to be distinguished (in form reception tasks). In reception function tasks, the first example trains the participant in the proposed meaning-contrast by using more than one label to describe the meanings subsumed in the function; the second example uses the two contrasting labels for the function as they are used in the task. Before all reception tasks, participants heard two examples of the task and two or three items for practice; before all production tasks they had two or four chances to practise the task. The final complete version of instructions can be found in Appendix 4.

All reception task instructions were recorded on tape. They were only used for some participants: these included those with aphasia. This recording process was useful for clarifying and refining the version to be used, but in practice it was necessary for the tester to repeat the instructions verbally after they had been heard on tape. The tester had a written version of the instructions, and for the majority of the participants, had repeated them enough times to be certain of producing similar instructions each time without the tape.

3.6.2 Elicitation of function production responses

The aim was for participants to have a function in mind in producing the item, i.e. a meaning that they were to convey and which could be verified. For the rationale behind this, see 1.9.1.6 and 2.3; for the choice of functions, see 3.2.3.3.

In trials, participants were encouraged to select one of the two meanings for themselves, with the tester guessing which meaning had been selected.

In trials, it emerged that there were two disadvantages to this: one, that the participants took a relatively long time to select a meaning, and showed evidence of finding the choice hard or boring; this therefore entailed unnecessary extra work for them. The second disadvantage was that they might choose to express one of the meanings, to the exclusion of the other, for most or all of the items.

For the main study, four copies were made of each choice card: four of each binary option were needed to suggest meanings to be conveyed on each of the eight items in a subtest. Before each subtest, the relevant eight choice-cards were shuffled. For each item, one was selected and shown to the participant without being seen by the the tester. The participant looked at the choice-card and produced the utterance with the meaning shown. The tester judged which meaning was being conveyed, noted it, and kept the flash cards in the same order in which they had been shown to the participant. At the end of the subtest, the tester checked the meanings that had been shown against the judgements made about the utterances. As an inter-rater reliability check the recorded results were marked by two other scorers who did not have knowledge of the meanings intended by the participants.

3.6.3 Instructions: form production tasks

The aim of this subtest was to see if the participant could produce the element over a minimal linguistic stretch as a conscious aim in response to elicitation.

For the scalar elements **Loudness, Length** and **Pitch**, the task was to produce four degrees of the element (adapted from the five-term scales proposed in Crystal and Quirk, 1964). They were thus asked to produce given utterances :

- as (loudly) as possible
- not quite so (loudly) as their (loud)est
- as (quietly) as possible
- not quite so (quietly) as their (quiet)est

(with the terms "loudly" and "quietly" replaced as appropriate by the terms "quickly", "slowly", "high" and "low")

For the participants with aphasia, these instructions usually needed to be expanded and demonstrated.

Length: It was expected that asking participants to say things as slowly as possible (Length) would be a problem (although in practice only a few participants produced excessively long responses) and a supplementary task was included here. Participants heard phrases in which the same word featured twice, once mid-phrase and once final, as in "on and on", "two by two". Appropriate repetition includes lengthening of the iteration that occurs in final position (see 1.6.5)

Pitch: participants sometimes responded with loudness when asked to produce high voice. High voice was demonstrated by referring to the form reception task which participants had just heard.

For **Range** and all remaining non-scalar elements except Accent, elicitation took the form of a request to listen to the item and to copy, imitate or mimic it: the choice of term depended on indications from the participant as to which one they appeared to understand best.

For **Accent**, participants were asked to say each word twice, first neutrally, then emphatically.

3.6.4 Order of testing elements and levels

The order of subtests used in the procedure is: Function Reception, Function Production, Formal Reception, Formal Production. (The order for each of the nine elements is as listed in 2.2.12.)

The purpose of testing function first is to introduce participants to tasks in which an element is the disambiguator without being preattuned to the element by having first heard it manipulated in formal reception tasks. In this way one form of predisposition or training is avoided.

It could similarly be argued that production should be tested before reception: so that participants' response would not be conditioned by having heard the elements in operation in the cues for reception tasks. To avoid this, participants were told that in function production tasks what was required was their own way of expressing the task, which might not necessarily bear much relation to the way they had heard the tasks done in the reception cues. Trials indicated that participants were slightly less confident and more self-conscious when production preceded reception but that they did not perform very differently in either case. For participants' ease, therefore, reception tasks came first.

One option that was considered was a change in the order of administering either form and function subtests or of reception and production subtests, in order to see if there were any effects of order in the results. It was decided that only one change of order was desirable so that the full population of participants would have undergone a procedure that was identical in all other possible respects. Order of cue-items within the subtests was selected as the only order variable: see 3.6.5.1.

3.6.5 Number and order of items in a subtest

3.6.5.1 Reception subtests

Binomial tables were consulted as to the opportunities that would arise for random responses given the binary options decided upon for reception subtests. Sixteen items in a subtest would mean that correct answers above 11 and below 5 would have a likelihood of .0278 ($p < .05$) of having been scored by chance. This allowed for scores of 12-16 and of 0-4 which could be attributed to level of prosodic ability as determined by non-random factors.

The sequence of stimuli within a reception subtest was randomly determined so that there was no discernible pattern in the order of expected answers. Where, however, the randomiser selected more than four consecutive items with the same expected answer, it was overridden, since trials showed that participants were reluctant to produce the same response more than four times in succession.

The stimuli within reception subtests were presented to 50% of the participants in one order and to 50% in reverse order.

3.6.5.2 Function production subtests

For function production subtests, the only binary option concerned the choice of meaning-function. Since this was determined by the card shown to the participant, the response was not subject to chance factors. Options for function production subtests were random, in that the choice-cards were shuffled for each participant. Other options in the response were multiple, according to the number of prosodic elements used by the participant to express the function. Fewer items were thus required than for reception tasks, and eight were given.

3.6.5.3 Form production subtests

For form production subtests, no binary options were involved, and (again for ease of comparison) eight tasks were given. The order of items in form production subtests was not varied.

3.6.6 Cues on tape

All reception task cues were recorded on tape for uniformity of stimuli. One methodological decision was to use a recorded copy of the first stimulus as the second stimulus in "same" tasks, i.e. to "dub" the second stimulus rather than to repeat the first with identical prosody. It was questioned whether to do so provides a natural language task, in that there may be clues to similarity in a dubbed copy that have little to do with the fact that the prosody is identical. On the other hand, in the instructions participants are asked to say if they hear "any difference at all" In trials, some comments on non-dubbed "same" tasks were that one of the two stimuli was "gentler", or "had two syllables", or that "the inflection" was different. Although descriptions of the stimuli were erratic, it was clear from this that participants were reporting on differences that they could hear, and that for them to judge two stimuli the same the second stimulus needed to be a dubbed copy. This in turn made it important that in "different" tasks the differences did not involve variation in timbre, vowel quality and irrelevant prosodic variables.

3.6.7 Recording

Material was recorded with high-quality digital audio equipment (Sony digital audio tape-corder TCD-D7) A laryngograph with an oscilloscope (Thandar SC110A) was used with 62 of the main body of participants; logistic problems or disinclination accounted for non-use with the other participants. Of the participants with aphasia, the non-fluent participant with mild articulatory difficulties and the fluent participant were recorded with the laryngograph. Measurements were made using the laryngograph recordings and a computer program devised to analyse it (Hu and Miller, 1997)

3.7 Scoring:

Scoresheets were devised and are shown in Appendix 1. The scoring is simple for reception tasks and (after allowing for the probability of chance scoring, see 3.6.5.1) can be interpreted as a direct reflection of participants' abilities. It is complex for production tasks and scores need further interpretation before being used as a measure of ability.

3.7.1 Reception tasks

Participants scored one point for each task where their judgment matched the judgment expected by the tester, nought where it did not.

For Pitch Function Reception tasks, which followed a different format, they scored one if they responded by producing a new item after the tester's low 'm...' and also if they responded by repeating what they had just said after the tester's high 'm?'. They scored nought if they produced a new item in response to a high 'm?' or if they repeated what they had just said in response to a low 'm...'

For Accent Function Reception, where the participants had to say which letter or number of the postcode was being singled out for query, they scored one if they identified the item correctly, i.e. the one highlighted (prosodically) by the tester, nought if they did not. Occasionally it happened that participants would place prominence on the correct letter or number, but attribute it to a different letter or number: these instances were noted, and are discussed in 5.8.

3.7.2 Function production tasks

Participants could score a maximum of 2 points per item. One point was scored if the tester judged correctly which card had been shown to the participant, i.e. which of the two selected meanings was being conveyed by the participant. Such a judgment was 'relative', i.e. based on the system of limited contrast established within the subtest. A second point could be scored if phonetic-prosodic contrasts between the utterances were judged as having the intended meaning when out of the system of contrasts established within the subtest: an 'absolute' judgment.

For Pitch and Accent the format of the function production tasks was different from that of the others, the sets consisting of 16 examples rather than 8; each example scored one point. In the Pitch function production task a point was scored on the success of each interaction, i.e. whether the participants elicited repetition or continuation as they wished from the tester. In the Accent function production task the point was scored if there was phonetic prominence on the postcode digit which (according to the participant) was being clarified.

3.7.3 Use of section-elements

Some hypotheses of the study concerned the use of the elements tested in the various sections in the tasks intended to elicit them, i.e. of the 'section-elements' in the 'section function tasks' (see **5.3**) e.g.:

a) that participants would use the section-element in the section function task;

b) that that element would be the one used most consistently by the participant for that task;

c) that it would not be solely responsible for disambiguation;

d) each participant would use each of the prosodic elements consistently for at least one function in the course of the test.

If these hypotheses were established by the study for a significant proportion of the participants, it would lend support for the use of these tasks as diagnostic for the functioning of certain prosodic elements.

In order to see whether participants were using all nine elements systematically it was necessary to examine the whole set of function production tasks. Charts were devised on the scoresheets to record the elements used in each function production task. If the section-element was not used consistently, or one of two or three elements used consistently, for disambiguation in the section function task, the tasks from other sections were checked to see if the element performed a disambiguating role in another task. If not, then it was noted that this was an element that the participant made little use of in the production tasks. This aspect of a participant's performance was correlated with the relationship of the participant's overall score on production to the overall mean of production scores. It was hypothesised that some normal speakers might show low use of some elements; for the possible implications of this, see chapter 6. If this were the case such a speaker, while not sounding prosodically disturbed, might be less readily understood than speakers who employed the full range of elements on the test. In a clinical situation, this would be an indication that the client's conversation could usefully be examined to see whether the kind of task used in the assessment procedure caused the client difficulty in conversation.

3.7.4 Form production tasks

Loudness, Length and Pitch: The contrasts looked for (which measure deliberate as opposed to unplanned performance) are as follows:

- Loudness: four degrees of loudness: pp (as quiet as possible), mp (a bit louder than quietest), ff (as loud as possible) mf (a bit quieter than loudest)
- Length: four degrees of length: ll (as slowly as possible), ml (a bit faster than slowest), aa (as quickly as possible) ma (a bit slower than quickest)
- Pitch: four degrees of pitch: bb (as low as possible), mb (a bit higher than your lowest) hh (as high as possible) mh (a bit lower than your highest)

In the following scoring procedures what applies to scoring of Loudness applies (with appropriate modifications, e.g. ll or hh, for ff) to scoring of Length and Pitch:

- If ff is as loud as any utterance recorded by this participant and louder than other utterances in this form production test, score 2.
- If ff is louder than other utterances in this form production test but not as loud as other utterances recorded by this participant, score 1.
- If mf is quieter than ff and louder than mp or pp, score 2.
- If mf is quieter than ff but no louder than mp or pp, score 1.
- If mp is louder than pp and quieter than mf, score 2.
- If mp is quieter than mf, but no louder than pp, score 1.
- If pp is as quiet as any utterance recorded by this participant and quieter than other utterances in this form production test, score 2.

- If pp is quieter than the others but not as quiet as other utterances recorded by this participant, score 1.
- If the variations are not in the element under test but variations only of other elements, score 0.
- If there is variation in other elements as well as in the element being tested, these are noted but do not affect the score.

The other tests are describable only in technical terms and therefore take the form of "listen and repeat" tasks; scoring procedure for them is described below:

Range: The cuetape gives, for copying, two degrees of range (wide and narrow) on each of four kinds of glide-direction (rise, fall, fall-rise and rise-fall). Participants score 1 for wide range or steep slope in wide utterances and for narrow range or shallow slope in narrow utterances, regardless of whether there is a match on glide-direction, pitch, loudness and length. Participants score a further point if there is a match on length. If it is not clear whether a response is wide or narrow, participants score 1 per pair clearly differentiated on range, 0 for no difference, and 1 if such a difference has been recorded in other utterances by this participant.

Glide: Participants are asked to copy four kinds of glide (fall, rise, fall-rise, rise-fall), each done twice: participants score 2 for each glide which matches the cue in direction, regardless of pitch, range, loudness, or length (although differences in these can be noted). They score 1 if the final direction is right: i.e. if they do a rise instead of a fall-rise or a fall instead of a rise-fall. If the participant produces a glide in the course of the task (or in surrounding conversation) but not in response to the appropriate cue, they do not score.

Silence: The cuetape gives phrases that either contain breaks in phonation or not. If participants put in pauses (or not) as in the example, they score 2; if they lengthen the word or phoneme before a pause but do not actually break phonation they score 1; if they put in pauses that were not there, they do not score.

Rhythm: The cuetape gives nursery rhymes said rhythmically; participants repeat what they hear, and if they achieve a perfectly even beat over the whole utterance, they score 2. If they achieve some even beats but not all (e.g. if they start rhythmical and end up with speech-rhythm or syllable-timing) they score 1. If they stumble more than once they score 0; if their speech is all syllable-timed they score 0.

Level: Participants hear one letter repeated once (done twice) in each cue, e.g: A-A. Four of these have the pitch-pattern level-glide; four have the pattern double-glide, i.e. the same glide repeated, with pitch reset between. Participants score for their production of the first letter: if it is level and their imitation is level they score 1, if it was a fall and they produce a fall they score 1, if it was a rise and they produce a rise they score 1; otherwise 0. They score a second point if they do pitch reset between double glides, and glottal stop or phonation-break between level and glide. They do not score the second point if the double glides follow on from each other in pitch, or if there is a semivowel (/j/ or /w/) between levels and glides.

Accent: Participants score 1 point if there is a contrast between accented (or emphatic) and unaccented (or unemphatic) production. They score a second point if there is a clear pitch difference between the stressed syllable and the unstressed syllable: if there is a clear step up when the stressed syllable is the second and a clear step down when the stressed syllable is the first. Unaccented items can be compared for whether "below" and "billow", "return" and "written", "demur" and "dimmer", "defer" and "differ" can be distinguished from each other, and if so whether this is achieved by glide, length, etc., and on which syllables.

3.8 Measures to ensure test validity

3.8.1 Second marking

10% of the production tasks in the 90 tests (i.e. 18 production tasks for each of 9 participants, 162 tasks in all) were marked by three other scorers. One scorer was extremely experienced and marked all 162 tasks. The other two scorers were recently qualified speech and language therapists, who divided the tasks between them. They had had a minimum of tuition in the participant and very little experience of listening for prosody, but it was felt that their reactions to the task would be useful for gauging the usability of the test with speech and language therapists in general.

3.8.2 Intra-rater reliability

After 30 participants had been tested and scored, the first 18 were rescored, to ensure that the scoring criteria were standardised.

3.8.3 Test-retest

10% of participants (i.e. 9) underwent the procedure a second time six months after their first assessment. By this means it would be possible to ascertain the consistency and reliability of participants responses.

3.9 Recruitment of participants

3.9.1 Ages of participants

It was decided to interview adult participants in three broad-band age-groups: 18-27, 33-47, 52-67. The lower limit was set at 18 as the threshold of adulthood; the upper limit at 67, being the highest age at which participants were not likely to be affected by presbycusis (Davis, 1991). A buffer zone of approximately 5 years between age-bands was set to ensure a lack of continuum effect between groups. Equal numbers of participants in each age-group, divided equally according to sex, were interviewed.

3.9.2 Education levels

The education factor was binary: participants were divided into those who had stopped full-tine education at 18 (18-) and those who had continued beyond (18+). Participants were divided more or less equally into 18+ (n = 44) and 18- (n = 46). Somewhat arbitrarily, it was decided that those with academic or vocational training involving university (including art or music degrees) counted as having higher education, while those with professional qualifications (accountants, secretaries, solicitors, radiographers, film technicians) did not. A further consideration is that some participants (5 of them) were only 18, so had not, strictly speaking, continued their education beyond that age; but since they all had university places which they were intending to take up they were included in the 18+ sample.

3.9.3 Numbers of participants

Ideally, the number interviewed should have been representative of the population as a whole, but this was not within the scope of the project. On the other hand, enough participants were required so that when divided by age-group and sex there were no fewer than 15 participants per group, which would provide statistically reliable data. With three age-groups, this led to the figure of 90 participants in the study.

Participants were drawn mainly from an area in North London where there is a wide range of the socio-economic spectrum; where possible, participants whose socio-economic background differed from that of the researcher were selected. They were either volunteers (17%) via advertisement (leaflets and a letter in the local paper) or approached by the researcher (in local shops, sports and leisure clubs and companies). It was intended to interview participants who were as far as possible unfamiliar with the researcher's speech-patterns: 8% were well-known, 16% were acquaintances; the rest were unknown.

It was established:

- that all participants were native speakers of English;
- that they had no known speech impairment or hearing loss;
- that they all spoke with a Standard Southern British English accent or with only slight regional inflections
- that none of them had had any training in phonetics

In addition participants were asked where they grew up, to monitor for possible regional influences on their speech-patterns, and questions to ascertain their age and educational attainment.

4. Interpretation of Scores and Statistical Analysis of Results

Scoring of the data was concurrent with running the procedure over a six-month period, during which all 90 participants were interviewed and recorded. Participants appeared to have little difficulty with the tasks. Function tasks seemed to be easier and more enjoyable than form tasks, and within these two test-modes production aroused more interest than reception tasks.

Scores were examined from two angles: test performance, i.e. how the test performed, in terms of content validity and reliability; and participant performance, i.e. how scores could be used as a guide to the range of prosodic norms in an individual.

For test performance, scores were examined by subtest: means, ranges and standard deviations of the scores of all participants in each subtest were computed, to see if there was any significant difference between them which might affect the validity or reliability of any subtest; the results are shown in 4.1. Having established that the differences were not significant, it was decided to use all the subtests in computing the norms according to participant performance. Subsequently, the effect of the cue-order variable is investigated (4.4).

For participant performance, audiometry is first examined to see whether participants should be excluded from the results on grounds of hearing impairment (4.2.1). Then the scores of individual participants on each subtest were examined, again in terms of mean scores, ranges and standard deviations (4.2.2) and examined for the effects of age, sex, and education (4.3.2, 4.3.3). The range of normal ability is then established. Reception and production skills are compared, as are form and function skills, and correlations between each pair of levels are obtained. Other aspects of test validity are examined: practice effects, interscorer discrepancies, and the effect of retest. Finally, function production responses are examined in some detail to determine which elements participants made use of to communicate their intentions.

4.1 Test performance: preliminary findings

The ranges, means, standard deviations and ranges of scores were calculated using a spreadsheet package (Microsoft Excel, 1985-1996 version 7.0a) and are given in Appendix 5. A summary of test performance results is given in Table 4-1 and Table 4-2; in Table 4-1 the findings for subtests are grouped to give a general overview of how participants performed on each of the tasks (function reception, function production, form reception and form production), with ranges and means for both scores and standard deviations calculated for each task across all nine elements. In Table 4-2 they are grouped by element, and the ranges and means of scores and standard deviations is calculated for each element across each of the four task-modes.

Table 4-1 Scores in subtests by task-mode

Subtests	Cases	Max. score	Min. score	Mean score	Max. SD	Min. SD	Mean SD
Overall	3234	16	4	14.71	2.73	0.38	1.5
Function Reception	810	16	5	14.88	2.66	0.6	1.74
Function Production	806	16	4	14.72	2.41	0.5	1.81
Form Reception	810	16	10	15.3	1.4	0.38	1.06
Form Production	808	16	6	13.95	2.73	1.32	2.14

Table 4-2 Scores in subtests by elements

Element	Cases	Max. score		Min. score		Mean score	Max. SD	Min. SD	Mean SD
		Potential	Gained	Potential	Gained				
Loudness	3600	16	16	0	7	14.79	1.97	0.6	1.27
Length	358	16	16	0	4	14.52	2.41	0.77	1.61
Pitch	359	16	16	0	7	15.11	2.36	0.5	1.16
Range	360	16	16	0	8	14.48	1.94	1.06	1.52
Glide	360	16	16	0	6	14.43	2.28	1.13	1.82
Silence	360	16	16	0	9	15.3	1.48	0.78	1.12
Rhythm	359	16	16	0	6	14.64	2.32	0.39	1.54
Level	360	16	16	0	7	14.62	2.03	1.4	1.7
Accent	358	16	16	0	5	14.47	2.73	0.38	1.9

Examination of the range of standard deviations in individual subtests shows that no subtest need be treated as an outlier. It was therefore concluded that all subtests could be included in the calculation of the range of normal ability.

4.2 Participants' performance

The effects of hearing loss are considered first, because potentially they could have affected all the results of those in the highest age-group.

4.2.1 Effects of hearing loss

All participants were assessed on the basis that they had no known hearing loss; nevertheless participants in the upper age-band were screened for presbycusis. This was important in case an unrecognised hearing loss affected their reception scores.

Pure-tone averages (PTAs) were calculated and are shown in Table 4-3 below in order of severity of hearing loss; an example of a participant's scoresheet is given in Appendix 6. The frequencies used to calculate the PTAs were 0.5, 1, 2 and 4 kHz in the better ear, i.e. the same as those used in a study of elderly British people (Davis, 1991). They were judged appropriate for evaluating the hearing for the participants in the current study since the band-width within which the stimuli for the test were created did not exceed 4 kHz. Thresholds could be slightly elevated because the average ambient noise level in the test room (in most cases the same room in which the participants underwent PEPS) was approximately 40 dbA. Values (in dBHL) for hearing at 4 kHz and at 8 kHz are included in the table to give an indication of the level of presbycusis. Participants' mean scores on PEPS reception subtests are given in the last two columns. It can be seen that some participants' hearing was outside normal limits (PTA above 20: Davis, 1991): these are shaded in the chart.

Table 4-3 Hearing loss and PEPS reception scores

Participant #	Age	PTA (dBHL)	4 kHz	8 kHz	Function Rec.	Form Rec.
54 female	53	0	5	5	80.56	90.57
60 female	61	1.25	0	5	91.67	95.14
69 female	54	1.25	5	35	95.63	98.61
36 female	55	3.75	20	30	95.14	92.36
65 male	62	3.75	25	65	96.53	97.22
56 male	52	5	20	10	98.61	97.92
87 male	59	6.25	10	20	90.28	99.31
10 female	60	6.25	10	20	91.67	91.67
50 female	60	6.25	10	20	94.44	98.61
71 male	55	6.25	5	25	96.53	98.61
72 female	61	6.25	10	25	97.22	98.61
35 male	58	7.5	20	25	89.58	93.06
55 male	53	10	25	25	77.78	93.06
46 female	65	10	15	50	94.44	94.44

Participant #	Age	PTA (dBHL)	4 kHz	8 kHz	Function Rec.	Form Rec.
43 female	59	12.5	25	15	87.5	95.83
3 female	64	12.5	15	15	98.61	97.22
76 male	63	13.75	25	45	94.44	90.97
74 male	52	16.25	20	30	99.31	97.22
11 female	54	17.5	15	10	95.83	88.19
75 male	63	17.5	35	60	99.31	95.14
77 female	58	18.75	30	NR	88.19	97.22
53 female	66	18.75	20	35	95.14	95.83
80 male	57	20	45	60	88.19	90.28
67 male	60	21	25	35	92.36	97.22
49 female	64	25	50	60	87.5	95.14
52 male	67	27.5	55	55	84.72	95.83
12 male	63	33.75	50	65	98.61	98.61
79 male	65	35	65	70	93.06	99.31
19 female	66	38.75	50	55	86.81	88.89

PTA levels were correlated with scores on form and function reception tasks and there was found to be no significant level of correlation ($p<.05$). Indeed it can be seen that, among the six participants who showed a degree of hearing loss above the normal limit, there were some very high scores (eight out of twelve being above 92%). A mild hearing impairment was thus not deemed to be a reason for excluding participants, although it is possible that the participant whose hearing is most impaired scored relatively low on these two tasks because of hearing difficulty; an examination of scores on hard items (see Appendix 16) showed this participant scored consistently low on all the hard items.

4.2.2 Participants' performance: preliminary findings

A summary of findings showing how participants performed is shown in Table 4-4 with scores grouped by age and gender of participants. Participants' scores on all 36 subtests are given as percentages:

Table 4-4 Participants' performance by age and sex

Participants	Cases	Max. score (%)	Min. score (%)	Mean score (%)	Mean SD(%)
52-67 female	15	97.05	84.2	92.05	3.5
52-67 male	15	97.68	81.6	92.47	4.6
33-47 female	15	96.88	70.83	92.58	6.4
33-47 male	15	97.05	84.38	92.1	4.1
18-27 female	15	97.4	81.77	91.72	4
18-27 male	15	94.27	84.38	90.72	3.1

It can be seen that the standard deviation for 33-47 females is much higher, at 6.4 % than the other scores. This suggested the presence of some outlying participants, which was investigated and is reported on in 4.3.3.4

4.2.3 Distribution of scores

Scores within subtests showed ceiling effects as expected. This suggested that the distribution of scores was likely to be abnormal and a Kolmogorov-Smirnov test was run on the distribution of scores in each subtest. Results are listed in Appendix 7. Non-normal distribution was confirmed in all subtests, with an alpha level of $< .05$ in all and of $<.0001$ in half of them. Nonparametric tests were accordingly used in further calculations, with an alpha level of .05 for all.

4.3 Effects of independent participant variables

It was important to discover whether the test was equally valid for all participants regardless of variation in their gender, age and level of educational attainment.

4.3.1 Sex

Participants were equally divided for sex (female n=45, male n=45). Mann-Whitney tests were used to examine possible effects of sex on scoring, and the results are given in Appendix 8. A summary of the calculations for scores overall and in the four different modes are shown in Table 4-5 and show no significant effect for sex.

Table 4-5 Mann-Whitney tests for effect of sex

SUBTESTS	Gender	Cases	Mean Rank	*U*	*Z*	*p*
Overall	**female**	45	47.81	908.5	-.8395	.4012
	male	45	43.19			
Reception	**female**	45	46.68	959.5	-.4281	.6686
	male	45	44.32			
Production	**female**	45	47.92	903.5	-.8800	.3789
	male	45	43.08			
Function	**female**	45	47.42	926.0	-.6985	.4848
	male	45	43.58			
Form	**female**	45	47.61	917.5	-.7671	.4430
	male	45	43.39			

4.3.2 Age

Participants were equally distributed (n=30) across the three different age-groups (18-27, 33-47, and 52-67). Using Mann-Whitney tests (reported in Appendix 9), each age-group was compared with each other on individual subtests and those where there appeared to be a significant effect for age are shown in Table 4-6, Table 4-7 and Table 4-8, in order of degree of significance.

Table 4-6 Mann-Whitney tests comparing performance of 1st and 2nd age-group

SUBTESTS	Age group	Cases	Mean Rank	*U*	*Z*	*p*
Length Form	**18-27**	30	23.90	252.0	-2.9748	.0029
Production	**33-47**	30	37.10			
Pitch Form	**18-27**	30	24.28	263.5	-2.8032	.0051
Production	**33-47**	30	36.72			
Length Function	**18-27**	30	24.75	277.5	-2.5929	.0095
Production	**33-47**	30	36.25			
Length Function	**18-27**	30	34.88	318.5	-2.1954	.0281
Reception	**33-47**	30	26.12			
Accent Function	**18-27**	30	26.15	319.5	-2.0121	.0442
Reception	**33-47**	30	34.85			

It can be seen that participants from the middle age-group perform better than younger participants in 4 out of these 5 subtests.

Table 4-7 compares the youngest with the oldest participants:

Table 4-7 Mann-Whitney tests comparing 1st and 3rd age-groups

SUBTESTS	Age group	Cases	Mean Rank	*U*	*Z*	*p*
Length Function Production	**18-27** **33-47**	30 30	22.30 38.70	204.0	-3.7910	.0002
Pitch Form Production	**18-27** **33-47**	30 30	24.03 36.97	256.0	-2.9109	.0036
Level Function Production	**18-27** **33-47**	30 30	25.08 35.92	287.5	-2.6646	.0077
Range Function Reception	**18-27** **33-47**	30 30	36.12 24.88	281.5	-2.5412	.0110
Length Form Production	**18-27** **33-47**	30 30	25.73 35.27	307.0	-2.1396	.0324

Young participants perform less well in 4 out of 5 subtests. In both cases the effect is most apparent in Length production (both form and function).

Table 4-8 compares the mid-aged participants with the oldest ones:

Table 4-8 Mann-Whitney tests comparing 2nd and 3rd age-groups

SUBTESTS	Age group	Cases	Mean Rank	*U*	*Z*	*p*
Length Function Reception	**18-27** **33-47**	30 30	25.53 35.47	301.0	-2.5110	.0120
Silence Function Reception	**18-27** **33-47**	30 30	26.17 34.83	320.0	-2.3026	.0213
Loudness Function Production	**18-27** **33-47**	30 30	25.68 35.32	305.5	-2.1942	.0282
Rhythm Function Reception	**18-27** **33-47**	30 30	35.07 25.93	313.0	-2.1068	.0351

SUBTESTS	Age group	Cases	Mean Rank	*U*	*Z*	*p*
Pitch Function Production	**18-27** **33-47**	30 30	33.03 27.97	374.0	-2.0173	.0432

The older participants have higher scores in 3 out of 5 subtests, giving no clear direction of the effect of age. All the subtests affected are concerned with function (both reception and production).

4.3.3 Education

Educationally, participants were divided into two groups: those (n=46) who had stopped full-time education at the age of eighteen or before (18-) and those (n=44) who had continued beyond eighteen (18+). Mann-Whitney tests were performed (and reported in Appendix 10); the results are set out in Table 4-9.

Table 4-9 Mann-Whitney tests for effects of educational achievement

SUBTESTS	Education	Cases	Mean Rank	*U*	*Z*	*p*
Level Function Reception	**18-** **18+**	46 44	36.48 54.93	597.0	-3.5238	.0004
Glide Function Reception	**18-** **18+**	46 44	36.73 54.67	608.5	-3.3563	.0008
Pitch Form Reception	**18-** **18+**	46 44	38.23 53.10	677.5	-3.1395	.0017
Accent Function Reception	**18-** **18+**	46 44	37.48 53.89	643.0	-3.1084	.0019
Glide Form Reception	**18-** **18+**	46 44	39.52 51.75	737.0	-2.3731	.0176
Rhythm Function Reception	**18-** **18+**	46 44	39.61 51.66	741.0	-2.2639	.0236
Accent Function Production	**18-** **18+**	46 44	39.82 51.44	750.5	-2.2208	.0264
Silence Form Production	**18-** **18+**	46 44	50.57 40.65	789.0	-2.0151	.0439

The effect for education is significant (with values as shown in Table 4-9 Mann-Whitney tests for effects of educational achievement) in 8 of the 36 subtests, with a clear direction: the 18- participants scored consistently lower than the 18+ participants. It can be seen that the subtests where this effect obtains mostly concern function reception tasks (4 out of 8).

4.3.3.1 Effects of education across age-groups

Scores were examined across age-groups using and Kruskal-Wallis 1-way ANOVAs and Mann-Whitney tests (Appendix10b) , and it was found that 18- participants in the 18-27 and 33-47 groups showed no significant differences on any of the task-modes or on overall scores; and the 18- participants in the 33-47 group showed no significant difference in scores from the 18- participants in the 52-67 group. Similarly, the 18+ participants in the 33-47 group showed no significant difference from the scores of those in the 52-67 age-group, nor did 18+ participants in the 18-27 and 52-67 age-groups. Differences were, however, apparent as follows:

- 52-67 participants in the 18- group showed significantly higher scores than 18-27 18- participants on function task scores ($U = 88.5, p = 0.04$, 1-tailed) and on production task scores ($U = 77.5, p = 0.02$, 1-tailed) but not on overall scores, form tasks or reception tasks.

- 33-47 participants in the 18+ group showed significantly higher scores than 18-27 18+ participants on overall scores ($U = 95.5, p = 0.03$, 1-tailed), form scores ($U = 89.5, p = 0.02$, 1-tailed) function tasks ($U = 101.0, p = 0.04$, 1-tailed) and production tasks ($U = 79.0, p = 0.01$, 1-tailed) but not on reception scores.

4.3.3.2 Effects of education within age-groups

Further investigations were carried out to see what contrasts there were in performance within age-groups:

- 18-27 18+ participants scored significantly higher than 18-27 18- participants on overall scores ($U = 58.0, p = 0.01$, 1-tailed) function task scores ($U = 51.0, p = 0.01$, 1-tailed) and reception task scores ($U = 50.0, p = 0.005$, 1-tailed)

- 33-47 18+ participants scored significantly higher than 33-47 18- participants on overall scores ($U = 61.0, p = 0.002$, 1-tailed), function task scores ($U = 44.5, p = 0.0003$, 1-tailed), production task scores ($U = 64.0, p = 0.03$, 1-tailed) and reception task scores ($U = 56.0, p = 0.01$, 1-tailed)

- 52-67 18+ participants scored significantly higher than 52-67 18- participants on reception task scores only (U = 56.0, p =0.04, 1-tailed).

4.3.3.3 Summary of age and education effects

In summary, it can be seen therefore that when looking at the effect of age within an educational level, the only significant differences for 18- participants are between the oldest and youngest groups in function and production tasks, where the older participants score higher; and for 18+ participants the only significant differences are between the younger and mid-aged participants. Further investigation was carried out to find out how much of the variance was caused by difference in educational attainment.

4.3.3.4 Regression analysis

Although there was non-normal distribution of scores, as reported in 4.5, it was possible to do regression analysis because above 95% of cases had standardised residuals within the range -1.96 to +1.96. Calculations for regression analysis are reported in full in Appendix 11. As far as function tasks were concerned, three participants whose scores were more than 3 standard deviations away from the mean on reception scores were treated as outliers and excluded from the analysis. By these calculations, educational level accounted for 14% of variance in scores on function tasks. In reception tasks, again three participants were excluded, on the same grounds (one of whom had been an outlier on function tasks) and educational level was found to account for 15% of variance in scores on reception tasks. In production scores, age accounted for 8% of the variance in scores, while education accounted for 7% of the variance in overall scores. In all cases these are low levels of variance, not seen as affecting the validity of the test.

4.4 Effects of independent test variables

As a measure of test validity, half the participants heard the cues for reception tasks in order A, half in order B (reverse order). Mann-Whitney tests suggested no significant effect for cue-order. Results for individual subtests are given in Appendix 12. A summary of the calculations for scores in the three modes where change of cue-order applied and overall is shown in Table 4-10.

Table 4-10 Mann-Whitney tests for effect of cue-order variation

SUBTEST S	Cue-order	Cases	Mean Rank	*U*	*Z*	*p*
Overall	**A**	45	46.01	989.5	-.1857	.8527
	B	45	44.99			
Reception	**A**	45	47.90	904.5	-.8724	.3830
	B	45	43.10			
Function	**A**	45	47.22	935.0	-.6258	.5314
	B	45	43.78			
Form	**A**	45	44.89	985.0	-.2221	.8243
	B	45	46.11			

4.5 Distribution of scores

Scores on the entire procedure were turned into percentages, and the scatterplot (Fig. 4-1) shows the distribution of mean percentages overall (on the entire test) among all participants, grouped by their ages. The line-graph (Fig. 4-2) shows the frequency with which scores were achieved, taken from all participants.

Fig. 4-1 Mean percentage scores overall from all participants

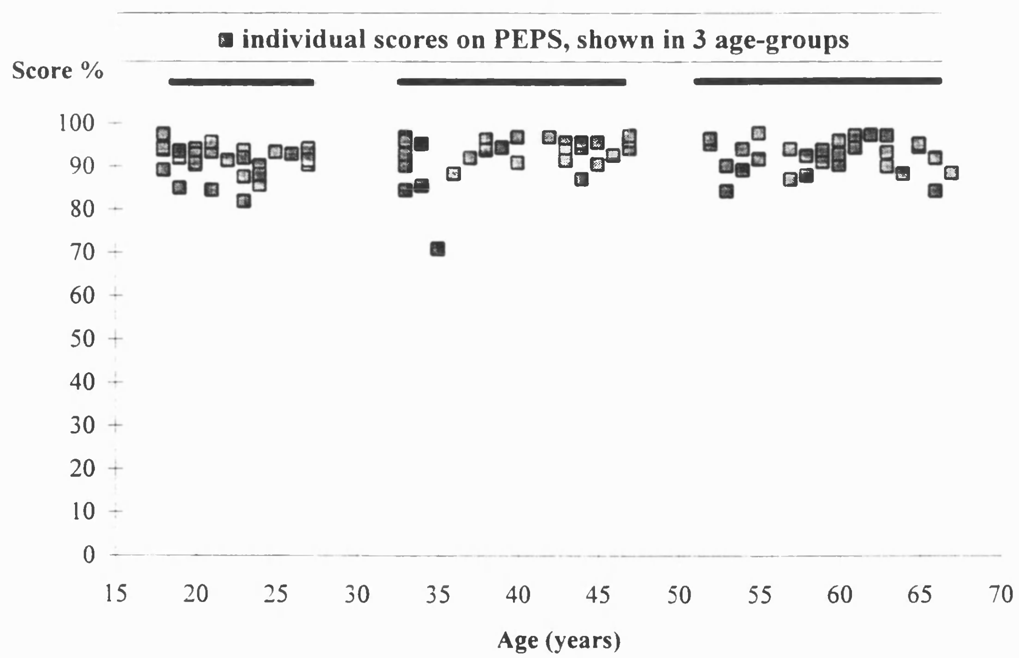
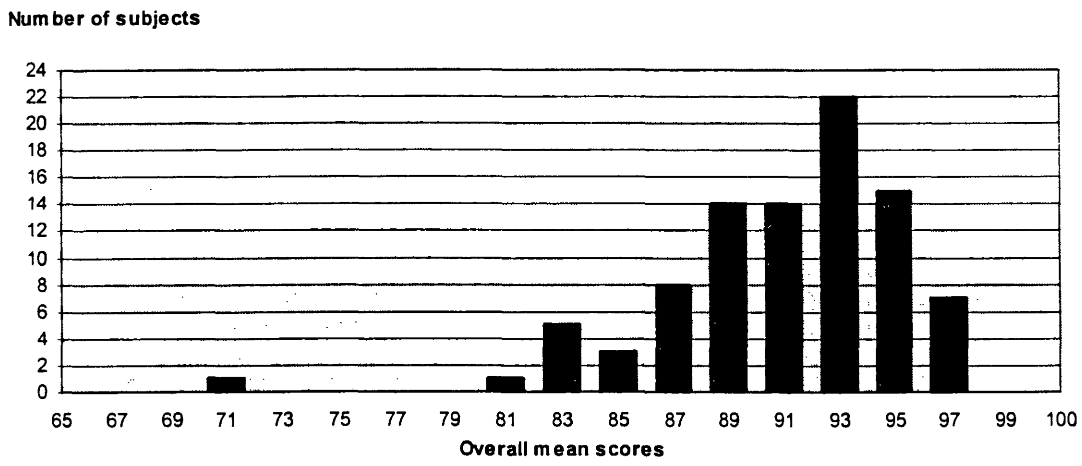


Fig. 4-2 Frequency of overall PEPS scores among all participants



The distribution is negatively skewed, with the lowest 20% of scores being spread between 88.6% and 81.8% (and one scoring 72.8%) while the scores of the highest 20% were concentrated between 96% and 97.7%.

4.5.1 Possibility of chance scoring

Results were examined to see whether scores within each subtest could have been obtained by chance. Since seventeen of the eighteen reception subtests consisted of binary options, binomial tables were consulted, and it was determined that, with a chance level of 0.5 in 16 items, participants scoring between 5 and 11 (inclusive) could be performing randomly (cf. 3.6.5.1) Of the 1530 reception subtests performed. 39 scores (2.55%) fell in this range (compared with 27 out of the 310 subtests (9.03%) performed by the three participants with aphasia.). Some clustering could be observed amongst the scores: one participant was responsible for 6 of these (possibly) chance scores and another for 5 (others for one or at most two); one subtest (Glide function reception: see 5.7) gave rise to 12 of them (others for between one and four).

These observations from the binomial tables have two implications, one for the test and one for prosodic norms. For the test, it suggests the Glide function reception subtest is the least reliable, although with an alpha level of .04 the risk of chance scoring does not achieve significance. For prosodic norms, with at least 97.45% of the reception tasks performed producing non-chance scores, it can be assumed that participants scoring 12 or more out of 16 on any subtest are performing within normal limits, while participants scoring less than 5 out of 16 are not using consistent prosodic patterns which can be inferred with any reliability.

4.5.2 Establishing the range of normal prosodic ability

Standard deviations can be used to determine the lower bounds of normal performance, scores more than 2 standard deviations from the mean being reckoned as falling below normal limits. This method should perhaps be used with caution since the scores are not normally distributed, but the lack of normal distribution is more apparent at the top end of the range rather than at the lower end. In the charts set out in Fig. 4-3, Fig. 4-4, Fig. 4-5 and Fig. 4-6, the subtests are divided according to task-mode (Fig. 4-3 function reception, Fig. 4-4 function production, Fig. 4-5 form reception, Fig. 4-6 form production) and subdivided by element. The range of normal prosodic ability extends from the maximum score (in all subtests there was at least one participant who obtained the maximum score) to two standard deviations below the mean; minimum scores are also shown.

Fig. 4-3 Range of normal ability on PEPS function reception tasks

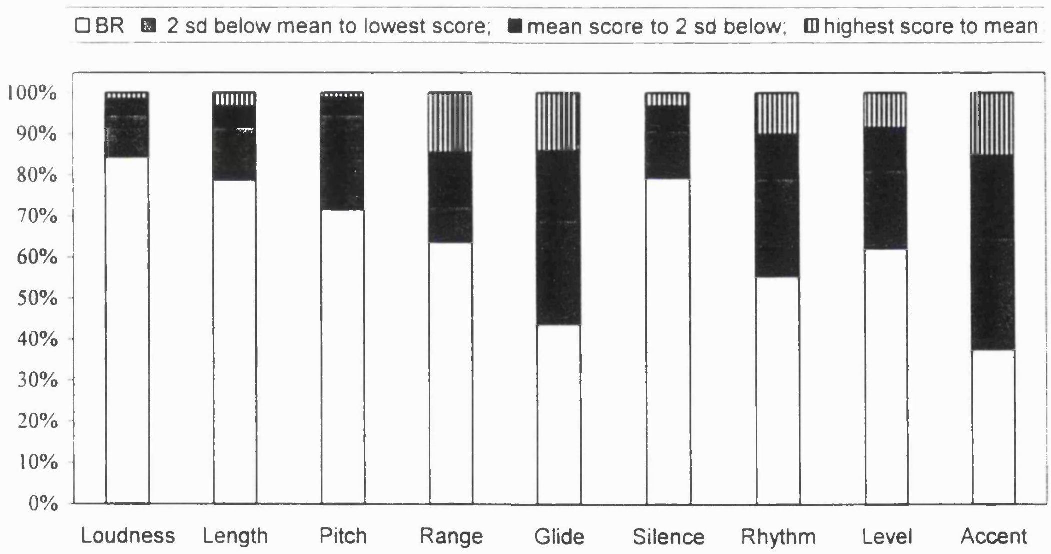


Fig. 4-4 Range of normal ability on PEPS function production tasks

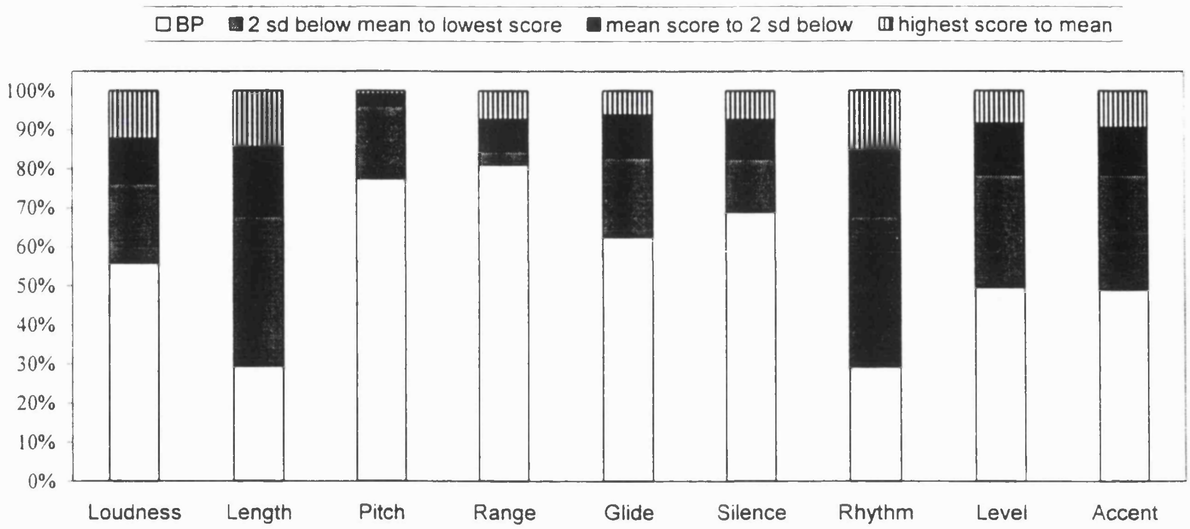


Fig. 4-5 Range of normal ability on PEPS form reception tasks

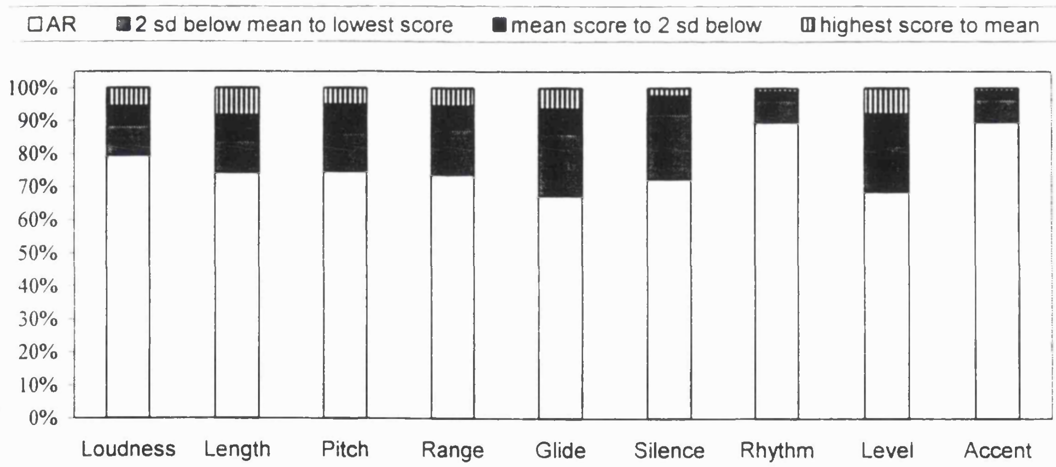
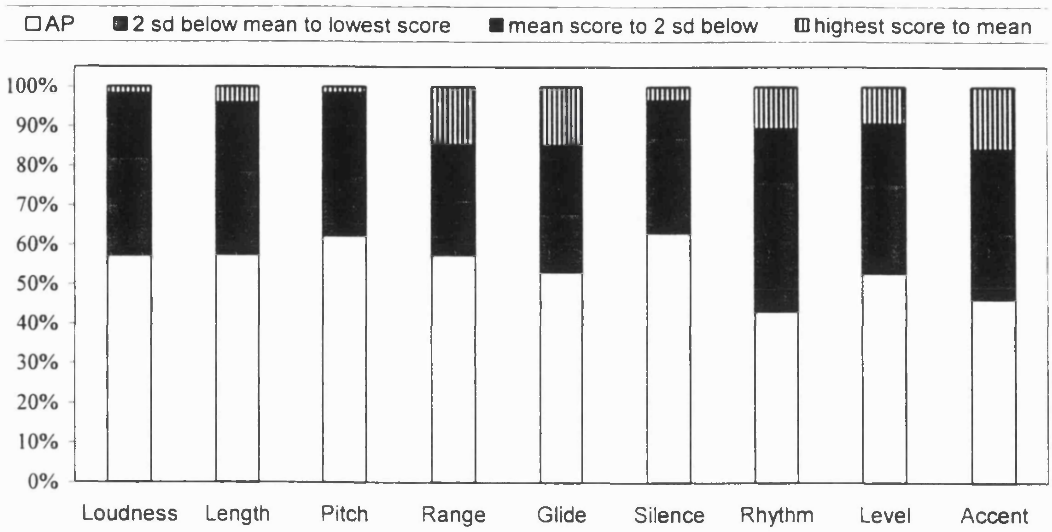


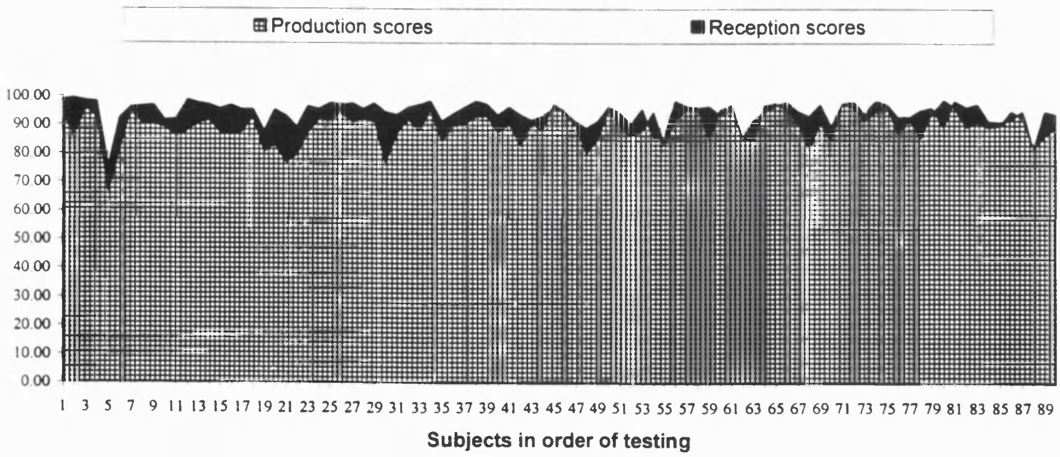
Fig. 4-6 Range of normal ability on PEPS form production tasks



4.6 Reception and production skills compared

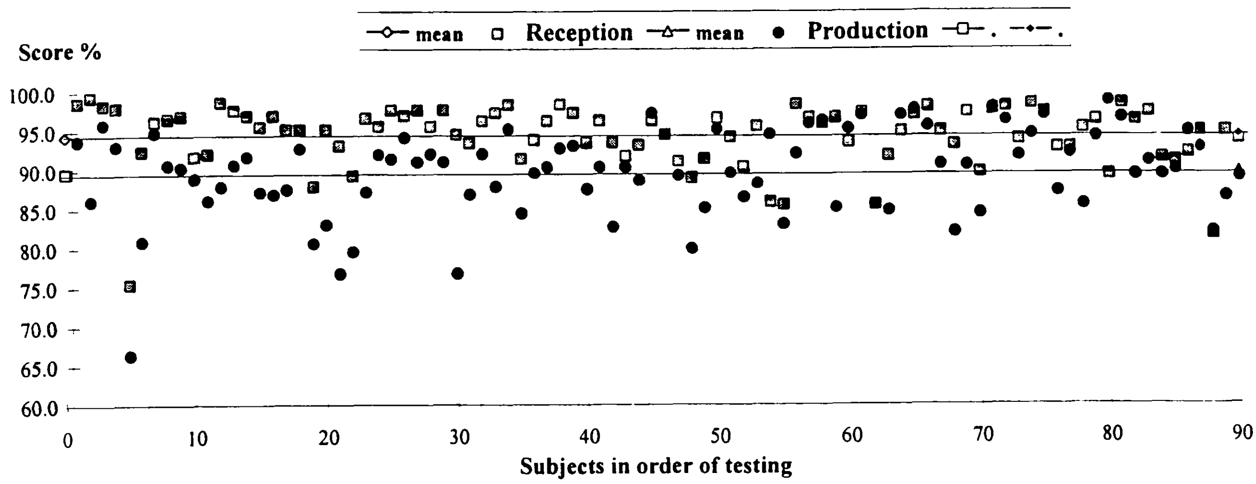
On the whole, reception percentages were higher than production scores, see Fig. 4-7.

Fig. 4-7 Overall comparison of reception and production scores



The mean of reception scores was calculated to be 94.3%, and of production scores 89.6%. In Fig. 4-8, the means are shown as horizontal lines, and each participant's reception and production scores are vertically aligned.

Fig. 4-8 Comparison of individual reception and production scores



Production tasks were designed to mirror reception tasks as far as possible to maximise the possibility of relating reception to production skills. To recapitulate: at the function level, participants first heard utterances with one of two specified and "opposite" meanings, and were then asked to produce similar utterances with similar polarities of meaning. At the form level, participants were required to produce a similar number of degrees of variation in the element as they had been able to process in the reception items.

Although differences in participants' scores ranged from +17.7% (reception higher than production) to -9.4% (reception lower than production), with a mean difference of +4.7%, there was a highly significant correlation ($p < .001$) between participants' reception and production scores overall. The implications of this are that unimpaired participants' level of reception ability is to some extent predictable from production scores, and vice versa.

This finding was investigated further to find out in which tasks and for which elements this correlation obtained. They are listed in Table 4-11, showing the degree to which the correlation was significant.

Table 4-11 Spearman's tests for correlation between reception and production scores

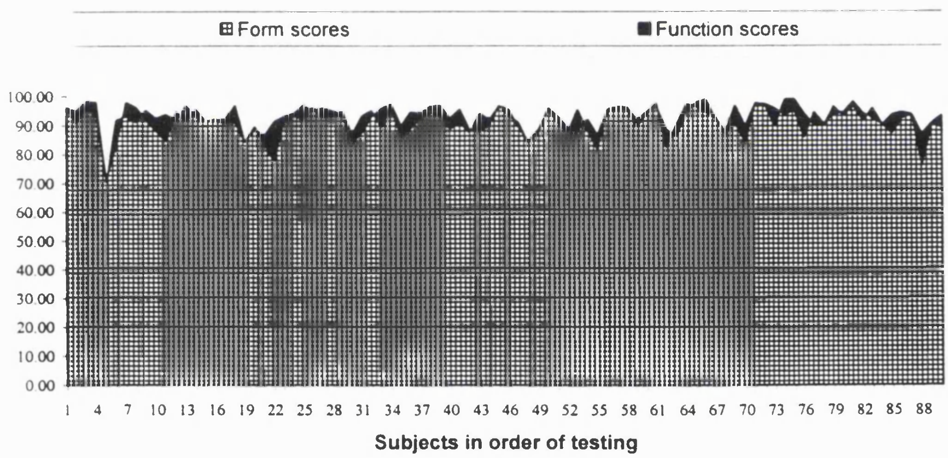
SUBTESTS	Cases		Means		SD		coefficient	*p*
	Rec	Prod	Rec	Prod	Rec	Prod		
Glide form	90	90	15.08	13.49	1.13	2.26	.4129	.000
Glide function	90	90	14.07	15.1	2.28	1.59	.4046	.000
Level form	90	90	14.78	14.84	1.49	1.84	.4909	.000
Silence form	90	90	15.64	15.1	0.78	1.33	.4218	.000

SUBTESTS	Cases		Means		SD		coefficient	*p*
	Rec	Prod	Rec	Prod	Rec	Prod		
Rhythm function	90	89	14.54	13.89	1.55	2.32	.3180	.002
Accent function	90	89	13.97	14.61	2.67	1.89	.2815	.008
Pitch form	90	90	15.25	13.49	1.25	2.26	.2570	.014
Pitch function	90	89	15.82	15.88	0.63	0.49	.2547	.016
Level function	90	89	14.85	14.03	1.4	2.03	.2286	.031
Rhythm form	90	90	15.83	14.28	0.4	1.87	.2255	.033

4.7 Form and function scores compared

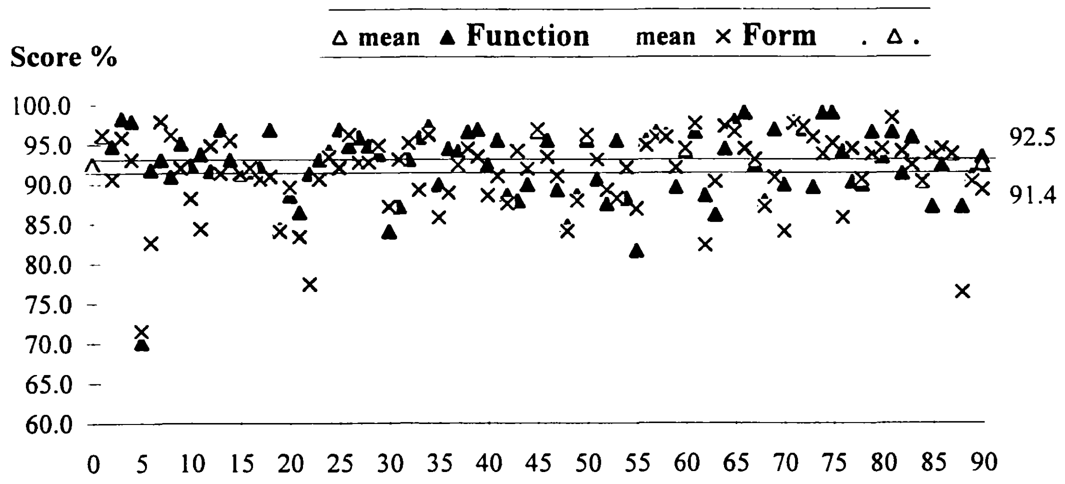
Form and function scores differed little, function scores being slightly higher than form scores, see Fig. 4-9

Fig. 4-9 Overall comparison of form and function scores



In Fig. 4-10, participants' form and function scores are vertically aligned, and the two horizontal lines show the mean scores for form and function tasks, respectively 91.4% and 92.5%.

Fig. 4-10 Comparison of individual form and function scores



The relationship between function and form (research question #3) was examined using Pearson correlation coefficients. Table 4-12 shows which subtests showed significant correlations between individual subtests within elements.

Table 4-12 Spearman's tests for correlation between form and function scores

Subtests	Cases		Means		SD		coefficient	*p*
	Function	Form	Function	Form	Function	Form		
Glide reception	90	90	14.07	15.08	2.28	1.13	.4278	.000
Pitch reception	90	90	15.82	15.25	0.63	1.25	.3873	.000
Accent reception	90	90	13.97	15.85	2.67	.38	.2700	.010
Length production	89	90	14.03	13.79	1.13	2.26	.2542	.017
Pitch production	89	90	15.87	13.48	.49	2.26	.2459	.020
Loudness production	90	90	14.26	14.0	1.25	1.92	.2141	.043

4.8 Reliability and validity of the test

Several aspects of the data were examined for the test's reliability and validity. These included:

- an investigation into practice effects;
- re-testing 10% of the participants after a lapse of six months

- re-scoring the first 18 participants after 30 participants had been tested (intra-rater reliability); and
- comparing the judgements of two other scorers with those of the first scorer (inter-rater reliability).

4.8.1 Practice effects

4.8.1.1 Practice effects within subtests

Since participants were "trained" in all tasks by having at least two practice items, it was not expected that they would show any practice effects, i.e. any observable tendency to score higher (or lower) at the end of a subtest than at the beginning. The longer (reception) subtests, containing sixteen items, were however analysed to see if such effects were apparent. Scores on the first five items were compared with scores on the last five in each subtest, the middle six responses thereby constituting a buffer between what could be considered as 'start-zones' and 'end-zones'. Items identified as "hard", i.e. those where approximately 50% of participants scored 0, were discounted. A full table of the results is given in Appendix 13. If a participant scored higher in the end-zone than in the start-zone they were deemed to have learned; if lower, to have tired, or shown the effects of fatigue. The comparison of scores was examined for both test performance and participant performance.

A first consideration here was the amount of difference between start-and end-scores that might be said to constitute a learning/fatigue effect. It was judged that differences of only one point could be caused by any number of reasons, such as lapses of attention, and not necessarily by learning/fatigue effects; therefore only differences of more than one point were taken into account.

One result of this analysis was that it emerged that participants who scored low overall in reception tasks showed both learning and fatigue effects (practice effects), while high-scoring participants showed neither (i.e. variations of no more than one point between start- and end-scores): the inverse correlation between overall reception scores and practice effects was high at -0.76.

A greater number of participants showed a bias towards learning effects rather than towards fatigue effects: 12 participants showed learning effects in more than 4 subtests while showing fatigue effects in at least 3 fewer subtests, while the reverse was true for only 2 participants.

From the angle of participant performance, the results were examined to see whether participants showed:

a. significant learning effects

b. significant fatigue effects

c. whether participants showed both (in different subtests), or showed consistency of learning or tiring across subtests.

Table 4-13 shows a summary of learning and fatigue effects shown by the participants.

Table 4-13 Practice effects: participants' performance

Subtests per participant showing effect (Max =36)	Cases (Participants) showing effect (Max = 90)	Learning	Fatigue	Both
1	81	44	37	12
2	14	7	7	1
3	5	2	3	1
4	2	0	2	0
5	2	0	2	0
6	0	0	0	0

It can be seen that only 2 participants out of 90 showed practice effects (fatigue) in 5out of a possible 36 subtests, so there was deemed to be neither significant learning effects nor significant fatigue effects, and no widespread consistency among participants as to one or the other.

Table 4-14 shows test performance. The numbers of participants who showed effects are grouped in four columns showing how great was the difference in start-scores and end-scores; for example, of the 14 participants whose start- and end-scores differed by more than 1 point, there were 6 who showed differences of more than 2 points, of whom 1 showed more than 3 points' difference. By this means, any unevenness between tasks should be observable, showing any particular bias towards learning or fatigue effects and which tasks were responsible for practice effects.

Table 4-14 Practice effects: test performance

Subtests showing effect	Learning Effects >1	>2	>3	>4	Fatigue effects >1	>2	>3	>4
Rhythm Function	14	6	1					
Glide Function	3	2	1		7	1		
Range Function	8				2	1		
Accent Function	1				8	3		
Level Function	6				3			
Glide Form	3				2	2		
Silence Form					4			
Range Form	3				1			
Level Form	2	1			2			
Length Form	2				2			
Pitch Function	1				2			
Pitch Form	1				2			
Silence Function	1	1			1			
Loudness Function					1			

It can be seen that the Rhythm Function task, the Glide Function task and the Range function task were responsible for more effects than the others, and the special difficulties of these tasks are discussed further in 5.2.2.2, 5.7, and 5.2.2.1 respectively.

4.8.1.2 Practice effects over whole test

The question of whether participants tired or learned over the whole test could not be calculated, since comparing the initial and final subtests within each task mode reflected the difficulty of the subtests in the elements concerned, and this obscured the practice effects.

4.8.2 Retest

The following table (Table 4-15) shows the differences in scores for first test and retest.

Table 4-15 Reliability: test-retest

Participants # 1st: i Retest: ii	Overall Percent	%Reception	%Production	%Function	%Form
#5 I **#5 ii**	70.83 70.83	75.35 79.17	66.32 62.5	70.14 74.31	71.53 67.36
Difference	0	+3.82	-3.82	+4.17	-4.17
#42(i) **#42(ii)**	88.02 86.98	93.4 94.79	82.64 79.17	88.54 88.54	87.5 85.42
Difference	-1.04	1.39	-3.47	0	-2.08
#49 I **#49 ii**	88.02 87.15	91.32 95.14	84.72 79.17	88.54 87.50	87.50 86.81
Difference	-0.87	+3.82	-5.56	-1.04	-0.69
#10 I **#10 ii**	90.28 92.36	91.67 94.44	88.89 90.28	92.36 93.75	88.19 90.97
Difference	+2.08	+2.78	+1.39	+1.39	+2.78
#17 I **#17 ii**	91.32 93.40	95.14 96.18	87.50 90.63	92.01 93.75	90.63 93.06
Difference	+2.08	+1.04	+3.13	+1.74	+2.43
#41 I **#41 ii**	93.23 93.23	96.18 95.83	90.28 90.63	95.49 95.83	90.97 90.63
Difference	0	-0.35	+0.35	+0.34	-0.34
#7 I **#7 ii**	95.49 95.49	96.18 96.88	94.79 94.10	93.06 93.40	97.92 97.57
Difference	0	+0.69	-0.69	+0.35	-0.35
#58 I **#58 ii**	96.01 97.05	95.83 97.22	96.18 96.88	96.18 98.26	95.83 95.83
Difference	+1.04	+1.39	+0.69	+2.08	0
#71 I **#71 ii**	97.68 97.57	97.57 97.57	97.79 97.57	97.79 97.92	97.57 97.22
Difference	-0.11	0	-0.22	+0.12	-0.35

The mean of the variations between first and second trials was calculated and is given beneath the mean scores obtained by the participant in the two trials on each of the four modes and in the test overall. The larger swings can be seen in the lower-scoring participants.

The scores were also examined to see how consistently the test had performed, and whether there were any subtests which were more prone to variation in retest than others. Maximum variation reached 11 (out of a potential score of 16) for one participant on Length form production and for another on Accent form production. Standard deviations between first and second tests were calculated on the differences: the maximum was 3.9 in the form production subtest for Length. 15 of the 36 subtests showed standard deviations of over 2; 8 of these were form production subtests (all except Silence), 5 were function production subtests and 2 were function reception subtests. Form reception subtests showed a maximum standard deviation of 1.5 (Level).

4.8.3 Intra-rater reliability: results of re-scoring

The first 18 participants were re-scored after 30 participants had been tested. There were two aims in re-scoring: one was to discover whether the principles of scoring had evolved and changed as a result of multiple test-scoring, and the second was to see whether, in cases where the scoring principles had not changed, the scorer's judgements were consistent. Reception scores were found to have undergone no change and judgements were consistent.

As far as evolution was concerned, the principles of scoring form production tasks were found to need some revision to ensure consistency, and subsequently all the first 30 participants' form production tasks were re-scored to reflect the changes. All the remaining 60 participants, and the tests marked by other judges, were scored according to the revised principles. A typical revision involved the scoring of the Pitch form production task: participants tended to produce an utterance with no pitch-movement for their production of very high pitch, and downward or upward glide (usually upward) for their production of the next requirement ("not quite so high as your highest"). In early tests there was some variation in scoring according to whether the starting-pitch or the end-pitch of the second response was considered to be the response. The revision stipulated that starting-pitch was to be considered.

Consistency improved in the course of scoring the first 18 participants, as shown in Table 4-16

Table 4-16 Intra-rater reliability

Participant:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
% variation	5.6	5.6	3.8	4.2	15	1	3.8	3.5	1
Participant:	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
% variation	4.9	3.1	1.4	1.7	2.4	2.1	2.1	3.1	2.4

The first 5 participants showed variation in scoring of up to 15% and the last five less than 3.1%. The mean rate of variation over participants 1-18 was 3.6%; over participants 1-9 it was 4.8%, and over participants 10-18 it was 2.6%. The latter rate can be considered as the likely rate of intra-rater variation for the remaining 80% of participants.

4.8.4 Inter-rater reliability: results of second marking

A spreadsheet showing how the scores were compared is given in Appendix 14, and a summary chart of percentage agreements on each of the tasks marked is shown in Table 4-17

Table 4-17 Inter-rater reliability

	Loudness Function	**Length Function**	**Range Function**	**Glide Function**	**Silence Function**	**Rhythm Function**	**Level Function**	**Accent Function**	
% Agreement	97.1	90.9	90.1	93.3	98.4	88.5	97.9	95	
Number of participants	9	9	9	8	9	9	9	8	
Number of items	72	72	72	62	72	72	71	127	
	Loudness Form	**Length Form**	**Range Form**	**Glide Form**	**Silence Form**	**Rhythm Form**	**Level Form**	**Accent Form**	**Pitch Form**
% Agreement	88.9	81.9	84.4	89.1	95.3	87.8	89.6	84.4	80.8
Number of participants	7	9	9	9	9	9	9	9	6
Number of items	56	110	72	72	72	70	72	72	74

Maximum agreement on one subtest (Silence function production) reached 98.4%; minimum agreement (on Pitch form production) was at 80.8%. Not all the tasks lent themselves well to second-marking, mainly because of the design of the scoresheet: the second marking of the

Pitch function production task could not be deciphered reliably, so these were left out of the calculations.

The second markers did not evaluate the "absolute" appropriateness of the function production task utterances, i.e. how well the responses would achieve their function out of the context of the test situation; they evaluated only the "relative" value, i.e. which of the two communicative functions was intended. Agreement was better on function production tasks (93.9%) than on form production tasks (86.9%), where the scoring procedures allowed more latitude. On 1263 items, agreement between three scorers (the researcher, the experienced colleague and one of the recently-qualified therapists) was 90.2%. This level of agreement suggests that the scoring procedures were readily learned by novices. It also suggests that the extent to which they were prone to subjective interpretation was at an acceptable level, except perhaps in the two subtests where agreement was lowest (Pitch form and Length form). The second markers commented on the difficulty of scoring these tasks.

4.9 Function production tasks

The function production subtests were examined in some detail, in order to determine which were the elements that participants used for the production of different meanings; (see 1.10, research topic #4). 80% of the results were selected at random from the population of the study.

Being purely concerned with the variability of prosodic exponency in the unimpaired population, this question has been considered as subsidiary to the main study, which is more concerned with individuals' ability to succeed in conveying the functions, rather than with the variation in the prosodic means they deploy to do so. The calculations and tables are not explained in precise detail nor have they been subjected to statistical analysis. They are intended as a rough guide to the frequency with which elements had a role in the function production tasks.

The aim of this analysis was to find out:

- how far these subtests bore out the assumptions found in the literature reviewed in chapter 1, as to the distribution of elements in functions. A summary of the distribution of elements in the data is given in 4.9.1.
- common combinations of elements for certain functions. This would be of interest if it emerged that one linguistic function was crucially dependent on one element, and if

production of the form of that element was not available to a person. A hypothetical example of this is that a falling-rising tone is (arguably) a crucially important prosodic means of implying a doubtful or reserved attitude, and there was some (but not significant) evidence during testing that some participants found this tone hard to produce.

- whether individual participants used the entire range of elements. For possible implications of low use of particular elements, see 5.9.1.1.
- how far the perceptions of prosodic elements were borne out by measurement: for this purpose, some of the responses, as recorded by laryngograph, were analysed instrumentally using a computer program.

4.9.1 Distribution of elements in functions

In order to find out which elements were used for which functions the following further analyses and calculations were carried out.

4.9.2 Use of section-element

Individual function production subtests were examined to see whether the participants used the section-elements consistently in that function. Judgments as to how the participant was using the element (e.g. whether a monosyllabic utterance sounded clipped and therefore short, or drawled and therefore long) were relative to the participant's own parameters and based on the tester's experience of the participant's speech as gained during testing. Two points were scored for every item where the section-element showed expected marked (non-default) use (e.g. brisk = short). One point was scored for default use (e.g. brisk = medium length); and zero for unexpected marked use, e.g. (brisk = long). (For unexpected marked use, see next paragraph.) Thus if no variation was made of the section-element, the score would be 8 (8x1); a score lower than 8 would indicate unexpected use of the element in at least some items. As an example, a score for the subtest on Length function production where the participant consistently used markedly short utterances to indicate briskness but utterances consistently unmarked for Length (i.e. medium-length) to sound relaxed would be 8 (=4x2) plus 4 (=4x1) making a total of 12. This score is designated the "element-use."

Tables were made (Table 4-18 and Table 4-19) showing the scores for each section-element in the second of five columns assigned to it (see also Appendix 15). The first column shows the participant's score on the task in terms as a whole if it was 12 or less. In the third, fourth and fifth columns are listed, in order of importance, other elements which convey the meaning-function in the task. The elements are denoted by number: Loudness 1, Length 2, Pitch 3, Range 4, Glide 5, Silence 6, Rhythm 7, Level 8 and Accent 9.

4.9.3 Negative polarity: unexpected marked use of elements

An example of negative polarity, or unexpected marked use of an element, is the use of lengthening to indicate briskness instead of lack of it: this was highly infrequent. Where it occurs in the study, the element concerned is shown with a minus in the scores in Appendix 15. Examples occur in the variation of Range in the Rhythm subtest for participants #8 and #15: i.e. their utterances were narrow when they were sounding as though they had said the item many times before, and wide when they were sounding as though they were saying it for the first time. As established in 1.6.3, wide range is generally associated with greater emotional involvement, so that it was expected that wide range would indicate having repeated something many times before.

Pitch and Loudness are also scored as being used with negative polarity by some participants in the Rhythm subtest; Range for one participant in the Length subtest; Range again for one participant in the Silence subtest; Loudness for two participants on the Range subtest; Pitch (one participant each) on the Loudness and on the Accent subtests. In addition it should be noted that these are cases where the participant used this polarity for two or more items, but there were also participants who used it in single instances.

4.9.4 Use of other elements

Elements were very seldom used as critical disambiguators by the participants to the extent that they were by the researcher in reception cues, i.e. the number of elements used by a participant in function production tasks was usually more than one. Regardless of whether the section-element was used consistently, subtests were examined for the role of other elements.

Occasionally, elements other than the nine included in the procedure were used, but seldom so consistently as to be important factors in the disambiguation of the utterance. Variations in voice quality consisted mainly of breathiness, which was sometimes associated with urgency and also with surprise. Tense or precise articulation sometimes (5% of all items) accompanied an item being said as though it had been said many times before (Rhythm subtest). Pauses were sometimes filled; one participant used this as the main means of indicating uncertainty (Silence subtest). In the Pitch subtest, participants occasionally used the utterance "mhm" instead of "m": this almost always as a request for continuation.

Table 4-18 and Table 4-19 show the proportions in which elements other than the section-element were used in the function production task assigned to each element, and some clarification is necessary.

Headers for Table 4-18 and Table 4-19:

The task is shown at the top of each column; in the same cell, the percentage shows the proportion of participants using the section-element to make the meaning of the utterance clear. The number of participants examined is also listed here.

For each task there are three columns, labelled "1st" "2nd" and "3rd": these denote the consistency with which elements were used. The same configuration was used for each participant and the complete set of results for all participants is given in Appendix 14. The table represents a summary of the frequency with which certain elements were preferred for certain tasks. Thus an element featured under "1st" would have been used in at least 7 out of the 8 items in a subtest to convey meaning, either instead of or in addition to the section-element. "2nd" elements were the next most consistently used, and "3rd" elements were used with some consistency. For a fuller discussion of the frequency with which participants used different elements see 5.9 and 5.10.

Stub:

The elements listed at the side are the ones that feature with the section-element in conveying the meaning in the section-task. In the tasks for which they are the section-element, they are frequently the main means for making meaning clear and therefore feature seldom as an alternative means (and are marked "x" in the table). In cases where they featured in the task but to a lesser extent than another element, the frequency with which they were used is indicated by a number.

It is clear from the chart that some elements are used with outstandingly greater frequency than others for some tasks, and these stand out in the table. For example, 38 out of 70 participants varied Range consistently in the Pitch task (requesting repetition or continuation), i.e. considerably more than those who varied Glide-direction (12 participants, with a further 9 using it with some consistency) or Length (8 participants using it very consistently, with a further 14 using it fairly consistently) or Loudness (4 participants using it with some consistency).

Table 4-18 Use of elements other than section-elements in first five function tasks

	Loudness Task: 89.2% Cases: 73			Length Task: 35.2% Cases: 71			Pitch Task: 52.9% Cases: 70			Range Task: 83.6% Cases: 73			Glide Task: 76.7% Cases: 73		
Element	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Loudness	x	x	x	**32**	**11**	4	0	1	3	**14**	**10**	3	1	1	3
Length	3	3	5	x	2	x	**8**	**14**	0	1	2	5	0	1	1
Pitch	**33**	**17**	1	**10**	**11**	5	x	1	x	**32**	**14**	5	**24**	**16**	1
Range	**2**	**15**	2	4	8	4	38	6	3	x	3	x	**21**	**10**	5
Glide	2	0	2	4	7	4	**12**	7	2	5	7	0	x	2	x
Silence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhythm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4-19 Use of elements other than section elements in remaining four function tasks

	Silence Task 31.9% Cases: 72			Rhythm Task 40.3% Cases: 72			Level Task 45.7% Cases: 70			Accent Task 80.3% Cases: 71		
Element	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Loudness	0	1	1	**5**	**15**	3	1	0	0	**6**	9	6
Length	**57**	**11**	1	**29**	**11**	2	**23**	**21**	8	**23**	**11**	7
Pitch	2	7	2	4	3	5	0	3	1	4	7	4
Range	0	1	1	**4**	**10**	1	0	0	0	3	3	0
Glide	1	4	1	**9**	**5**	2	0	0	0	0	0	0
Silence	x	x	x	1	2	4	**28**	**24**	5	**14**	**22**	4
Rhythm	1	**16**	11	x	x	x	0	0	1	0	0	0
Level	0	0	0	0	0	0	x	x	x	0	0	2
Accent	0	0	0	0	3	1	0	0	0	x	x	x

Ways in which these figures could be of use in establishing norms for prosodic usage are discussed in 5.9.2.

4.9.5 Measurement of perceived variability of exponency

The figures given in the foregoing sections have been based on perceptual evaluation of the elements featuring in responses. In order to find out how instrumental measurement agreed with these findings, laryngograph signals from participants' responses in the function production tasks for Accent and Level were examined using a computer program designed (in the Phonetics Department at University College London) to display speech signals in visual form, quantifying the loudness, the relative pitch and the length of any given section of an utterance.

These two tasks have been singled out for measurement for different reasons. The Accent task (focus) because of the great variety of exponency for marked (and unmarked) accent-forms that was observed in the responses, and the Level task (delimitation) was examined because in perceptual terms it proved difficult to attribute tokens in the responses to the categories 'level' and 'moving'.

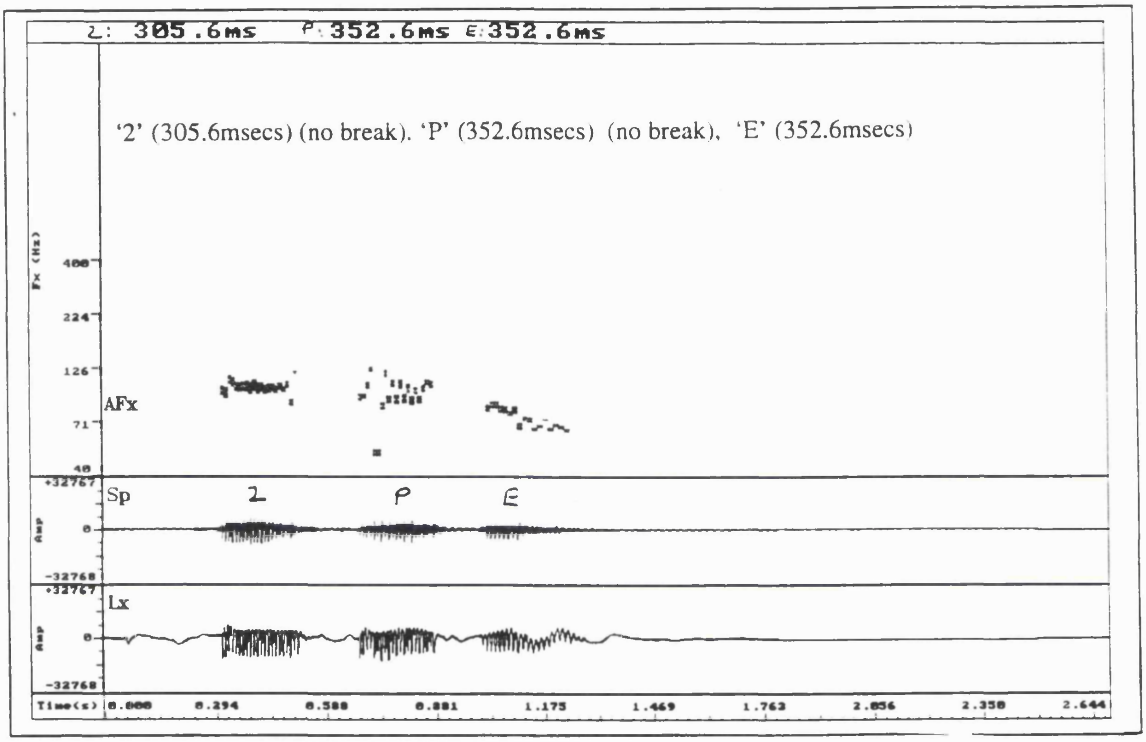
The laryngograph signals of a selection of items were displayed to see whether these categories were clear in visual form. Broadly speaking, the perceptual categories were discernible in the visual display, but perceptions and images did not concur well in minutiae, and many decisions as to the discreteness of the items to be measured would have had to be taken in order to determine categories of responses by this means.

4.9.5.1 Measurement of responses in the Accent function production task

It was expected that participants would use a marked rather than an unmarked accent pattern (Halliday, 1967). The following figures show how existing categories were subdivided so that such judgements could be made. On the basis of earlier research and our pilot studies, the elements of marked accent were expected to include lengthening and extra loudness on the focal digit, step-up before it, and falling pitch-movement on it, and possibly silence before and/or after the accented digit (cf. Wells, 1986). It is generally recognised that where accents are prefinal (and signalling focus), the 'tail' syllables continue the pitch from where it ends after the movement on the focal syllable (O'Connor & Arnold, 1973; Quirk, Greenbaum, Leech & Svartvik, 1985). It was therefore expected that syllables after the focal digit would continue the movement produced on the focal digit.

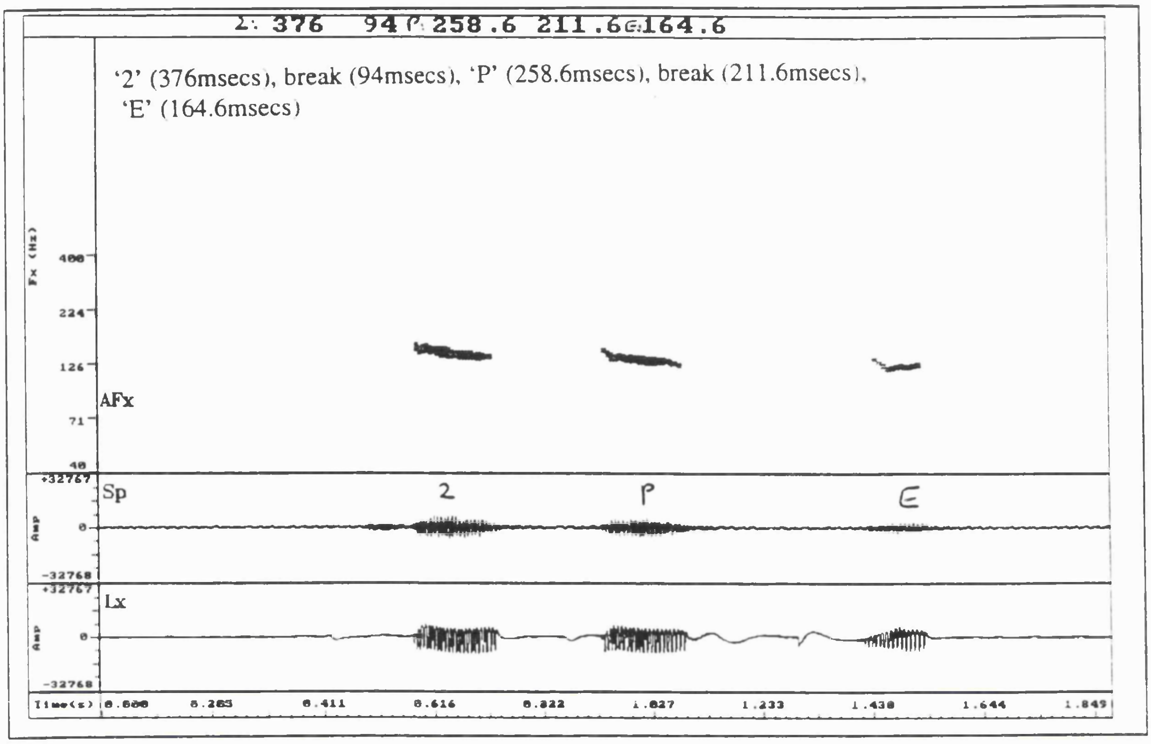
An unmarked accent-pattern was defined as a pattern lacking the use of these elements, except for declination (i.e. each syllable starting at slightly lower pitch than the previous one: see 't Hart, Collier & Cohen, 1990) and falling pitch-movement on the final digit. This is the pattern usually associated with 'broad focus' (Ladd. 1996). Fig. 4-11 (participant No. 12) shows a classic example of unmarked pattern, with all digits of similar length, no breaks between them, and even pitch-pattern with fall on the final digit:

Fig. 4-11: Unmarked accent-pattern (No. 12)



The definition of unmarked accent-pattern was extended to include those patterns where *all* digits were 'accented', i.e. sounded emphasised, but where none was relatively more accented than another. Fig. 4-12 (participant no.30) shows a small pitch excursion and fall on each digit with breaks between each:

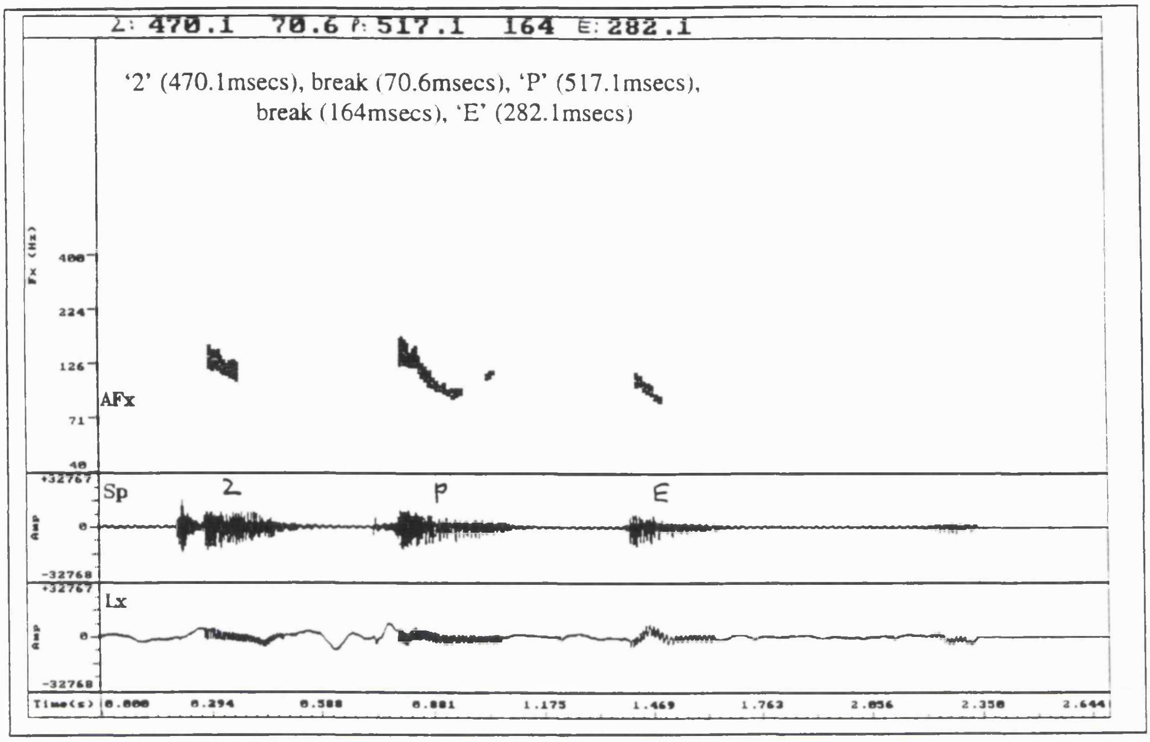
Fig. 4-12: Unmarked accent-pattern (No 30)



'Dual accent' is the term used to describe utterances where the participant added prominence to the focal digit while retaining characteristics of unmarked accent pattern by putting a pitch-movement (usually a fall) on the final digit and maintaining declination. Prominence on the focal digit could take a number of forms: lengthening, falling-rising pitch-movement, step-up (in which case declination was not maintained), and/or silence. Two illustrations are given in Fig. 4-13 and Fig. 4-14. In both cases, the focus is on the middle digit, P.

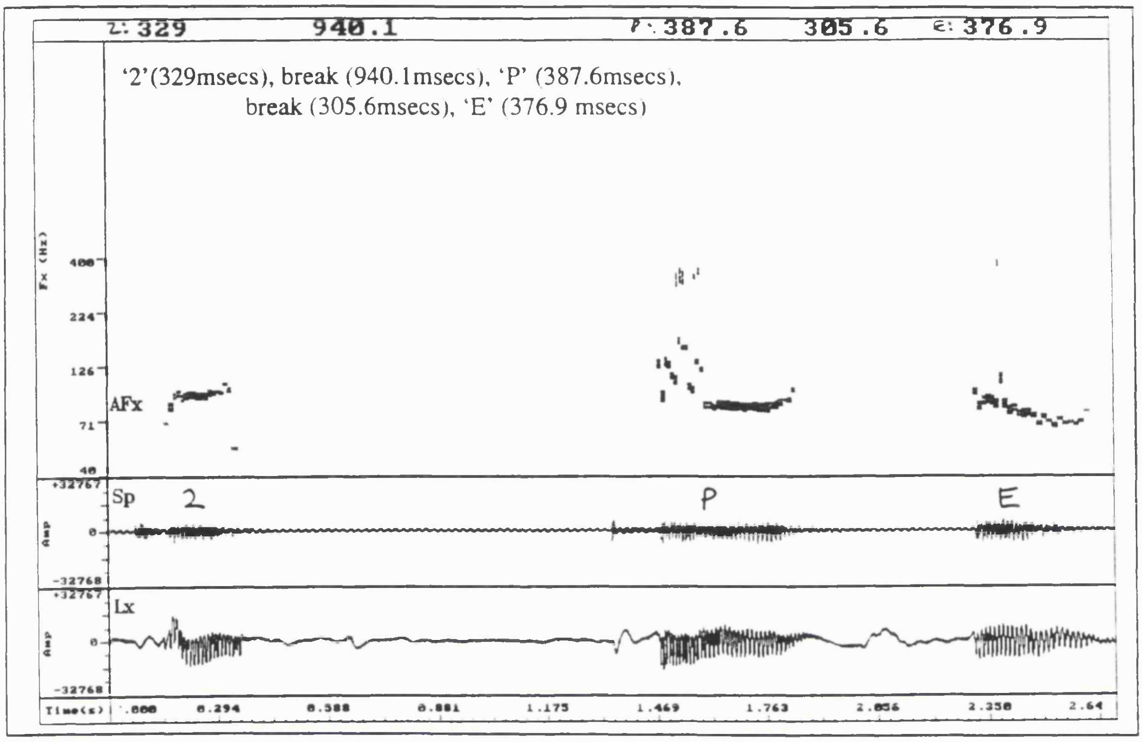
Figs. 4-13 and 4-14 are shown overleaf:

Fig. 4-13: Exponency of dual accent. (No 40):



This participant makes a small gap and slight pitch excursion up before the 'P', on which there is a steep fall-rise (although the rise does not feature in the display very clearly) and another short break and small step-up before the contour turns to a (quieter) fall on 'E'.

Fig. 4-14: Exponency of dual accent. (No. 26):



The participant in Fig. 4-14 (No. 26) makes, most noticeably, a long break before the focal digit and a shorter break after it. The focal digit has a pitch excursion upwards before it, and what was perceived as a shallow fall-rise on it but which in the display has more the form of a fall. The pitch-flow appears to be interrupted by a slight step up and a fall-rise on the 'E'. The impression here is one of exaggerated focus, as if the 'P' has been put in inverted commas.

Utterances with dual accent pattern go against the expectation that digits after the focal one will continue the pitch-movement produced on the focal one. Dual accenting occurred in 12.3% of the responses; 10% of the participants used it in more than one third of their responses.

4.9.5.2 Measurement of responses in the Level function production task

The following illustrations show the presence of pitch-jumps, glide-presence, lengthening and silence in delimitative tasks. Fig. 4-15 and Fig. 4-16 both from participant No.84, demonstrate variation in all four elements:

Fig. 4-15: a 2-list (No. 84)

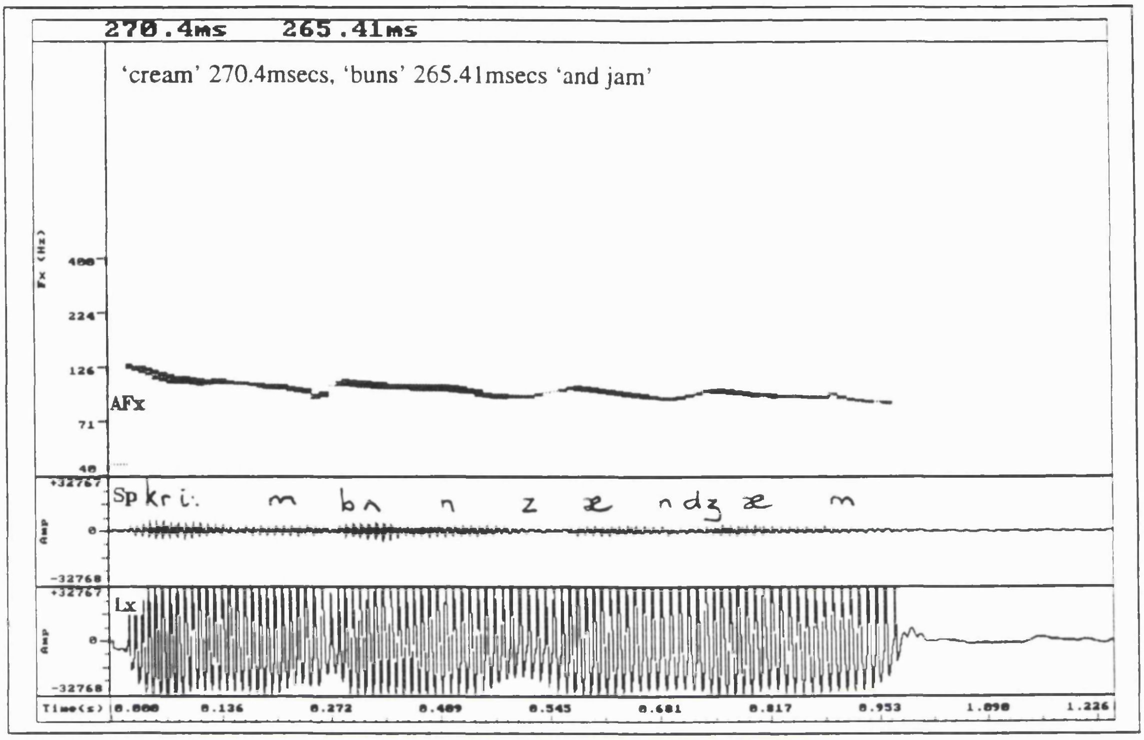


Fig. 4-15 shows the second word virtually the same length as the first, with falling pitch on it; no silence after it and no pitch excursion for the second word.

Fig. 4-16: a 3-list (No. 84)

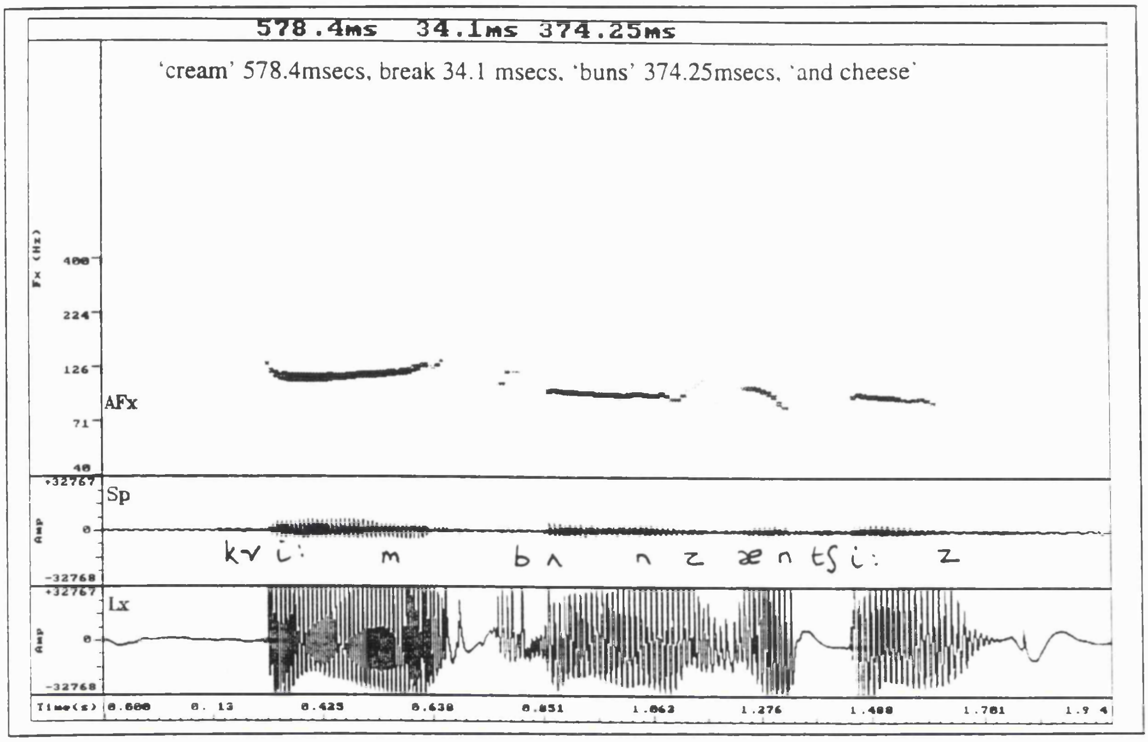


Fig. 4-16 shows the first word is longer than the second, has rising pitch, silence after it, and downward pitch excursion for the second word.

The following examples demonstrate how judges could assign responses to the correct category on the basis of little pitch differentiation and small phonetic differences in length and/or silence. The examples show a 2-list (Fig. 4-17) and a 3-list (Fig. 4-18) by participant No. 56 where the length of the words varies very little, and the pitch pattern is very similar. The crucial difference appears to be the presence of silence between the first two words; see over.

Fig. 4-17: 2-list: (No. 56)

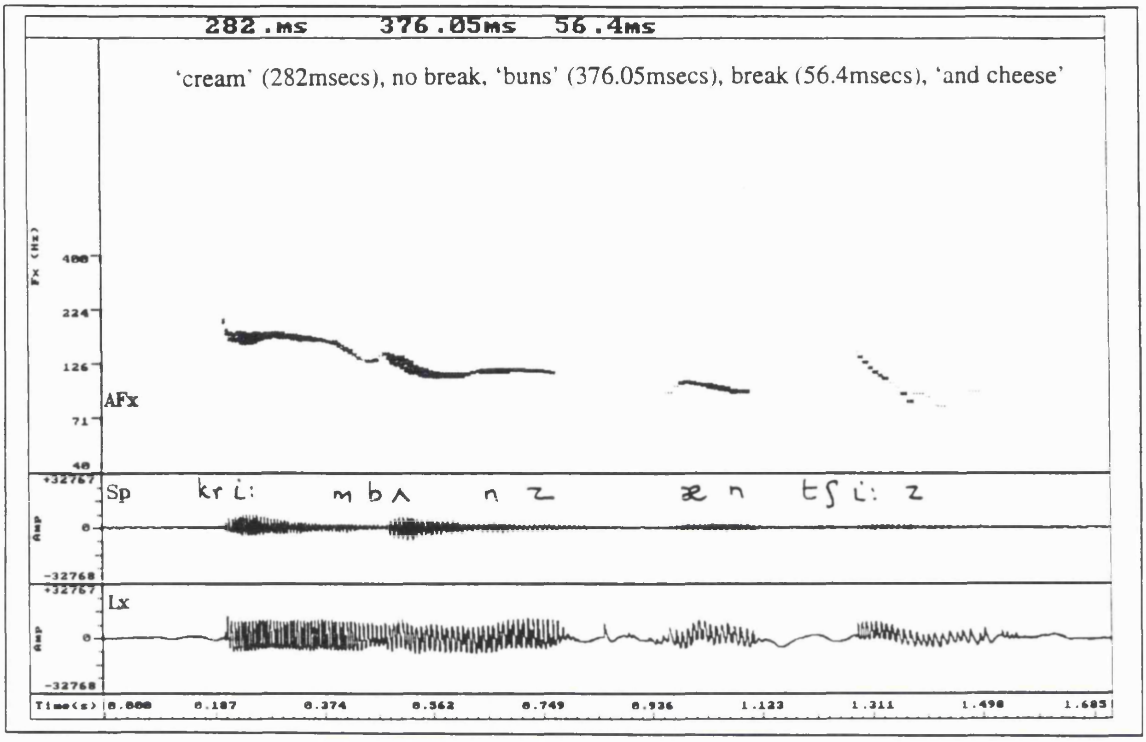
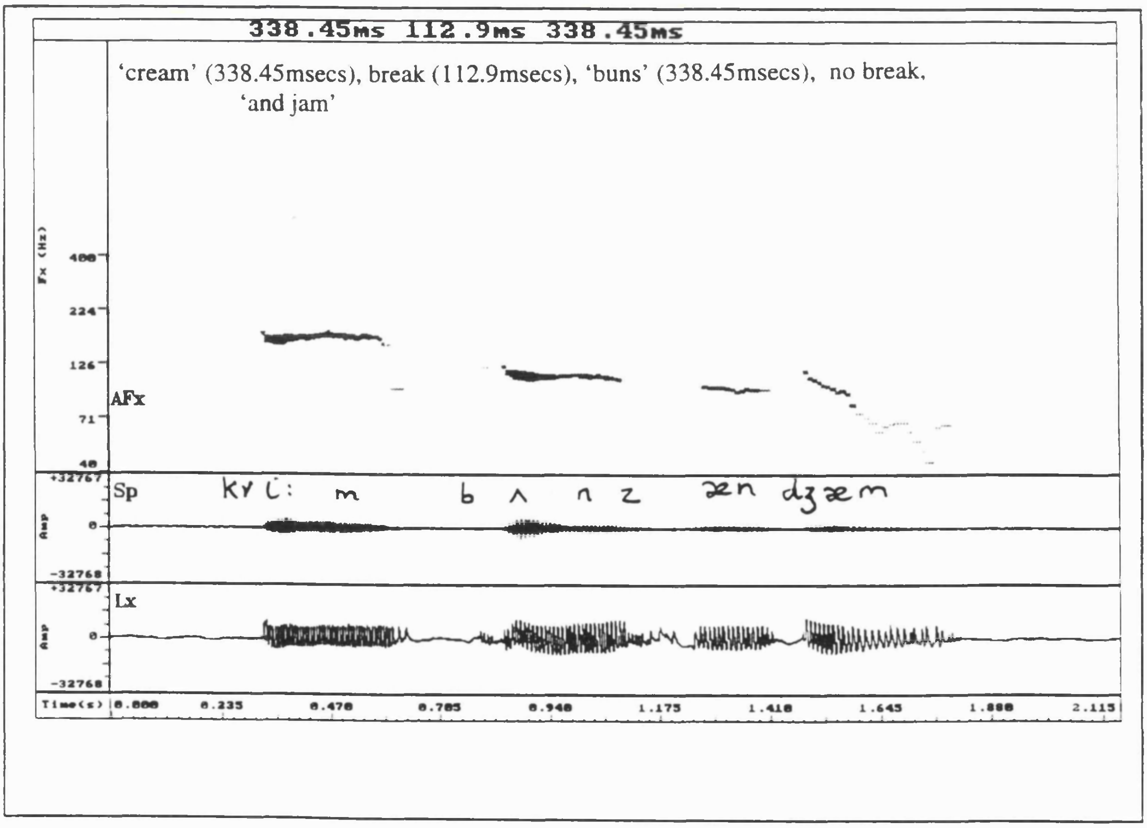


Fig. 4-18: 3-list: (No. 56)



By contrast, although participant No. 82 appears to make some use of silence in the following examples of a 2-list (Fig. 4-19)and a 3-list (Fig. 4-20), it seems likely that the relative length of the first two words is more important.

Fig. 4-19: 2-list: (No. 82)

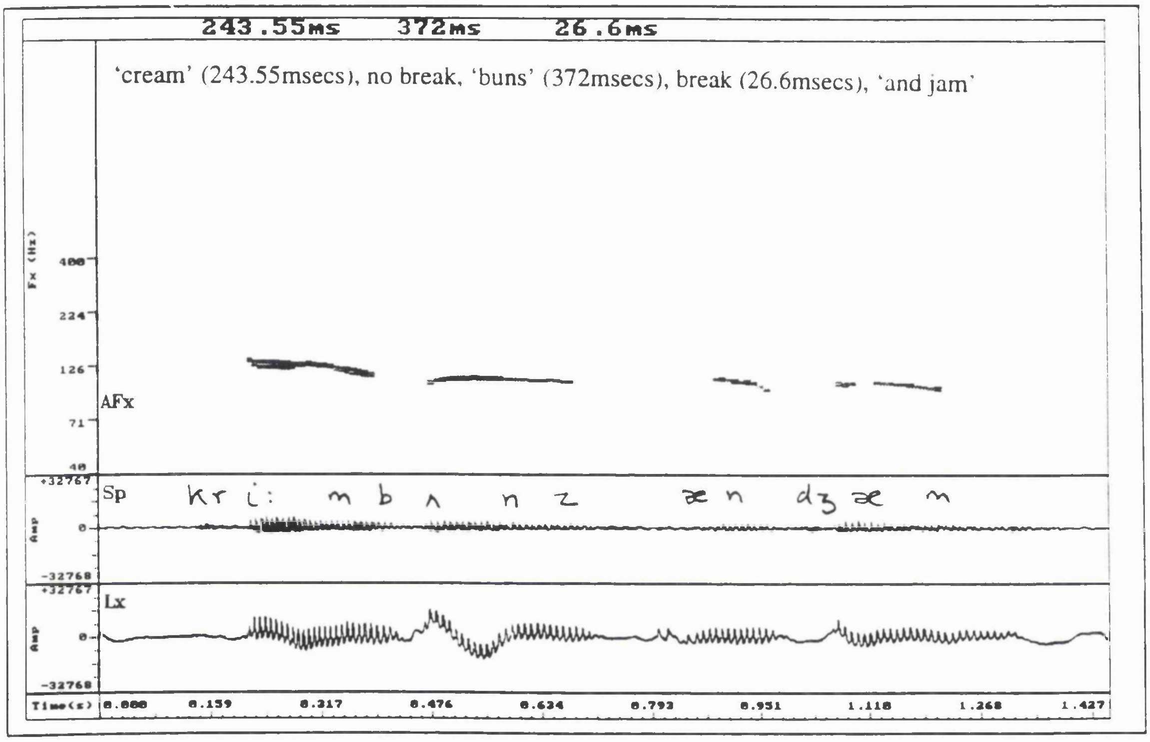
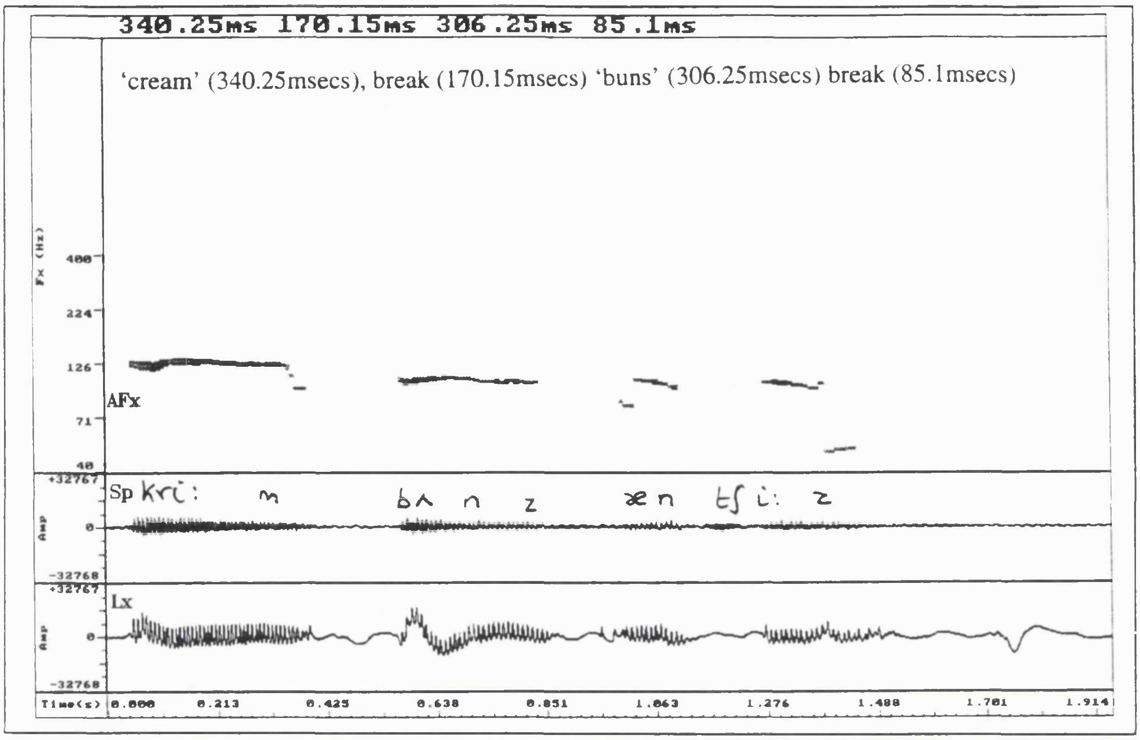


Fig. 4-20: 3-list: (No. 82)



It can be seen that the displays are not helpful for categorising the pitch on various syllables as either level or moving from these examples; typically, they are level for one portion of a syllable but not for another, and there is no way of knowing which portion is instrumental in triggering perception. Similarly, in Fig. 4-19, there appears to be a break between 'cream' and 'buns' although no silence was perceived; the laryngograph gap is presumably occasioned by the held phase of the initial consonant of 'buns', and not perceived because it is not thought to be functional in distinguishing the meaning of the utterance. This illustrates the problems of judgments based on measurement as opposed to those based on perceptions, as referred to in 2.1.1.

5. Discussion of Results

In this chapter questions are raised about the reliability and validity of the test according to factors which were suggested during testing. In addition, some indications about the norms of prosodic exponency as it emerged in function tasks are included.

5.1 Test reliability

This section comments on aspects of the statistical analysis of the scores and their relevance for the test's reliability, which was deemed satisfactory. One concern was the length of the procedure: the impression from data collection was that, at two hours per unimpaired participant, the test was too long for practical clinical use, and ways of streamlining it were sought: these are discussed in 7.3.

5.1.1 Distribution of scores

Although the presence of ceiling effects in the scores was a disadvantage from the point of view of statistical analysis, it is an advantage from the clinical point of view because it makes for small risk of floor effects in impaired clients. Controls' mean scores ranged between 13 and 16 on any one subtest, and lower bounds of normality were no lower than 8 (higher for most subtests); this gave a wide potential range for scores outside normal limits, and thus for judging the degree of severity of disorder.

5.1.2 Effects of cue-order

The fact that the change of cue-order produced no significant effect was interesting with regard to function reception. There was some evidence to suggest that participants imagined contexts or scenarios for the utterances they heard (and in some cases they were encouraged to do so: see Appendix 4). Given this, it was possible not only that the mental setting of a scene might influence the way in which a cue was heard, but that the scene might carry over from one item to the next. This would produce one judgment in one cue-order, but not necessarily the same judgment when the cues were reversed, because a different cue-order would probably have evoked a different scenario. The fact that this was not the case suggests that although participants may have constructed scenes to make their judgments, these were specific to separate items.

Other order variables had been mooted and rejected for various reasons (3.6.4). After testing, there was no reason to be dissatisfied with the order chosen. The options mentioned in 3.6.4 do however remain as potentially interesting variations.

5.1.3 Effects of gender, age and education variables

The results of statistical tests reported in chapter 5 suggest that participants' age and gender would be unlikely to influence their scores on the test to any significant extent. Gender appeared to produce no discernible trend; it is however of interest that older participants scored marginally better than younger ones. It has been suggested (Vihman, 1996) that prosody, although regarded as one of the first language skills to manifest itself, in infant babbling, may continue to be acquired after the individual has reached maturity in other areas of language development, and that it is possible that experience is an influential factor in the use of prosody.

Although regression analysis (4.3.3.4) suggested that education accounted for only a relatively small amount of variance in the scores, this is not expected to have an effect on test validity. It is also notable that, with the lower limit of the range of normal ability set at 2 standard deviations below the mean, even the lowest unimpaired scorers were within normal limits. This was not true of participants with aphasia, who scored considerably lower, as will be seen in chapter 6.

5.2 Ecological validity: function reception tasks

The question of error analysis, which relates to ecological validity, is considered in conjunction with participants' observations in examining the ecological validity of the tasks. The latter were noted during testing and those that had relevance are documented in Appendix 18. A table showing the frequency of errors and on what items they occurred is given in Appendix 16. To avoid repetition, ecological validity is considered under the headings of the main task-modes, function reception, function production, form reception and form production.

5.2.1 Function labels

Function-labels, i.e. the terms used to identify the meaning-options tested in the function-tasks, were occasionally disputed by participants, usually when the function was introduced, i.e. in the function reception tasks. This was not unexpected in the case of some affective functions. The ensuing discussions were important because of the questions they raised about the validity of the tasks, and whether tasks that were easily labelled had a higher success rate than those where the function was not readily identified.

Function-labels which caused no problems were:

- Loudness task: loud or quiet utterances
- Length task: brisk or relaxed
- Pitch task: requesting continuation or repetition
- Glide-task: questioning or giving an answer
- Silence-task: certain or uncertain
- Level-task: 2 items or 3
- Accent-task: which letter/number being focused on

These functions are given "no-problem" status because when participants were given examples of utterances being said in order to convey these meanings they nodded quickly or gave similar signs of affirmation. In many cases the tester had the impression that to the participant the meaning was obvious and that further clarification would be seen as a waste of time.

Labels which caused problems were:

- Range-task: surprised or not
- Rhythm-task: many times or first time

The success rates of these tasks with affective function and problems of identification are compared in the following paragraphs with tasks involving easily-identified linguistic function, and the outcome suggests that the difficulty of identifying the meaning-function does not affect performance.

5.2.1.1 Range-task

Alternative labels that were proffered (either by the participant, or by the tester if the participant was demurring but short of inspiration) included: involved/automatic; interested/uninterested; excited/bored; intense/neutral. After discussion of these, in which tester and participants came to an agreement about the meanings conveyed in the example-cues, participants occasionally opted for their own preferred labels, but mostly adopted the tester's suggestion of designating them "surprised" and "not surprised".

For several participants, surprise appeared to subsume questioning. (This raises issues about what constitutes questioning intonation, relevant to the Glide-task and addressed in 5.7) This inference was based on the fact that after hearing the example ('twenty') uttered with wide fall a few participants said: "That doesn't sound surprised to me, but this would: '/twenty???'", producing 'twenty' with a wide rise. When this occurred, it was established that although surprise might well include questioning, utterances could also sound surprised when they were not questioning; and that participants were simply to listen for 'a note of surprise' in the cues. All participants appeared to be satisfied with this.

5.2.1.2 Rhythm-task

Giving this function a name was in most cases a collaborative effort by tester and participant. Alternative labels proffered by participants were: fed up/neutral, emphatic/don't mind, before/first, repeated/new.

5.2.2 Errors on tasks with problematic labels

5.2.2.1 Range function reception task:

Errors were examined to see whether these suggested a misconception of the task by participants. Wide falls occasioned more errors (81 out of 270 items: 30%) than did wide rises (61 out of 270 items: 23%), and both produced more errors than all other items in total (46 out of 900 items: 5%). Compared with other tasks, the mean score on this task was lower than on any other function reception task, but not significantly so: at 13.96 out of 16, it was barely lower than the mean score on the easily-identified Accent-task: (identify focal item) which was 13.97.

5.2.2.2 Rhythm-task:

The item that attracted most errors was "I don't like the sea" said as if for the first time (30 errors in 90 cases, i.e. 33%), followed by "They're not going to win" also a first-time utterance (16 in 90, i.e. 18%), and "There's no time to eat", first-time (12 in 90, 13%) . The mean score on this subtest was 14.54 out of 16; this is mid-range for success rate and comparable with the easily-identified Level-task (2 items or 3), where the mean score was 14.78.

5.2.3 Relative difficulty of function reception tasks

Ease of function-identification did not correspond to ease of task-performance. Participants sometimes expressed concern that they would not be able to make the required distinctions; in most cases the training items removed any cause for concern. Difficulty could be identified in several ways: by explicit doubt (e.g. "I haven't a clue what I'm doing here"); and by prosodic clues, e.g. longer response times; lengthening in responses (e.g. /qu::estion/), and in some cases by the pitch and glide of a response (e.g. *high* que↗stion). Desirable as it would have been to ascertain whether participants felt uncertain when they sounded uncertain, a few attempts showed that participants were made uneasy and defensive by such questions. It was also interesting that although participants occasionally expressed doubt as described above, they were nevertheless capable of producing expected responses in non-random proportions.

Difficulty of tasks is evaluated as follows:

No difficulty (hesitations were few and short and responses were not lengthened):

- the Loudness-task (loudness),
- the Length-task (briskness),
- the Silence-task (certainty) and
- the Level task (information-chunking).

Problems of explanation but not of execution:

- the Range-task (surprise)
- the Pitch-task (requesting repetition or continuation)
- the Accent-task (focus)

Hesitations and lengthened responses:

- the Glide-task (questioning/affirming)
- the Rhythm-task (repeated/first utterance)

Further notes on some of the tasks are in order:

The Pitch-task (requesting repetition or continuation) sounded daunting in explanation, but after the training-items participants made fewer errors than on any other function reception task and in almost all cases responded with no hesitation to a minimal cue; no other task had as little information (lexical, segmental or prosodic) for participants to go on.

The Accent-task (focus) caused varying amounts of apprehension, usually allayed after the examples and training items. This task presented participants with more options (three rather than two) to choose between than the other function reception subtests, which may have been the reason for more and longer hesitations. Another possible reason for these was that the cues were "live", and so participants took their time, not anticipating the next cue on the cuetape. On the other hand, the Pitch-task was also live, and did not occasion hesitations in the same way.

The Glide-task (questioning) caused most errors during the training items and occasioned many hesitations, often quite long, and expressions of doubt during the test. Because this task seemed particularly hard, a scenario was given (that of being in the same room as a person who is on the telephone, and trying to imagine whether the person is making questions or giving answers). There were two reasons why the variation in responses was unexpected. Firstly, as a result of pilot studies, the stimuli were distinguished by variation in two prosodic elements, instead of in one as for the other tasks: both by type of glide (fall and fall-rise, 3.1.1.8) and by pitch-height (high and mid, 3.5.1). Secondly, there was support in the literature for the notion that questioning was associated with high rises but no suggestion that it would be associated with high falls (except where questions are syntactically marked, as by the use of *wh*-words). Reasons why it should have occasioned so much difficulty are examined at some length in 5.7.

5.2.4 Error analysis

A different measure of difficulty was the number of times participants gave unexpected or wrong answers. Arguably, these were not errors in the sense of lack of ability or competence in the participant : there was the possibility that they reflected prosodic usage which has not been documented, or the influence of a non-southern variety of English, or a lack of realism in the task.

Lack of competence can be considered in the following ways:

5.2.4.1 Performance-errors

The participant misheard or misperceived the cue for reasons such as lapse of attention: they were nonce-occurrences. Although fatigue effects were not great enough to be significant (see 4.8.1) participants performed on average 3 items per minute during about 100 minutes. The occasional lapse of concentration was likely, and the pattern of errors is irregular enough for this to be a feasible explanation.

5.2.4.2 Undetected impairment.

Although participants with speech or hearing problems were excluded (3.9), receptive problems specific to prosody may never have been identified.

5.2.4.3 Low ability.

Some participants may have had better prosodic perception than others, and some distinctions may not have been perceptible to all participants. If this were the case, participants with low ability in any element would be expected to score low on all the hard items (see 3.4.3) in that element. A spreadsheet showing performance on hard items is given in Appendix 17. Correlations between low scores on hard items, low mean reception scores and hearing ability (where tested) were examined; also correlations between high scores on hard items and high mean reception scores. Hearing ability did not appear to be a factor in low scoring, except perhaps in the case of one participant as already discussed in 4.2.1. who was the only participant to score consistently low on hard items. Although high-scorers made occasional errors on hard items (19 in 2,048 cases) low-scorers made 5 times as many. This supports the validity of the test as a tool for assessing prosodic ability in spite of the tendency for participants to score at ceiling.

5.3 Function production tasks

The overall picture of function production tasks is that participants were in the main successful at conveying their meaning with an average of 14.71 out of 16; the lowest mean score on any one task was 13.89 (Rhythm task). As suggested, 'errors' could have been caused by the same factors in participant-performance as listed in the section on function reception (5.2.4); i.e. because of a lapse of attention, because of undetected impairment or low ability, or because of dissociation between reception and production.

5.3.1 Subtlety of performance

The issue of subtlety was important in production tasks. As described in 3.7.2, scoring was on two scales: one relative and one absolute. Participants were not asked to sound "as surprised as possible" or "as brisk as possible," only to "sound surprised in the way you think you sound surprised" when they were shown the "surprised" function-card. They were told that it was recognised that their responses might sound completely different from the cues in the reception task, but that they were to use the practice-items to make sure that they sounded natural to themselves (instances where participants were unhappy with their practice items were very rare). They were also told that the tester would be trying to guess which function-card had been shown from the way the item was said. This gave participants the freedom to be as subtle or as obvious as they wished. The quantity and quality of cues for detection varied hugely, but, as suggested in 4.9, very little was necessary for making a judgment.

There was some evidence that a degree of subtlety was sometimes deliberate, particularly in the Level task (list-chunking, 2 and 3 items). One participant said he could have made his meanings more obvious than he did. Another said "That was a giveaway", after one item. No such indications were given in any of the other tasks, but it may have been that the more concrete the difference between the two meanings, the more a participant felt there was latitude to play around with the conveying of the meaning.

5.3.2 The volitional nature of the tasks.

Participants were performing to instruction and in an artificial test situation. Any generalisations from these results to performance in everyday talk are subject to this caveat. This problem was recognised during the design stage but it was decided that it would be valuable to find out what participants produced, and how far they were able to conform to the test requirements, when tasks were of this volitional nature, to see if this aspect of prosody is testable. In a non-systematic way, participants' opinions of the tasks were sampled, and while these are not intended to supply an objective measure of validity, it is at least reassuring that they were not adverse comments (a selection of them is included in Appendix 18). They expressed no surprise at being asked to perform the tasks, and only in three cases did they suggest that they would not be able to do them. When, as occasionally happened, they appeared to use the same element as heard in the reception cues, they were questioned as to whether they really thought they had sounded as they normally would, and no participant admitted to having sounded unnatural to him/herself.

The conflict between 'real' life and acting (as required by the task) occasionally became apparent; for example, on a few items in the Silence task. In this task, the participants were presented with a card showing eight sweets of different colours. They were told they could say the same sentence: "I'll have a [colour] sweet please" about each sweet in any order they chose. The purpose behind this was to introduce an opportunity for real certainty or uncertainty about the choice being made. In some cases, it seemed clear from the start of the participant's utterance that the "Certain" card had been shown, but that the participant had not in fact decided which sweet to choose, or was uncertain about how to designate the colour: this was apparent from the introduction of a prosodic element (silence) which had not been used in other 'uncertain' items, and verified when inspecting the choice cards at the end of the task.

5.3.3 Binarity.

Since there were only two meaning-options for each task, most participants quickly established one set of prosodic parameters for use with one option and another for the second, and the tester was in most cases quickly able to decide which set was being used for which option. In no case did it transpire that the tester was mistaken in this initial assignment. Few participants however were rigorous in applying the sets without variation throughout the task, and it cannot be gauged whether the variation was intentional or not. (The presence of variation does however provide some support for a separate hypothesis, i.e. that people resist to some extent the use of identical prosody for consecutive utterances having the same function.)

The speed with which it was possible for the tester to establish which meaning was intended was not unexpected. Each task was thoroughly investigated for extraneous (non-prosodic) factors which cold be supplying clues to interpretation. The conclusion was that elements such as Loudness, Length and Range were providing more clues in many tasks than had been expected. One implication is that whatever prosodic polarities an individual uses to convey these functions (and they varied enormously) they are inferrable by the listener from very few instances. This has relevance to clinical practice, and will be discussed in connection with the aphasic participants.

5.3.4 The number of items.

One problem of having only eight items with two options was that after the first four it could have been easy for the tester to weigh up the possibilities of what function card was being shown to the participant and to make the decision on that basis rather than on the prosody of the participant's utterances. It would also have been possible to verify each decision as soon as it was taken. Both of these options were eschewed because of the need to have sufficient numbers of valid examples in the study. More importantly, however, it might have appeared to the participant, especially after several subtests had followed similar lines, as though there was no need to bother with the last few items, because it would be obvious to the tester which meaning was being shown and required; in addition, the last item (which was always known to be the last) would be likely to have "concluding" intonation, which might interfere with the meaning to be conveyed. One subtest where these factors would be expected to show an effect is the Glide task, in cases where the final item was a question, since the vast majority of participants used rises or fall-rises for questions, but anticipation of the end of a task would be expected to prompt a fall. In 42 of the 44 cases where the last item was a question, participants used a variation on a rise; of the two cases who used falls, one participant appears to have been affected by anticipation of the end of the task; the other had used falls as questions earlier. In other subtests it was not possible to measure with any certainty what effects there were of awareness that less clarity was needed in the final items.

5.4 Form reception tasks

These tasks were very straightforward and presented fewer points of interest than the function tasks.

No problems were encountered in the instructions: all participants appeared to hear the differences and to be confident of what they were listening for without any necessity for identifying the differences. More than two examples appeared to be superfluous; the main problem with this task was tedium.

It was questioned whether the form tasks for the composite elements were related closely enough to the forms used in the function tasks. In the level task, for example, the form reception task consisted of hearing the difference between glide and lack of glide on one syllable. Although glide or lack of it was what was used in the function tasks for differentiation, the function task used more syllables. A possibility for further exploration would be to use, in the form reception task, the same cues as in the function task, but to record as cues the laryngograph reading only, i.e. with all segmental and lexical information extracted.

Another possibility for improvement was to have more 'different' than 'same' cues. Those participants who had difficulty hearing the differences were likely to respond 'same' to at least half the cues and it is suspected that some who did so may have said 'different' occasionally merely to ring the changes.

5.5 *Form production: copying tasks*

Participants performed less well on these tasks than hoped: it was thought that it would have been a simple matter to elicit the range of prosodic forms.

It was hypothesised that there were three possible reasons for a low score on tasks involving copying:

- participants might have reduced output skills; or
- they might be able to produce the required contrasts but not volitionally; or
- they might have receptive deficiency, i.e. be unable to copy because their receptive skills were poor and they could not hear clearly the contrasts required in the production tasks.

Receptive and productive scores, especially on form tasks and especially for those elements where copying tasks scored low, were correlated.

- High correlation between a participant's receptive and productive scores would suggest the third possibility, receptive deficiency, as the main cause.
- If correlation was low, participants' non-test output would be assessed: if it showed a poor range of productive skills, then the first possibility, low output skills, would suggest itself as the main cause.
- If reception-production correlation was low and non-test output showed a good range of productive skills, then the second reason, that of being unable to produce prosody volitionally, would be adduced.

This analysis would provide a basis for assessing the implications of the test for interactional skills as well as for receptive and productive ability.

5.5.1.1 Dissociation between reception and production

Many participants did not consistently associate rises with questions and falls with answers in the reception task (see 5.7), but the vast majority used that distinction in the production task (90.7% produced rises when doing questions, 84.9% produced falls when doing answers). Autoresponses (see 5.8) also imply a dissociation between reception and production, as well as between function and form.

5.6 Test-validity questions arising in the course of administration and scoring

The following points can be seen as lack of validity in the test, and are true of most formalised assessment procedures. Errors could have been caused by erroneous theory or the practicalities of testing. It should be stressed that the likelihood of any of these being of any importance is probably belied by the overall high scores in the data collection.

5.6.1 Theoretical problems

5.6.1.1 Lack of theoretical support

If significant numbers of participants produced consistently 'wrong' answers in function reception tasks, it could be inferred that the theory was faulty in proposing that the element did not perform the designated function. There were only two cases where the numbers of wrong answers were high enough to warrant investigation as to their significance: these were the Range-task (surprise) and the Glide-task (questioning). In the Range-task, 7% of participants consistently judged that a steep fall did not convey surprise, which although not conclusive is nevertheless indicative of some lack of reliability, given the restricted scope of available judgements. In the Glide-task, as seen below (5.7) there was more reason to doubt the function of glide-direction.

5.6.1.2 Hard items

Errors could have been made because there was not enough prosodic information in the stimulus for distinctions to be made, and this was most likely to occur in hard items. There was only one item (in the Glide function reception subtest, see 5.7) where judgments were almost evenly distributed, i.e. participants appeared to score at chance levels, suggesting that in this item there was not enough prosodic information.

5.6.1.3 Regional variation in the English used by the participants

For some regional accents, which may have been subliminally influential for some participants (although, see 3.9, they all spoke with a standard southern British English accent) the test's assumptions about which prosodic forms effect which prosodic functions do not apply. This would be expected to produce specific patterns in the results: i.e. participants would presumably apply consistent judgments to each item where this was the case. No such consistency was found.

5.6.1.4 Socio-cultural variation among the participants

Certain prosodic functions may be particularly in use in certain social strata. In this study there was the risk ·, ... that some of the functions selected would reflect mainly the usage of the researcher. If this were the case, then those participants who were most familiar with the researcher would perform better than those who were unfamiliar. As stated in 3.9.3, 8% of the participants were well-known to the researcher. In comparing their function reception scores with those of participants unknown to the researcher, the mean score of unknowns was 92.91% as opposed to a mean score of 97.57% scored by familiars. This suggests that socio-cultural variation accounts for a small percentage of the variance in scores, but not enough to invalidate the test functions.

5.6.1.5 Interference from other language factors (semantics, syntax)

It has been pointed out (3.3.1) that some participants said that it was impossible to say certain items in the proposed way, and there could have been unremarked cases where the participant felt either a) that semantic factors applied *ipso facto* to some items, or b) that the utterance was ill-formed or in some way synthetic, or c) that while well-formed, neither of the available meaning-options applied.

5.6.1.6 Polarity in the function tasks

Since there were only two options, participants may have learned to assign one (set of) phonetic/formal exponent(s) to one meaning and a different set to the other. In other words, they stopped listening for the meaning (function)and listened for the form instead. Some participants were asked, at the end of a task, whether they could describe what they had been listening for; whether they had discovered a "key". This was not asked very often because a) it introduced discussion and tended to lengthen the whole process unacceptably, and b) it tended to make participants self-conscious. The question was generally considered hard to answer (except in the case of the Silence-task, where most of the participants who were asked were readily able to identify "the pause" as the distinguishing factor) and brought a variety of reactions, as listed in Appendix 18. The fact that they could not identify the 'key', or were not given the opportunity to do so, does not however imply that they did not use one.

5.6.1.7 Vocal quality interference in the stimuli

In cues involving more than one syllable this would certainly have been a factor, and, despite efforts to exclude it on the cuetape, may have been present to a small extent in some of the cues. Sometimes, when asked for suggestions as to how they were distinguishing differences in the Length function reception cues, participants commented that the voice on the cuetape was 'gentler' for the items they judged 'relaxed'. This may have been either a reference to voice quality or a lay term for 'shorter', so does not provide conclusive evidence, but suggests a possibility.

5.6.2 Practical problems

5.6.2.1 Faults in cuetape construction

Although the cues were recorded with as little non-systematic variation as possible, there may have been some, since they were natural stimuli (as decided in 2.1.1).

5.6.2.2 Interference from perceived parameter of variation

One possibility is that participants mentally assigned prosodic parameters to the demonstration items, and that their score in responses depended on how far this categorisation matched the categorisation used in the design of the stimuli. If the element was easily identified in lay terms, the degree of matching could well have been high; for Range, Glide and Level this is unlikely to have been the case: a parameter may have been assigned but possibly an inadequate one. An example of this is shown by the participant who, questioned about the Glide function reception subtest, said "For me it's questioning if it goes up at the end, and these go up at the beginning." Some of the items were uttered with a rising glide starting from the beginning and ending higher, some starting with a step-up in pitch before a falling glide, ending low: the former were intended as questions, the latter as affirmations. It can be seen from this comment how the participant's responses were (allegedly) based on formal rather than functional criteria, and that his formal categorisation was different from the test principle.

5.6.2.3 Multiple repetition of the tasks

There was an impression, which cannot be substantiated, that the task lost its function for a participant after the first few items. This factor would have similar consequences to the polarity factor, i.e. that participants started responding automatically once they had discovered a key. One solution to this problem would be to vary the items after the first few, making the syllabic and segmental content different, and introducing unrelated prosodic parameters. This option was rejected in designing the test because of the need first of all to establish over a sufficient number of similar items (see 3.6.5.1) whether participants made consistent judgments about variations in the element being used.

5.7 Glide function reception

More errors (107) were scored in this than in any other binary-option function reception task Other tasks which produced nearly as many were the Range-task (98 errors) and Rhythm (86 errors) which were discussed in 5.2.1.1 and 5.2.1.2 respectively; the mean number of errors on other tasks was 20.

All participants except one heard Item #6, 'this ↑~week' (step up between 'this' and 'week', fall-rise on 'week'), as a question. Just under half of all participants (42) heard Item #8, 'next ↑\week' (step up between 'next' and 'week', fall on 'week'), also as a question; however, an item with a pitch-pattern similar to #8 (#2, 'the 20^{th}': step-up after first (unstressed) syllable, fall on next syllable) but with more syllables, was heard as a statement by 75 of the 90 participants. This suggests that it is not the pitch-pattern but the number of syllables or some other factor that determines the question/assertion function of this utterance. On the other hand, 94.5% of the fall-rises in the task were judged to be questions, and some falls with different syllabic patterns were also judged as questioning.

It might be suggested that since 'week' is a monosyllable ending with an unvoiced plosive consonant it is a poor carrier of prosodic information, having little period of voicing: but this would imply that participants who thought it questioning had imagined a non-existent fall-rise on it. Since this would involve hearing information (an element of rise) which is absent, it seems unlikely to have happened in 42 participants.

The hypothesis proposed to account for these inconsistencies is that a fall after a step-up can sound questioning. If this were the case, participants who heard 'this ↑~week" as a question may have heard a fall instead of a fall-rise on 'week': this means hearing less of the information which is present, a more likely consequence of the short period of voicing in 'week' than hearing a terminal rise which is absent.

The main conclusion from this is that glide-direction, even when assisted by corresponding pitch variation, is unreliable as a guide to whether an utterance sounds questioning or stating, but that there may be a tendency for falls preceded by high pitch to be heard to be heard as questions.

5.8 Accent-task: incidence of autoresponse

"Autoresponses" was the term coined for responses in the Accent-task which took the following form:

Tester (Cue):	~2SX?
Participant (Response):	\2SX.
Tester (Reception check):	Which letter or number was I asking about?
Participant (Response):	S.

This on-line task combined reception and production, with a check on reception following production. What has apparently happened here is that the participant responded to the tester's accenting of '2' with a fall-rise by repeating the utterance with accenting and fall on the '2', thus indicating that she understood that there was some doubt about the '2' and that she was affirming that this was the item required. In the reception check however the participant asserted that she thought it was 'S' not '2' that was in question. This 'error' occurred frequently enough in the Accent task (3.2% of all responses) to merit the special term and to be examined in some detail. Numbers of occurrences can be found in Appendix 15, in the column for the Accent-task headed "AutR".

When participants correctly identified the character being queried and produced a glide on that character in the production response, the assumption was that they were guided either by having heard the tester's accenting or by auditory feedback from their own response. 14.2% of the judgements on the tester's accent-placement, as given in the reception check, were wrong, and autoresponse occurred in 22.9% of the wrong judgements. The possibility that responses to reception checks could have been merely correct guesses was investigated: with three digits to choose from, participants needed to score higher than 10 out of 16 responses in the reception task to be scoring at better than chance levels. 94.4% of participants did so, suggesting that the majority of responses to reception checks were the result of decision, not chance. The correlation between autoresponses and the total number of wrong responses to reception checks was high (0.73), suggesting that those who autoresponded were less adept at than the others at spotting the tester's accent-placement. It also appeared that some participants were more prone to autoresponse than others: 8 participants produced 2 or more, totalling 80% of all autoresponses. The incidence of autoresponse suggests that, for these participants at least, the tester's accent-placement was more influential on production than auditory feedback from their own responses.

It could be argued that participants might have responded differently to the reception check had it been phrased "Which letter or number were you emphasising?", but the task as they understood it (by examples and practice items) was to emphasise the one being queried by the tester, i.e. the one being queried was the one they were emphasising. In the instance quoted above, there was a follow-up. After a two-second pause, the participant corrected herself, saying:

> "Actually it was the 2, wasn't it, because you went 2SX".

This suggests that the 'correct' response is in fact recoverable, but may not always be recovered and may be subject to delay. (No other participant made a similar correction, although all had the same chance to do so.) The remark also confirms that, for this participant at least, the task was well understood.

The Accent function task, like the Pitch function task, appeared hard to most participants in explanation but generally seemed easy, or easier, after demonstration; in the case of some participants, vigorous nodding suggested they thought the explanation a waste of time, and they appeared to find the task very easy, doing it very quickly and correctly. Although all participants managed to do it, some appeared to find the format difficult and artificial and a few did not find it easier after the practice tasks (i.e. not as in the Pitch task); they took a long time to respond, often targeting the wrong character in both reception check and accenting.

It was also possible that all the production events where the participants placed glides on the character targeted in the cue might have been non-volitional reactions, mere copies of the tester's accent-placement. Further investigation of production responses suggested that this copying did not extend to the glide-direction, which was usually in some sense complementary; the tester's glide was a fall-rise, and the participants mostly responded with a fall. It also sometimes happened that the tester's fall-rise was echoed by a fall-rise from the participant: 4.76% of responses. In some cases (6.9% of wrong answers to reception checks) an attenuated version of autoresponse was to acknowledge the place of accentuation (i.e. the item that needed emphasising) by placing some prominence on it (step up, lengthening, extra loudness) while placing glide on the final item (and giving the wrong verdict in the reception check). Correlation between those who tended to do this and their reception scores was not significant.

The phenomenon of autoresponse raises questions about memory and levels of cognitive processing which are outside the scope of the present study, but it suggests that accent-placement may sometimes be occasioned by what has just been heard, rather than by a planned decision.

5.9 Use of elements

Results of these tasks were analysed in some detail in 4.9, and the following paragraphs refer again to the spreadsheet in Appendix 15. The primary aim of these tasks was to see whether they provided enough scope for participants to make use of all the elements in carrying them out, with each element being used with consistency for disambiguation in at least one task. A secondary aim was to find out whether, broadly speaking, they used the elements in the ways predicted by the literature and the theoretical framework. The data collected would support analysis of which elements were used for which task, but this has not been undertaken in this study because it is outside the scope of a test designed to find out whether there are prosodic elements which are unavailable to language-impaired clients (1.10).

5.9.1 Use of elements: between participants

5.9.1.1 Failure to use task-elements and communicative effectiveness

"Failure to use" an element was defined as neither using it for disambiguation in the section-task nor using it very consistently (i.e. in the column headed "1st") in any other task. On this criterion, out of the 73 participants sampled for production, failure to use elements was distributed as follows:

49 made no use of 1 element
28 made no use of 2 elements
18 made no use of 3 elements
6 made no use of 4 elements
2 made no use of 5 elements

Correlations were calculated between failure to use elements and communicative effectiveness as indicated by function production scores. As expected, there was inverse correlation (-0.49). There was a slightly smaller inverse correlation (-0.47) between number of elements not used and formal production scores. This may mean that those participants who do not make use of all the elements are less readily understood or less expressive than those who do, while not sounding abnormal; but this finding would have to be verified by comparing it with assessment of conversational ability.

5.9.1.2 Accent-task: indication of narrow focus

The Accent-task required participants to indicate narrow focus by contrastive accent-placement on the appropriate item. In 6.8% of cases, participants used sentence accent to indicate narrow focus. This occurred consistently with the first participant, who (after the practice items) was asked:

> T: Would it be natural to you to put extra emphasis on the one I hadn't heard
>
> when you were repeating it?
>
> S: No.
>
> T: No. Okay. You'd repeat it in the same way.
>
> S: Yeah.

This exchange suggests that there were no grounds for thinking the task had been misunderstood, and that therefore the use of contrastive accent was not obligatory for this participant in this task. This raises some interesting questions.

The use of accent-placement may be contingent on the need for correction as opposed to confirmation, i.e. on there being new content, not merely a need to focus on a given item. One version of the test (3.3.2.3) used 'sound-alike' digits and a need for correction (e.g. BFE? No, BSE.). As explained there, the format was rejected because it contributed segmental as well as prosodic differences to the reception task.

One possible reason for unmarked accent-pattern was that the participant had been unable to identify the focal digit in the reception task, and therefore repeated the postcode in a non-committal way while deciding which had been the targeted digit. This was investigated, and it was found that unmarked accent-patterns coincided with wrong identification of the focal postcode component in less than 2% of the cases of unmarked accent. While this does not exclude the possibility that uncertainty prompted unmarked accent pattern (participants could have decided which was the targeted digit while giving the response), it makes it unlikely. The fact that 6.8% of these 'narrow focus' responses were made with an unmarked accent patterns thus remains something of a puzzle. It suggests that one should not be too sweeping in assuming that 'narrow focus' corresponds to marked accentuation for all members of this speech community. Another possibility, not explored here, is that although their own variety of English was southern British standard, these participants have been influenced by varieties of English that habitually retain a final accent, even in cases of prefinal narrow focus, e.g. London Jamaican (Local, Wells & Sebba, 1985) and Indian English (Gumperz, 1982).

5.9.2 Use of elements: within participants

It was noticeable that use of certain elements co-occurred frequently for certain tasks, as noted in 4.9. A summary of the findings from tables 4-18 and 4-19 is given in Table 5-1 below. Calculations have been done by noting the proportion of participants using the section-element and/or favouring certain elements to achieve the given function. Elements were included in this table as "favoured" if they were first or second supporting element for more than 15% of participants. Participants used varying numbers of elements, so the figures do not add up to 100% for each task.

Table 5-1 Principal elements used in function tasks

Tasks	**Section-element: % of participants using it**	**Supporting elements: % of participants using them**			
Need for loud/quiet speech	Loudness 89.2%	Pitch 68.5%	Range 23.3%		
Briskness/relaxedness	Length 35.2%	Loudness 60.6%	Pitch 29.6%	Range 16.9%	Glide 15.5%
Repeat/continue	Pitch 52.9%	Range 62.9%	Length 31.4%	Glide 27.1%	
Surprise/lack of surprise	Range 83.6%	Pitch 63%	Loudness 32.9%	Glide 16.4%	
Question/affirmation	Glide-direction 76.7%	Pitch 54.8%	Range 42.5%		
Hesitation/certainty	Silence 31.9%	Length 94.4%	Rhythm 23.6%		
Many times/first time	Rhythmicality 40.3%	Length 55.6%	Loudness 27.8%	Range 19.4%	Glide 19.4%
Delimitation	Glide-presence 45.7%	Silence 74.3%	Length 62.9%		

Tasks	Section-element: % of participants using it	Supporting elements: % of participants using them			
Focus	Accent-position 80.3%	Silence 50.7%	Length 47.9%	Loudness 21.1%	

These figures could be used in the assessment of prosodic deficit, and are used in chapter 6 for the prosodic profiles of the three participants with aphasia. If, for example, a participant shows marked inability to produce (formal) variation in Length, then such functions as information-chunking, focus and the expression of hesitancy might be impaired, since Length was a prominent feature in these functions for a large proportion of participants. These figures are do not suggest that any individual would be dependent upon skill in lengthening or shortening syllables for any of these functions, but that if it were deficient, one out of three or four significant factors in the effecting of these functions would be lost. On the other hand, the expression of briskness and "relaxedness" (the function-task assigned to Length) would not necessarily be affected: it would depend whether the participant in question used variation in length for conveying briskness, given that only 35.2% of participants did so.

5.10 Prosodic norms as based on data collected

The following, based on the data in the participants' responses, is a list of the phonetic-prosodic forms used for the functions tested in the procedure:

Loudness: (loud for 'loud' and quiet for 'quiet')

long/high/wide for 'loud' and short/low/narrow for quiet: not vice versa

variant glides used contrastively do not convey the function

Briskness: (short for 'brisk' and long for 'relaxed')

loud/high/wide for 'brisk'and quiet/low/narrow for slow: not vice versa

variant glides used contrastively do not convey the function

Surprise: (wide for 'surprised' and narrow for 'not surprised'

loud/high/short for surprised and low/long/quiet for not: not vice versa

Repeat/continue: (high for 'repeat', low for 'continue'

long/quiet/narrow for continue, short/loud/wide for repeat.

Questioning/stating:

high rise, low fall-rise, (high fall), not low fall for questioning high fall, low fall, low rise-fall, high rise-fall for affirmation;

not high rise or high fall-rise for affirmation

Certainty: (silence for uncertainty, lack of silence for certainty)

lengthening, high pitch + narrow range, fall-rise for uncertainty;

shortening + low pitch, wide range, rise-fall for certainty.

Many/first: (rhythmicality for many times, speech-rhythm for 1^{st} time)

for many times: spiky or glissando pitch-pattern, high peaks & wide glides, loudness, shortening

for first time: low narrow range, quietness, lengthening

Delimitation: (presence of glide on first item for "3", lack of glide on first item for "2")

"2": shortening of first item/no silence/no pitch-jump (down) between items

"3": lengthening of first item/silence/pitch-jump between items.

Focus: any combination of:

increased loudness/length/width on focused item

pitch-jump up or down to focused item

silence before or after focused item

quiet/short/narrow/no pitch excursion/no silence for unfocused items.

Many of these findings reflect commonly-held assumptions about intonation. A few, such as the apparent use of high fall for questions, are worth further investigation, but this is not within the scope of the present study.

6. Aphasic study

6.1 Approaches to prosody in aphasia

This brief review of some studies of prosody in aphasia shows that different aspects of prosody have been investigated, but that a means of seeing these aspects both in relation to the whole of a person's prosody and in relation to other language parameters is lacking. It was hoped that the design of the PEPS test, by being methodologically rigorous, would provide a comprehensive way of looking at prosody in aphasia so that the relative importance of specific deficits could be evaluated. It was also hoped that this approach would provide a means of measuring disordered prosody by relating it to unimpaired prosody; a way of comparing prosodic ability in different types of aphasia; and specific targets for rehabilitation.

6.1.1 Existence of prosodic impairment in various conditions

Impairment of prosody due to brain damage has been identified in the following conditions: aphasia due to left hemisphere damage (Gandour, Ponglorpisit, Khunadorn, Dechongkit, Boongird, Boonklam and Potisuk, 1992; Moen, 1991; Berthier, Ruiz and Massone, 1991; Gandour, Petty and Dardarananda, 1989; Black and Byng 1986; Kean 1979); foreign accent syndrome (Blumstein, Alexander, Ryalls, Katz and Dworetsky,1987); verbal dyspraxia (Blumstein, 1973; Kent and Rosenbek, 1982); and after right hemisphere damage (Grosjean and Hirt, 1995; Gandour, Larsen, Dechongkit, Ponglorpisit, and Khunadorn, 1995; Bryan 1995, Shapiro and Danly, 1985). Most types of dysarthria have a dysprosodic component: it has been identified in dysarthria due to subcortical damage (Kent and Rosenbek, 1982; Scott, Caird and Williams, 1984; Vance 1994) and specifically in Parkinson's disease (Ludlow and Bassich, 1984, Chenery, Murdoch and Ingram 1988, Hertrich and Ackermann, 1993).

6.1.2 Aspects of language impairment

While language processing deficits at single word, sentence and text levels are well documented, the literature on prosody in aphasia is often restricted to descriptions of the production of prosody (Samuel, Couillet, Louis-Dreyfus, Azouvi, Roubeau, Bakchine and Bussel, 1996; Ouellette and Baum, 1994; Berthier, Ruiz and Massone, 1991; Dressler and Stark, 1988). Studies frequently describe either phonetic aspects of prosody, such as pitch and loudness, or phonological aspects, such as intonation and stress (Stark and Stark, 1990; Berndt, Salasoo, Mitchum and Blumstein, 1988; Emmorey, 1987; Danly, Cooper and

Shapiro, 1983; Danly and Shapiro. 1982). They rarely describe the effect of prosodic deficiency on communication skills. and seldom look at reception aspects.

6.1.3 Identification of abnormal prosodic forms

Kent & Rosenbek (1982) described the abnormal prosodic patterns associated with ataxic dysarthria, apraxia of speech. Parkinsonian dysarthria and right-hemisphere dysarthria. Some of the features that emerged were described as: excess and equal stress, flat pitch, prolonged phonemes, prolonged intervals, slow rate, and low volume. Blumstein et al. (1987), in a study of "foreign accent syndrome", sifted its symptoms into a number of defects relating to segments, syllable-stress and intonation of sentences and attributed them to a "faulty intonation component".

6.1.4 Identification of abnormal prosodic function

Other researchers have used a prosodic perspective in seeking to explain particular language impairment in aphasia. Kean (1979) put forward a theory of impairment of word stress domains to explain the non-fluent telegrammatic output in Broca's aphasia. Danly and Shapiro (1982) tested Broca's aphasics for declination, sentence-final fall in declarative sentences, sentence-final lengthening, and fundamental frequency reset; they found sentence-final fall to be present, sentence-final lengthening to be absent, and declination to correlate with the degree of linguistic impairment. In a study of single word reading in deep dyslexic participants, Black and Byng (1986) argue that prosodic factors need to be accounted for in any model of word recognition and production. and that prosodic factors constrain the early stages of lexical access.

Prosody in aphasia appears either to be indirectly disturbed by problems in lexical accessing, sentence structure accessing and information processing load, or directly disturbed by lack of access to prosodic information which may itself produce disorders at other levels of language.

6.1.5 Localisation of prosody in the hemispheres

Prosody research has sought to establish the localisation of prosody within the brain, to describe those prosodic disorders produced by specific lesions, and to put forward hypotheses about how specific aspects of prosodic disorder may arise. In contrast to the literature on left hemisphere damage, prosodic deficits in right hemisphere damage are well documented.

As a general rule, it has been taken that the left hemisphere processes "linguistic" material. ie the lexical (semantic) and syntactic aspects of language, and the right hemisphere processes the prosodic and emotional aspects. Right-hemisphere damage may cause difficulties with both production and comprehension of affective prosody (Heilman, Scholes and Watson, 1975; Schlanger, Schlanger and Gerstman, 1976, and Tucker, Watson and Heilman, 1977). More recent studies have produced evidence suggesting that the right hemisphere also has some role in processing the linguistic or nonaffective functions of prosody (Weintraub, Mesulam and Kramer, 1981; Bryan 1995). This however was contested in the following studies:

Lesser (1989) quotes an experiment by Mihailescu, Botez and Kreindler (1970) suggesting that stress is resistant to disturbance in aphasia; Behrens (1985), testing the processing of stress in words and small syntactic units (noun compounds), found that when semantic content was included (eg **hot** dog and hot **dog**), the right ear (left hemisphere) processed it; when the stimulus was composed of nonsense syllables with a stress pattern (eg **bot** gog and bot **gog**) there was no ear advantage; and when all phonetic information was filtered out and only stress remained, the left ear (right hemisphere) processed it. From this it was concluded that stress appeared to be processed by the right hemisphere. Blumstein and Cooper (1974), administering stimuli separately to the right ear and the left ear, showed that pitch-processing tended to be processed in the right hemisphere, whether or not syntactical, lexical and phonetic information was present (material was complete, filtered and semi-filtered). Bryan (1989) found that language deficits associated with right-hemisphere damage included understanding of metaphorical language; ability to make inferences based on linguistic information; lexico-semantic comprehension problems, and difficulty in appreciating linguistic humour. These studies produce an indeterminate picture as to the localisation of prosodic processing.

On the whole, these approaches do not take into account the interaction of prosodic parameters (and deficits) with each other, and with other language functions. An exception is a study by Bhatt (1987) of two participants with non-fluent aphasia and clinical diagnoses of accompanying agrammatism and dysprosody; acoustic analyses of their spontaneous speech demonstrated that, although they showed deficiency in the phonetic realisation of intonation, they maintained enough to make phonological contrasts. Despite this finding, there are few attempts to compare phonetic and phonological aspects of prosody. Haveman (1994) demonstrates that Broca's aphasics show flatter declination over long sentences and elliptical utterances than over short complete sentences, but not how the flatter declination affects their intelligibility. In a study by Cohen, Riccio and Flannery (1994), a patient was asked to state a series of stimulus sentences to determine if she was able to spontaneously convey emotions (happy, sad, angry) appropriately and was asked to repeat a series of stimulus sentences to determine if she could convey the same emotions as the speaker, but it seems unlikely that simple repetitions of stimuli could be a realistic indication of how the patient would spontaneously convey such emotions.

A study of dysprosody after severe closed head injury (Samuel et al, 1996) is a case in point. 15 patients and 11 controls were required to read aloud a sentence with six different prosodic intonations: neutral, declarative, interrogative, happiness, sadness and anger. It was found that although no significant differences could be found between patients and controls for mean acoustic values, patients were "significantly less able than controls to modulate speech output according to prosodic context" (Summary). It is not clear from the experiment what was involved in "modulating speech output according to prosodic context". The target sentence was "Je m'en vais samedi matin." While it is accepted that such a sentence can be produced as a question by intonational means, and that there is no necessity for an interrogative structure (such as inversion or "Est-ce que"), it is also true that change of intonation is not essential to make it a question: context, eyebrow-raising and gaze-direction are sufficient to achieve that. If it is explained that what is required is a change of intonation, the task becomes one of form production. If the requirement is not explained, it is hard to be sure that the participants knew what was required and thus whether they can reliably be said to be attempting to modulate speech output according to prosodic context. It has been established in the previous chapter that form production tasks, however formulated, are not a reliable guide to either formal or functional ability.

One aspect of these studies is that researchers have been concerned to investigate aphasic speech which "sounds odd", i.e. in which prosodic abnormality can be detected; and to attribute these characteristics to phonetic attributes of prosody, such as disordered speech timing or loss of fundamental frequency contrasts. As was made clear in 2.3.3, however, the standpoint adopted in the current study is that prosody which merely sounds odd and discourages prosodic interpretation is less pernicious than prosody which passes for interpretable but conveys the wrong meanings: phonetic disorder is relevant only insofar as it impairs phonological function. A few studies (such as Bhatt, 1987) make it clear that such disorders can be categorised as "odd-sounding", rather than having an effect on a person's ability to make themselves understood.

A study by Perkins, Baran and Gandour (1996) recognises the lack of clarity in experiments related to cerebral specialisation in the processing of prosody. The authors consider two controversial positions: the 'parallel processing hypothesis'(Shipley-Brown, Dingwall, Berlin, Yeni-Komshian and Gordon-Salant, 1988) which assumes that the right hemisphere is dominant for processing the acoustic correlates of prosody and passes the prosodic information to the left hemisphere for further processing: this would mean that distinctions between linguistic and non-linguistic function of pitch-patterns are irrelevant. The other hypothesis, the 'functionalist hypothesis' (also quoted in Shipley-Brown et al) takes the position that hemispheric specialisation is determined less by formal acoustic properties than by their function in sentence processing; thus if linguistic functions are processed in the left hemisphere, prosody relating to linguistic function will be processed there, and non-linguistic functions of prosody will be processed in the right hemisphere. Perkins et al. recognise methodological limitations in some of the experiments cited above. For example, the study by Blumstein and Cooper (1974) is criticised for bias towards a right hemisphere response by requiring participants only to discriminate between prosodic patterns without using a linguistic analysis to formulate responses. Perkins et al. suggest that it is therefore not surprising that a left-ear advantage was found, "misleading the authors towards a questionable interpretation that intonation contours must always be processed in the right hemisphere regardless of their function" (p.345). From a series of four experiments where the questionable methodological issues were systematically manipulated the authors concluded that the functionalist hypothesis is the more securely based, and that the left hemisphere is dominant in processing intonation contours that have a linguistic function and the right hemisphere is dominant when linguistic significance is reduced and non-linguistic factors such as emotion are involved.

6.2 Questions to be answered

In order to investigate the suitability of PEPS as a research tool with clinical applicability, these considerations have given rise to questions that the current study seeks to answer, namely:

- What reception and production deficits in prosody do the individual aphasic participants exhibit?

- What are the possible interactions between prosodic deficits and other language processing deficits?

- Do phonetic and phonological aspects of prosody break down differentially in aphasic participants?

- Can we identify whether any aspect of the prosodic disorder is a primary disturbance or is caused by a deficit in another area of language processing? This would be indicated if participants' prosodic scores were below normal range but they scored highly in other language tasks.

- What implications for rehabilitation are suggested by the prosodic profiles?

These topics will however be examined for each participant as part of individual profiles and the findings summarised in 6.6.

6.3 Methodology

Using single case study methodology, three male adults, Sam, Simon and Keith (not their real names) were tested. They were in the age-range 48-63 and each had acquired aphasia, representing three commonly occurring patterns of aphasic impairment:

- non-fluent aphasia with severe articulatory difficulties (Sam)
- fluent aphasia (Simon)
- non-fluent aphasia with mild articulatory difficulties (Keith)

These three participants represent two major types of aphasia (fluent and non-fluent) and a divison into subtypes (mild and severe articulatory difficulties). The aim in testing them was twofold:

a) to see if the test would show up differences between them and

b) to see if the test could be performed by people with different types of aphasia.

Medical criteria for their inclusion in the study were:

- left hemisphere cerebrovascular accident
- at least 6 months post-onset
- no psychiatric or other neurological history
- no significant hearing loss
- no significant dysarthria

By these criteria it was hoped to exclude causes of other communication/language disorders.

The following procedures were used in assessing the participants:

- audiometric evaluation

- tests for assessing language parameters other than prosody: aphasia quotient tasks from the Western Aphasia Battery (WAB) (Kertesz, 1982), the Boston naming test (Kaplan, Goodglass and Weintraub, 1983), and selected subtests from Psycholinguistic Assessments of Language Processing in Aphasia (PALPA) (Kay, Lesser and Coltheart, 1992);.

- the PEPS test for assessing prosody

- simultaneous laryngograph recording, to provide objective instrumental validation of judgement of participants' performance in the test.

Selections from the two aphasia tests were included for examining participants' ability in language parameters other than prosody. There were two aspects to this: one was to establish what deficits there were that might have been affecting the participant's ability to perform prosodic tasks (such as difficulty with repetition, or with the 'same-different' distinction): for this aspect, tasks directly related to the prosodic tasks were used. The other aspect was to examine language abilities far removed from prosody, to establish the state of the participant's language abilities in areas other than prosody: for this aspect, tasks completely unconnected with prosody were used.

This resulted in three aims:

- to discover how prosodic skills might be affected by deficit in other language parameters.

- to evaluate the effect of the input from other language parameters in the PEPS test, although, as already explained (3.3) this was minimised.

- to ascertain how far functions where prosody seemed deficient might be achieved by other language parameters.

Selections from two batteries (WAB and PALPA) were included because of their differing approaches to language assessment. The WAB examines conversational language, including spontaneous speech and tasks that might occur in everyday situations, with production tasks based on naming, repetition, and reception tasks based on yes-no questions, auditory word recognition and sequential commands. PALPA subtests are constrained tests of specific language skills, as detailed below, focusing on particular aspects of comprehension and expression. Similarly, the Boston naming test is a more comprehensive test of naming than that contained in the WAB.

The PALPA subtests chosen for this study were as follows:

- three reception tasks involving segmental phoneme discrimination and identification: auditory discrimination of minimal pairs (No. 2: consonants, same or different, e.g. bed-bet, coat-coat), of rhyme judgement (No. 15: vowels, same or different, e.g. wand-pond, card-ward), and phoneme identification (No. 16: consonants, multiple choice, e.g. is the initial phoneme of 'pill' /t/,/r/,/d/,/p/ or /b/)

- three reception tasks to test semantic and syntactic comprehension: auditory synonym judgement, (No. 49: do pairs of words have the same meaning, e.g. story-tale, tool-crowd) auditory sentence comprehension (No. 58: locative relations; which of four pictures best represents such phrases as "boxes beside buckets", "square above circle") and auditory lexical decision (No. 5: word/non-word judgement, e.g. dunkey, foaster)

- two tasks to assess ability in repetition (No. 9: word repetition and No. 12: sentence repetition)

6.3.1 Test administration and scoring details

The participants appeared to understand and engage with the tasks readily, and, while their abilities were stretched, they did not admit to tiredness. On average, four sessions, each of one and a half hours, were required for each participant. Two examiners scored a selection of the test results independently for inter-rater reliability: these showed a high level of agreement (87.5%). Where perceptual ratings were in conflict, a third judgment was sought.

6.3.1.1 Variation in test as administered to participants with aphasia

Two tasks caused great difficulty: the two involving postcodes (focus as a function of Accent), since all three participants had great difficulty in reading out the letters and numbers. For two of the participants, Sam and Simon, a modified form of the reception task (whereby reading out was avoided and the participants pointed to the letter or number in question instead) produced results, but for Keith the modified form appeared to mean nothing. The possible implications of this are discussed at 6.5.3.1. For production skills, a further task was devised, avoiding postcodes. Instead, participants were given a stimulus (e.g. "Is he thirteen?") which they had to correct (e.g. No, FOURteen"), stressing the first or second part of "-teen" numbers according to which was appropriate to correct the foregoing stimulus (the contrasting example was 'forty?'

'No, fourTEEN'), and it is this score, and its comparison with scores by unimpaired participants on the same task, that is shown in the table showing function production scores.

A different way of indicating responses in the reception tasks was available to the participants with aphasia. They could either do as the unimpaired participants did, i.e. in the function tasks, say the word that would denote difference of function (e.g. certain/uncertain), and in the form tasks say "same" or "different", or they could point to cards which showed which they meant. In practice they all tended to use words.

6.4 Results and discussion

6.4.1 Audiometric evaluation

All three participants were screened for hearing loss, and the results, in terms of PTA (see 4.2.1) are shown in Table 6-1, with controls. The PTA for Keith's right ear is given here as a measure of his effective hearing ability, although hearing in his left ear was considerably impaired (PTA = 67), in accordance with the practice of taking the hearing of the better ear for this assessment where hearing is in free field, as was the case in the administration of the PEPS test. With normal hearing calculated as PTA <20 (Davis 1991), it can be seen that the oldest participant, Sam, is the only one showing any presbycusis (PTA = 25); this is well within the normal range for people of his age (Davis 1991), and comparable with the hearing of control participants of similar age. Also shown in the table are the scores on form reception and function reception tasks for both the participants with aphasia and the controls.

Table 6-1 Hearing loss in aphasia and in controls, with PEPS scores

Participant	Age	PTA (dBHL)	Function Reception	Form Reception
Sam	63	25	65.28	82.64
49 female	64	25	87.5	95.14
52 male	67	27.5	84.72	95.83
Simon	48	10	85.42	90.97
55 male	53	10	77.78	93.06
46 female	65	10	94.44	94.44
Keith	52	16.25	64.58	76.39
74 male	52	16.25	99.31	97.22
11 female	54	17.5	95.83	88.19

It can be seen that the participants with aphasia performed less well on the tasks than hearing-matched controls. None of the participants with aphasia had greater hearing loss than the most hearing-impaired of the participants in the normal study; four of the participants in the normal study had worse hearing ability.

It was found in 4.2.1 that among unimpaired participants there was no significant correlation between mild hearing loss and PEPS reception tasks, and equally there is no significant correlation between the reception scores and hearing ability of the participants with aphasia. It is therefore concluded that the aphasic prosodic scores are not likely to have been influenced by the participants' hearing ability.

6.5 Results of language tests and discussion

These are reported in chart form for all three participants. WAB and PALPA tests are divided into reception and production tasks: PEPS tests are in four parts for each participant: reception tasks, production tasks, form tasks and function tasks: each task is thus shown twice. The charts appear in the text where the results are discussed.

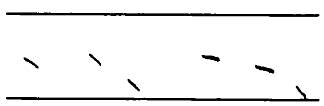
6.5.1 Individual profiles: Sam

Sam has non-fluent aphasia with pervasive articulatory dyspraxia. Initial impressions are that his everyday understanding is good, perhaps completely unimpaired, and that production is his worst, perhaps only, problem. His maintains eye-contact well, and his features are mobile. He appears to have developed strategies for coping with minimal output, such as condensing what he has to say into as short an utterance as possible, and maximising his use of gestures and facial expressions.

A short sample of his speech is given in Fig. 6-1:

Fig. 6-1 Conversation with Sam

Tester well it was a lovely day on Sunday - wasn't it beautiful



Sam: [wʌ . wʌdə] . won .der .ful .

{syllabic, lento}

Tester: yeah - were you outside

Sam: [jə . jɛ əm] no [ɪn - sɛd]
{lento.....}

Tester: *(1) (0.9) inside the house

Sam: [jɛ] my [mɛdər· ə: mɛərənt]

Tester: m - she's not too well

Sam: oh! (laughs) (raises eyebrows, hand gesture up and down)

Tester: really - oh dear - oh dear

Sam: I - I (2-3secs) I can [əm] I [spəʊt] - to - her - for [sen] for three -
{lentissimo, syllabic..}

years no [s] [əm] three [əm - ə . gə . əm. gər əm] three years no
{allegro..} *{lento, syllabic...}*

Tester: *(2) not three - you want something to write

Sam: (3.0 secs) three years (5.0 secs writing)

{p… … … …}

Tester: yeah three hours (laughs) right

Sam: three=

Tester: =hours - really

Sam: (laughs) oh!(raises eyebrows, hand gesture up and down)

Tester: it's hard work

Sam: yeah yeah

Tester: yeah - does she understand your problem -

yes

{f, precise}

Tester: yes but ə does she=

Sam: cry(in) (points to eyes, raises eyebrows, shrugs)

Fig. 6-2 demonstrates how Sam scores on the broad categories of prosody tasks compared with scores by unimpaired participants, and Table 6-2 shows the tasks in which he scores outside the range of normal ability, and by how many standard deviations.

Fig. 6-2 Overall mean scores in all prosodic modes compared with controls: Sam

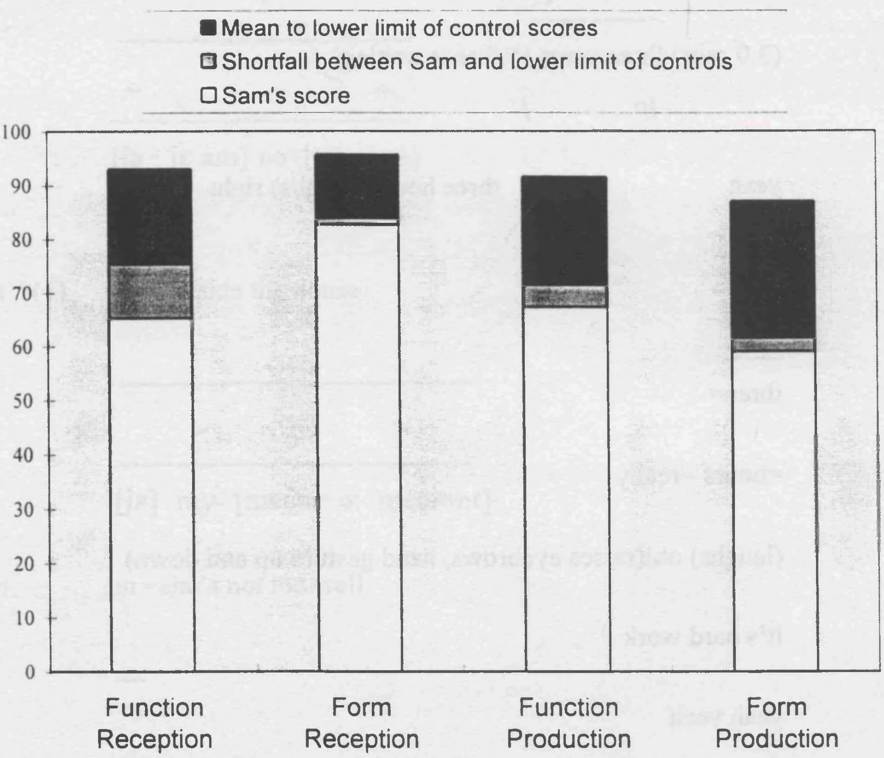


Table 6-2 Tasks in which Sam scores outside the range of normal ability, and by how many standard deviations

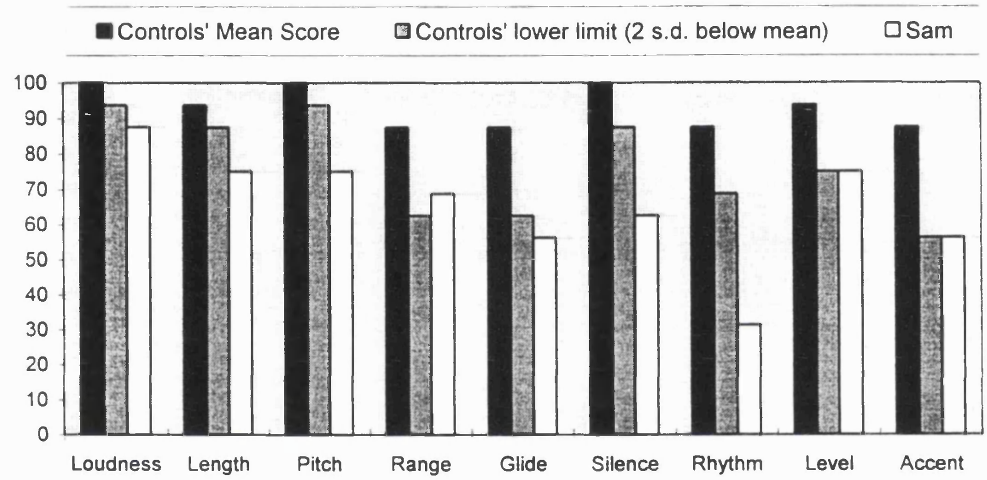
Elements	Function Reception	Form Reception	Function Production	Form Production
Loudness	1.68			
Length	2.6			3.79
Pitch	4.76			
Range		4.72	0.83	
Glide	0.44		1.89	
Silence	4.65			3.03
Rhythm	3.87	5.13	3.02	1.60
Level			0.49	0.49
Accent		10.53		

It can be seen that the main deficit is in prosodic function reception, i.e. in the understanding of prosodic meaning, and that form reception is the least affected. His production scores also show deficit. The consequences of these scores for Sam's reception and production are considered below.

6.5.1.1 PEPS Reception

In Fig. 6-3, Sam's scores for understanding prosodic meaning (function reception) on each of the elements are compared with the range of normal-ability scores.

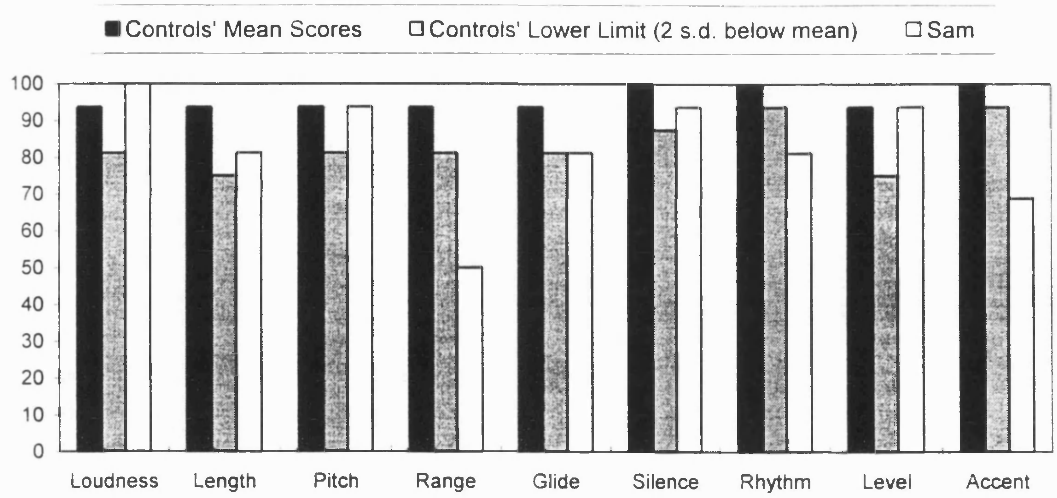
Fig. 6-3 PEPS function reception scores: Sam



It can be seen from Fig. 6-3 that Sam scores in general below the lower limit of normal ability. In six out of the nine tasks he scores below the lower limit for normal controls, and in five of these (Range, Glide, Silence, Rhythm, Accent) he is scoring at chance level. In one task, Range, he was above the lower limit; in the Level and Accent tasks he scored at the lower limit, and in the Loudness and Glide tasks he was one standard deviation below the lower limit and in Length two standard deviations below. In the remaining tasks (Pitch, Silence, Rhythm) he was three to five standard deviations below the lower limit. Another point to be noted is that whereas for unimpaired participants mean scores on function reception tended to be higher (M = 93%) than function production scores (M = 91.5%), this tendency was reversed in Sam: (in function reception tasks M = 65.28%; in function production tasks M = 67.36%)

It was important to establish whether Sam's ability to understand prosodic meaning was affected by lower than average ability to perceive the cues accurately at a phonetic level. Fig. 6-4 shows his scores on the form reception tasks.

Fig. 6-4 Sam's PEPS form reception scores compared with controls'

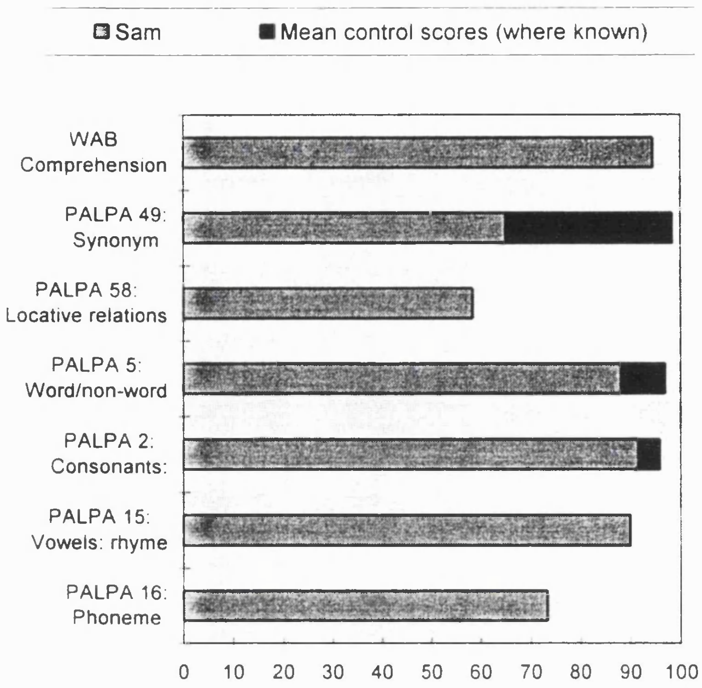


In six out of nine elements, he scores within normal limits. In the Loudness task he scored above the mean, and in five other tasks (Length, Pitch, Glide, Silence, Level) he scored at or above the lower limit. He scored at chance level in only two tasks: Range and Accent. In only one task (Range) did he score both well below the mean (more than four standard deviations) and lower than in the function task. The overall picture in prosodic form reception is of scores only just below those of normal controls.

6.5.1.2 WAB and PALPA Tests: reception

Sam's results on the WAB and PALPA reception tasks show how he performed on tasks which specifically look at the understanding of meanings of words and at the ability to perceive segmental phonetic distinctions, are presented in Fig. 6-5.

Fig. 6-5 Sam's WAB and PALPA reception task scores



In the WAB comprehension test Sam scored almost 100%. The yes-no questions were simple ones relating to himself and his knowledge of the world (e.g. Are you a man, Is this Toronto); auditory word recognition concerned names of common objects (mugs and matches), and the sequential commands involved pointing to common objects. This score reveals an important aspect of his conversational ability, in that he appears to be very well able to make use of pragmatic and circumstantial detail. In the tasks on synonym judgements Sam scores below normal limits: this appears to indicate a difficulty with linguistic meaning. In the PALPA test for distinguishing words from non-words (No 5), non-word status was in many of the cases determined by one phoneme only (as in the examples given, 'foaster' and 'dunkey'). This task, in which he scored 88%, can therefore to some extent be classed with the tests of segmental phonetic discrimination discussed below, in which he scored similarly well.

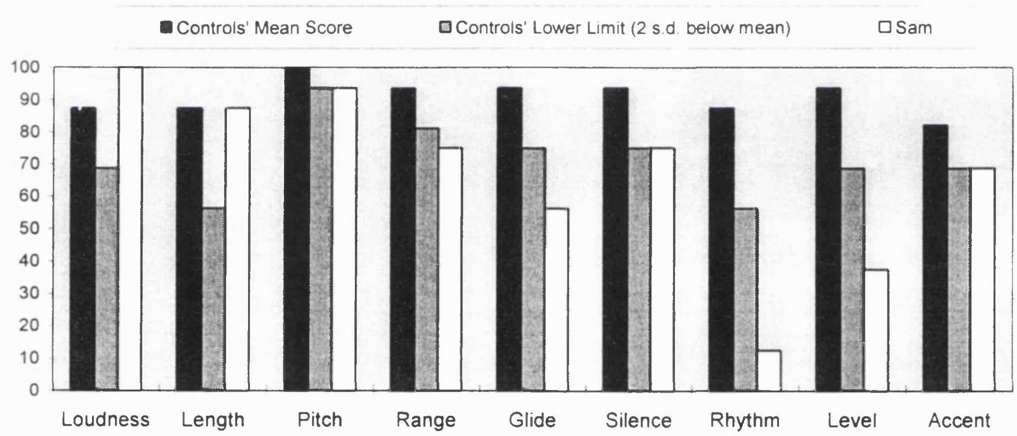
Sam's results in two of the segmental phonetic tasks parallel his results on the PEPS form reception tasks in that they are not significantly lower than normal controls: the mean score for unimpaired participants on the consonantal task is 96%; Sam scored 92% on that task and 90% on the rhyme task. On the third segmental phonetic task, phoneme identification (PALPA No. 16), he scored 73%; less than would be expected from an unimpaired speaker. There was no significant difference between Sam's performance on words and on non-words in this task.

The pattern of reception task results suggests that Sam has specific deficits in linguistic comprehension, in syntactic and semantic (although not pragmatic) aspects. These deficits are unlikely to be compensated for by prosody since he has deficits in the functional comprehension of prosody (as shown in Fig. 6-3), and the converse is also true: misunderstandings caused by his difficulty with functional comprehension of prosody are unlikely to be elucidated by reference to the syntax or semantics of an utterance.

6.5.1.3 PEPS Production

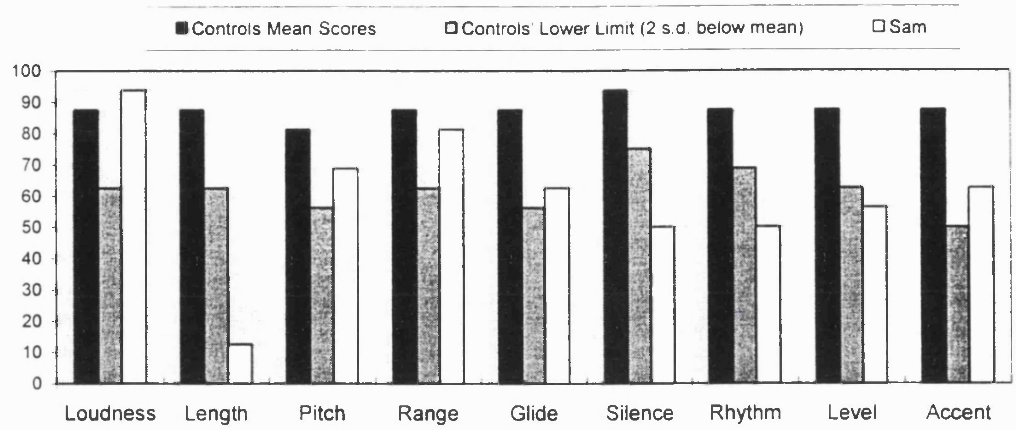
Sam's production presents a more complex picture than his reception skills, without the same dissociation between function and form. Fig. 6-6 shows his scores on function production tasks.

Fig. 6-6 Sam's PEPS function production scores



He scores at or above the mean in the Loudness and Length tasks, and at the lower limit in the Pitch, Silence and Accent tasks. He scores below the lower limit of normal controls in Range, Glide, Level and Rhythm: in Rhythm his score was three standard deviations below the lower limit.

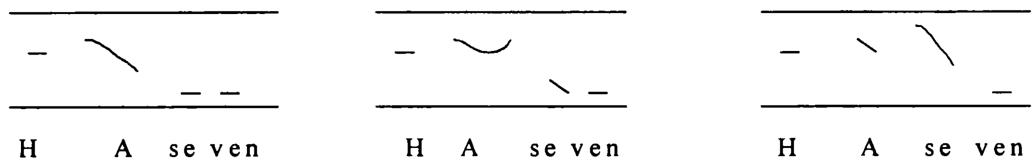
Fig. 6-7 Sam's PEPS form production scores



He scores at or above the mean in tasks for Loudness, Pitch, Range, Glide and Accent, and below the mean for Level, Rhythm, Silence and Length. There is no simple parallel, as in reception, such that scores on form tasks were high and on function tasks low. What can, however, be observed in both modes (form and function) is that, with the exception of Length, he tends to score higher in the monosyllabic tasks. All the form production tasks for the first five elements shown in Fig. 6-7 (i.e. Loudness, Length, Pitch, Range, Glide) required monosyllabic replies except in the case of Length, where the task investigated whether lengthening occurred at the end of the participant's polysyllabic utterances; participants had to copy short phrases that they heard on tape, such as "more and more", "on and on", to see whether the item in end position was lengthened. This task highlighted Sam's marked tendency to syllable-timing, which is a characteristic of non-English languages, English being 'stress-timed' (Pike 1946). In correlating Sam's scores with the number of syllables needed in the responses to each task a high inverse correlation was found; the function task for Rhythm (in which he scored lowest) required 5 or 6 syllables. On tasks requiring monosyllabic responses, however, he managed better; he scored highly, for example, on the function production task for Length where there were monosyllabic names to say. His difficulties with these prosodic tasks, could be related to the functional processing load of longer utterances. One consequence of his having difficulty with the production of Level, Silence and Length is that, according to the findings of the normal study in which it emerged that these were the elements used in the delimitation (or chunking) of information (see 5.10), he is likely to have difficulty with indicating the end of his remarks; there is possible evidence of this in the fragment of conversation at *(1) in Fig. 6-1, where the tester pauses for nearly a second before apparently deciding that Sam's utterance of "inside" is in fact a complete one.

The consequence of Sam's problem with increasing utterance-length for prosodic function manifests itself in such tasks as the one for Accent. Here he had to say a sequence such as 'HA7' (being part of a postcode), placing the focus on the A. In Fig. 6-8. the first two examples shown how controls produced prosody; the third is Sam's version.

Fig. 6-8 Realisations of 'HA7'

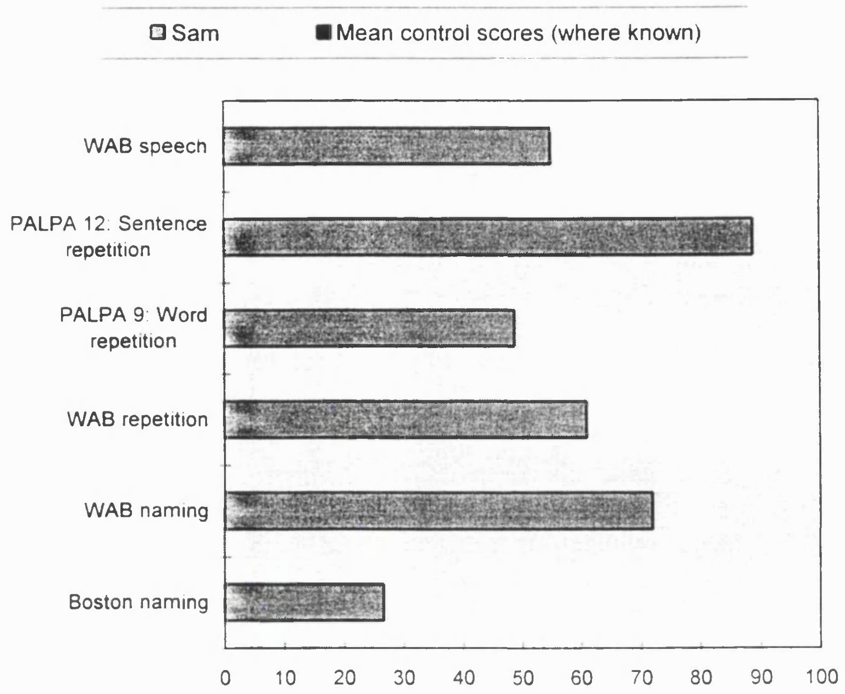


Controls produced either primary accent (falling glide) on the 'A' with '7' de-stressed, or a default accent pattern with a falling glide on the '7' and but extra stress on the 'A'. Sam had initially all the right prosodic factors in play on the right letter, but the balance was upset on subsequent tokens. His version tends to give the impression that he made a mistake initially in emphasising the 'A' and wished to correct it by placing even greater prominence on the '7'. Thus the focus of his utterance is not clear. On the other hand, the longer utterances of PALPA No. 12 (Sentence repetition) produced an improvement in intelligibility, as described in 6.5.1.4. In the fragment of conversation (Fig. 6-1) there is evidence however that Sam fails to communicate the focus of an utterance: at *(2), the tester understands him to be having difficulty with the word 'three', whereas it emerges that it is the word 'years' (i.e. 'hours') that is causing problems.

6.5.1.4 WAB and PALPA tests: production

Lexical production in the Boston Naming Test produced a markedly low score of 27%, and WAB naming 72%. In the repetition tasks, he scores 61% on the WAB, 48.75% on PALPA word repetition, and 88.89% on PALPA sentence repetition. In the WAB speech test he scored 55%. Scores are shown in Fig. 6-9.

Fig. 6-9 Sam's WAB and PALPA production tasks



Naming

Problems here may be caused either by anomia or by apraxia: the difficulty may be a functional one, of not being able to access the right word for the meaning, or a formal one (not being able to utter the word once accessed from the lexicon). The low score for the Boston naming test suggests anomic difficulty; but the higher score for the WAB naming task, where the items were more familiar ones, suggests that this difficulty is less severe for common items. In the WAB speech test Sam scored moderately well on information content but low on fluency.

Repetition

Scores on reception tasks are relevant here, in that accurate repetition depends initially on accurate reception of the item to be repeated. Sam's prosodic reception scores suggest that if only form is necessary for accurate repetition, his ability to repeat will be in the normal range, but if understanding of meaning is necessary, his repetition will be impaired.

In the tasks that Sam performed, the meaningfulness of the items is open to question. Sentences in the WAB test are graded in their predictability (from "The telephone is ringing" to "Pack my bags with five dozen jugs of liquid veneer") and PALPA sentences also vary (e.g. "The horse's kicking the girl" and "This horse's got less chickens to scare"). In the PEPS test connected-speech items included prepositional phrases (e.g. "on the wall") reduplicative phrases (e.g. "more and more") lines of nursery rhymes (e.g. "Rain, rain, go away"), and pictures of food and drink (e.g. "cream buns and jam"). In the scoring procedure for these tasks there is no way of determining which items the participant found meaningful and which not. On the other hand, as mentioned in 6.5.1.2, the results of the one task involving non-words suggests that he tended to process the form of the items in the tasks rather than their meaning.

Scores on repetition tasks present a mixed picture. In the WAB repetition task a score of 61% suggests phonemic paraphasias making some words unintelligible, as does the score on PALPA word repetition; what is surprising is the relatively high score of 88.89% on PALPA sentence repetition. In this task, no penalties were scored for the time taken over utterances, but Sam sometimes took as long as 25 seconds to utter a six-word sentence; to some extent, therefore, the high score is misleading as to the difficulty experienced. On the other hand, although phonemic paraphasias were many, the context of the sentences and faultless word-order rendered the words and the sense of the utterances intelligible: this is an important effect when considering utterance-length for this speaker (see 6.5.1.5) .

6.5.1.5 Conclusions for Sam

The conclusion drawn from the results of all the production tasks is that whereas prosody breaks down in longer utterances, the effect of dyspraxia and multiple phonemic paraphasias on content intelligibility diminishes with increasing utterance-length. This means that Sam is likely to be able to convey the functions mainly associated with prosody effectively in short utterances but not in long ones; and that where long utterances are concerned, he is likely to succeed (eventually) in communicating the lexical content but without such prosodic functions as focus.

The consequences of his scoring at chance level on a number of function reception tasks (Range, Accent, Glide, Silence, Rhythm), in connection with his scoring at chance level on the form tasks for Range and Accent, could be far-reaching. The chance scores in the Glide and Silence tasks are of less importance than the others. Scores on the Glide task produced some surprises, as shown in 5.7. Although he scored low in the Silence function task, he scored within normal limits on the form task, which means that his perception of non-phonation is adequate and is available for functions other than the one designated in the test (hesitancy is discernible by means other than silence, as shown in 5.10). Deficit in the other three elements (Range, Rhythm and Accent) could be more significant, however. Lack of appreciation of the form and a function of the element of Range deprives him of one strong pointer towards the attitude of interlocutors. Not understanding the form of accent-difference nor the function of focus means that one common means of identifying the important points in what is said is not available to him. A lack of appreciation of one of the functions of rhythm in speech leaves him without one particular means of discerning conversational cohesion (Couper-Kuhlen, 1993).

6.5.2 Simon

Simon has fluent aphasia with phonemic paraphasias but no accompanying dysarthria. On the whole, his reception and production were well-matched: where reception scores in one element were slightly down, production scores tended to be down also.

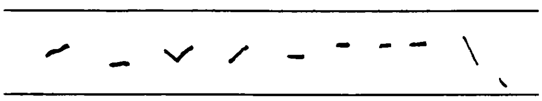
Fig. 6-10 shows a sample of his conversation, taken from a point in the PEPS test where he had been repeating reduplicative phrases. He had repeated 'more and more', 'on and on', 'by the bye, and 'two by two' with no problem, and has been asked to repeat 'door to door':

Fig. 6-10 Conversation with Simon

Simon door (1.3) by no that's war I'm sorry . I can't do these . things at all I'm

{lento.........}{alleg.........}{arh...}

Tester that's okay əm=



Simon =door by . door - or . but you didn't do that

{lento..................}{p, allegro..................}

Tester no what I did was=

Simon =no . you said door

Tester [tʊ̆] - door

Simon [tʊ̆] - door =

Tester: =okay=

Simon: =yes=

Tester: =it's not terribly important=

Simon: =it is be-cause I can't I can't =
{wide}

Tester this =I =

Simon: = I can't ə: ə it's mad . less . ly difficult I mean ə because I can't
{wide, lento... ....}

Tester: right ← we:ll:

Tester: m . yes . yes . I I I see what you mean

Simon [jɑ]

Tester: ə:m it must be . very frustra ting

Simon very . [jɑ]
{allegro...}

Tester	it's just that əm I meant that . for what I'm looking at

Simon:	doesn't make much difference

{allegrissimo……………………..}

His prosody scores were, on the whole, below the mean but within the range of prosodic ability of unimpaired participants overall: Fig. 6-11 shows how his scores in the broad categories of prosodic ability compare with the mean scores of unimpaired participants. Only the top parts of the columns, between 60% and 100%, are shown in the chart, in order to highlight the fact that in form production Simon scores at almost the mean level for unimpaired participants. In contrast to the other two participants, Simon does not score below the lower limit of unimpaired participants in the broad categories of prosodic ability.

Fig. 6-11 Overall mean scores in all prosodic modes compared with controls: Simon

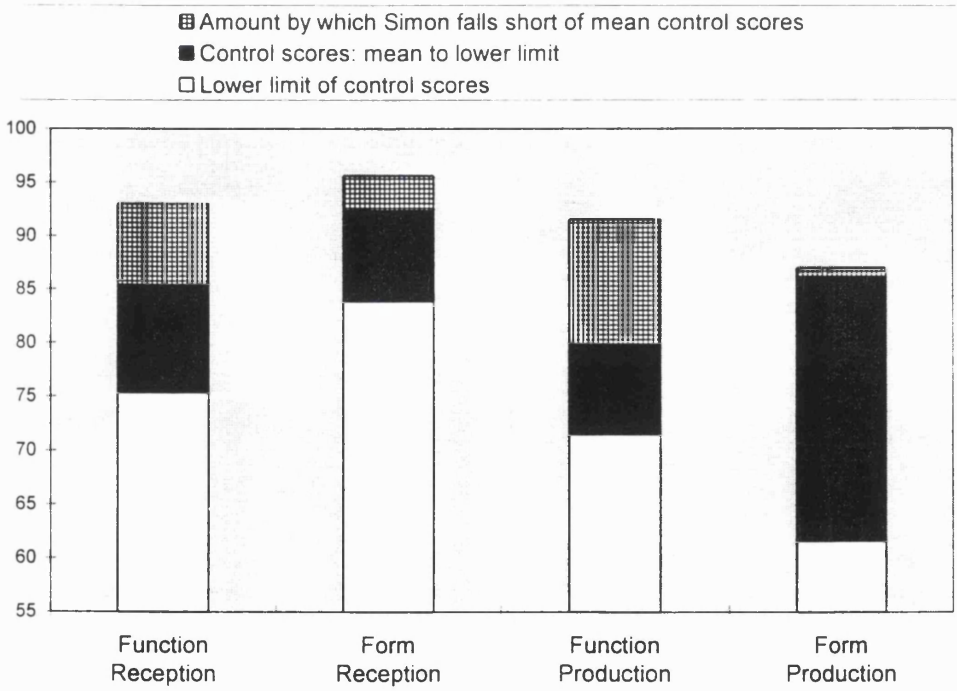


Table 6-3 shows in which individual tasks Simon falls below the range of normal prosodic ability, and by how many standard deviations:

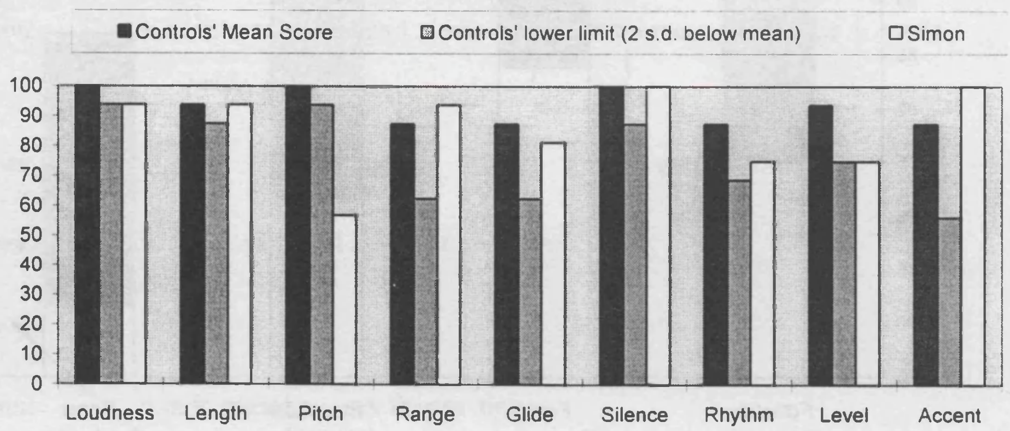
Table 6-3 Tasks in which Simon scores outside the range of normal ability, and by how many standard deviations

Elements	Function Reception	Form Reception	Function Production	Form Production
Loudness				
Length				
Pitch	9.37		4	
Range			0.83	
Glide			1.26	
Silence				
Rhythm				
Level				
Accent				

6.5.2.1 PEPS Reception

Although overall he scores well within the normal range on function reception tasks, it is clear from Fig. 6-12 that there was a problem with the function reception task for Pitch.

Fig. 6-12 Simon's PEPS function reception scores



He also experienced difficulty with some other tasks. He managed to comply, but only after requests for clarification. His problem with the Pitch function reception task is reviewed in some detail, since it was the only reception task in which he scored at chance level, and was one where, as seen in Appendix 5, unimpaired participants tended to score at ceiling and experienced no difficulty after a short practice. An explanation for his difficulty is that he was concerned about his pronunciation of the months: if his utterances of each month are viewed as important achievements for him, it can be seen that he may have had no concentration left for hearing whether the cue signalled 'next-please' or 'repeat-please'. More simply and generally, where he is monitoring his production, he may fail to hear and to produce the less obvious aspects of conversation, such as prosodic inflections. Indications from his utterances are that his concern is with the segmental correctness of what he says, e.g.

Fig. 6-13 Simon's 'October' fragment

Octu:na - you see there's a bad one; what's that

{ff }

He thus produced repetitions according to whether he thought his words were adequately pronounced or not, and not according to the cue he heard from the tester. The test was stopped and the task reviewed, after which Simon appeared to listen to the cues. The following exchange occurred:

Fig. 6-14..Simon's 'July' fragment

Simon July

Tester: m

Simon (2.0) m . ah . that could be either

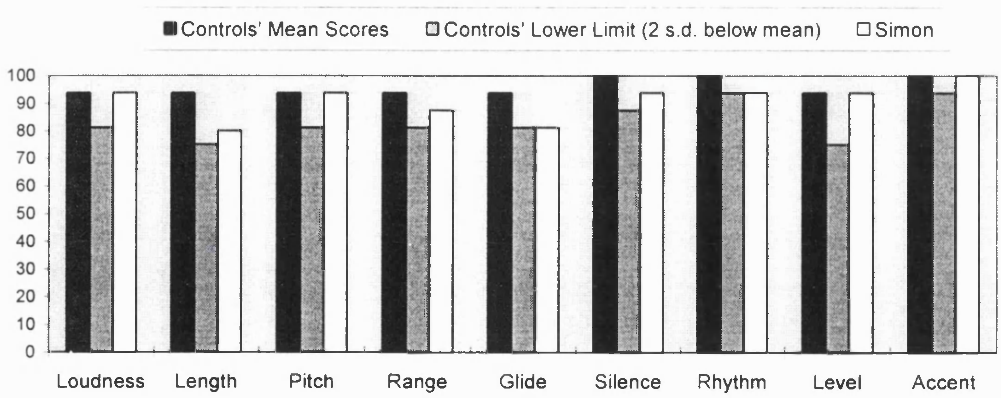
Tester right

Simon so I shall do.July anyway

In Simon's second turn here, his "m" appears to be produced as a repetition of the tester's "m", but the glide direction is reversed. His decision to repeat "July" may be influenced (as it was expected to be) by the intonation of the tester's "m" (high pitch, steep rising glide) although he explicitly fails to identify its distinctiveness ("that could be either"). Soon after this, the months were abandoned since it was clear that the pronunciation of them was causing too much distraction, and short names (Kay, Lee, Di, etc), which had occasioned no problem in Length function production, were used instead. Simon showed a learning effect, starting with misinterpretations and hesitations and ending by being confident at least about producing repetitions in response to the high "m?" His final score is based on his later efforts.

Apart from the consequences of his phonemic paraphasias for his communication, these results are useful from the point of view of the success of the assessment procedure. It appears that in spite of assurances that his mispronunciations were not relevant or important, Simon was still preoccupied with them, and the test thus failed to elicit a clear account of his prosodic ability. Fig. 6-15 shows his scores on PEPS form reception tasks

Fig. 6-15 Simon's PEPS form reception scores

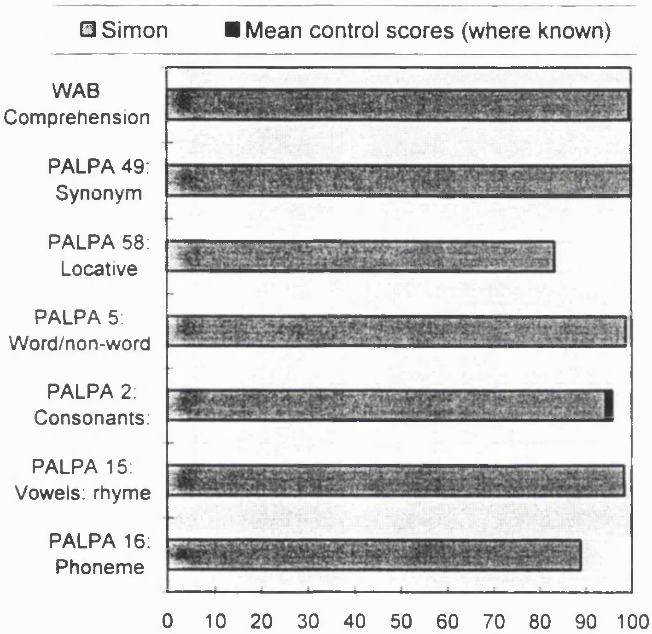


Although his scores on form Reception tasks were in general within normal limits, Simon experienced a difficulty with some of them that the other two participants did not apparently have. For example, he sometimes heard what he described as two syllables where there was only one. At the time, Simon was complaining that he could not listen to music with the same appreciation as before his CVA, and his results on the reception tasks do not rule out the possibility that he was processing auditory stimuli not present in the cue (Simon did not suffer from tinnitus).

6.5.2.2 WAB and PALPA tests: reception

Fig. 6-16 shows Simon's scores on WAB and PALPA reception tasks

Fig. 6-16 Simon's WAB and PALPA reception scores

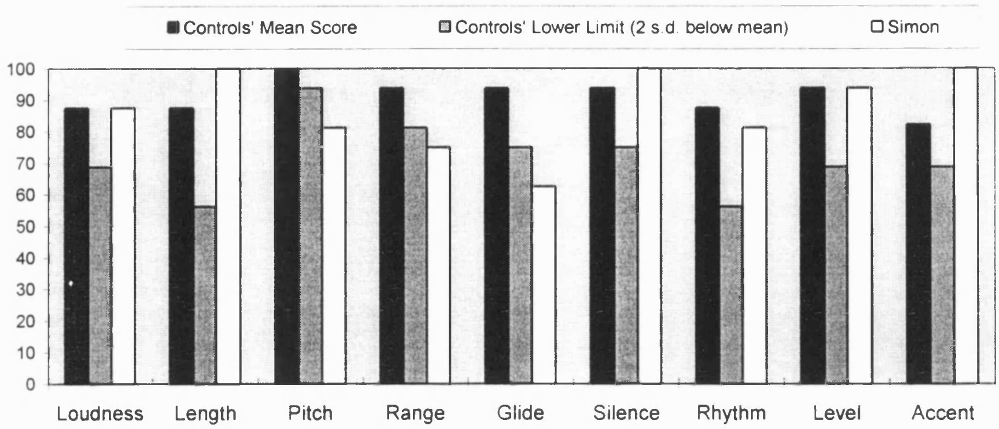


Simon made some errors in comprehension of locative relations (PALPA 58: 83%) and fewer in the identification of initial segments (PALPA No 16: 89%). A closer look at his performance on these task shows that his errors in PALPA No 58 were to choose the reverse relation rather than to show incomprehension of the prepositions involved. It is to be noted that a phonological parallel, metathetic differences in word discrimination (PALPA No 2), e.g. 'cap-pack', did not attract erroneous "same" judgements. This appears to indicate that the tendency to transposition suggested by the score on PALPA No 58 is connected with semantics or syntax rather than a phonological problem. In PALPA No. 16 two of his errors involved words, three non-words; of the five, three concerned voicing. As with Sam, this indicates a tendency to process these tasks without much concern for the meaning of the items. It thus appears that reception on the whole is not a problem for Simon.

6.5.2.3 PEPS Production

Fig. 6-17 shows Simon's results on PEPS function production tasks

Fig. 6-17 Simon's PEPS function production scores



PEPS tasks which Simon found difficult were the Loudness function production and Pitch function production tasks. He showed anxiety at the beginning of the PEPS test, and Loudness function production was the second task he did, so anxiety may have been the reason for the difficulty, which was to repeat his understanding of the instruction with appropriate loudness instead of producing the required token with appropriate loudness. He showed greater confidence and less attention to segmental detail by the very end of the PEPS tasks, suggesting that in normal conversation he might be less self-conscious and more receptive.

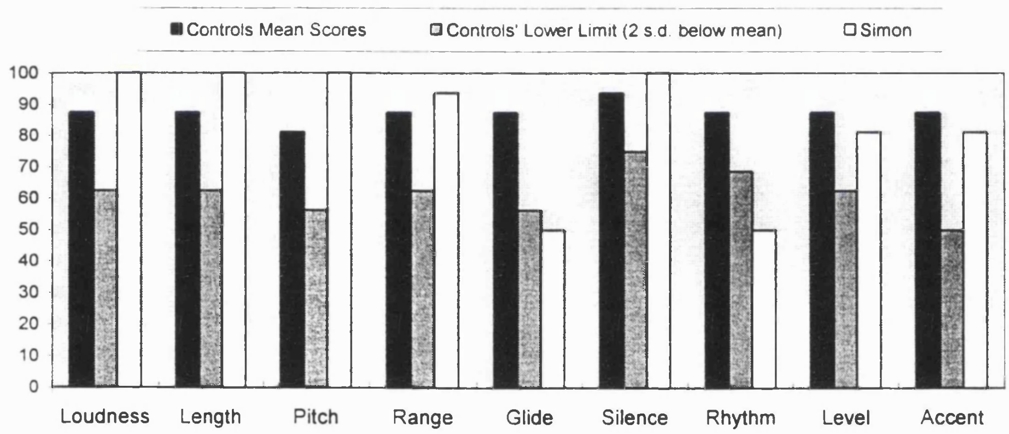
He found the Pitch function production task difficult, and it seems that this may have been because he found the token "m" distasteful; he said of it: "I think it so badly that I try not to use it, ever." (see Fig. 6-20)

It was hypothesised that a tendency to phonemic paraphasias might have a prosodic counterpart: e.g. the production of falls in place of rises. There were a few occasions when this could have been the case. For instance, given that Simon used a southern British standard variety of English, it was expected that his questions would be uttered with a rise; but in the task of saying clocktimes in a questioning way, two were uttered with a fall, and judged as statements not questions by three scorers. Of these two clock-times, however, one emerged first as "O'clock a ten" instead of "Ten o'clock", and was corrected. In this case it would appear that, in correcting himself, Simon might have forgotten that his task was to make the utterance sound questioning. Apart from these two clocktimes, a third was misinterpreted by judges: in this instance, Simon's task was to make "eight o'clock" sound questioning, and he used a high narrow rising glide, also marked as 'stating' by the three judges. In this instance it would appear to be the narrowness of the rise that prompted the judgement of 'statement', in which case it would indicate a misuse of Range. These results were considered in connection with the fact that it did not appear from Simon's conversation that he frequently produced transpositions such as rises for falls; with the fact that the PALPA tests showed up his preoccupation with producing words in their phonemically correct form.

It is proposed that Simon's preoccupation with his phonemic paraphasias both obscured his reception of prosodic function, and prevented semantic feedback in his own sentence repetition. It should be questioned how far this appeared to be an effect of the test situation.

Fig. 6-18 shows his results on PEPS form production tasks

Fig. 6-18 Simon's PEPS form production scores

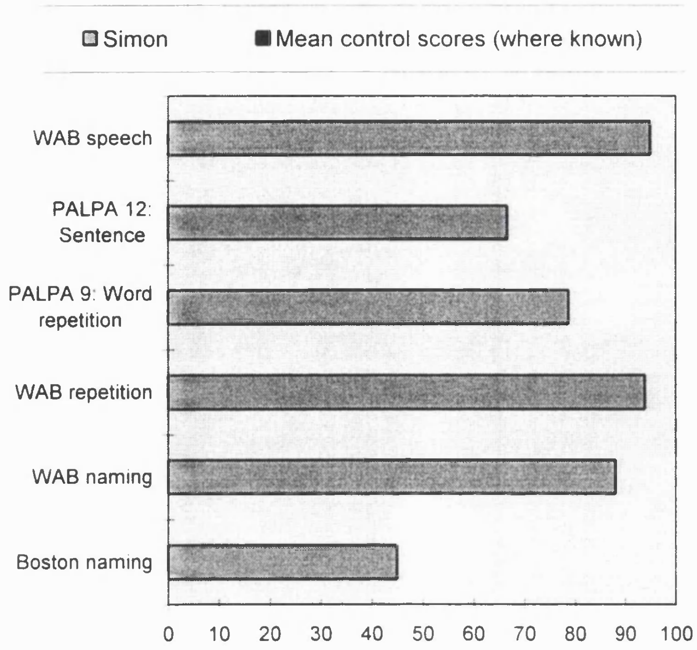


Simon found Rhythm form production difficult, making three or four attempts at each item; early attempts were apparently rejected by him as not phonemically correct enough. In Glide form production, Simon's low score can be attributed to the possibility that he was concentrating on repeating the cue semantically and phonetically correctly and not noticing or reproducing the way it was said by the tester, even though the cues were by this time very familiar (the short names were used again, because of their previous success) and the form of the task should also have been familiar by that stage.

6.5.2.4 WAB and PALPA tests: production

Fig. 6-19 shows Simon's scores on WAB and PALPA production tasks

Fig. 6-19 Simon's WAB and PALPA production scores



Naming

On WAB naming Simon scored 88%, naming the everyday objects with little hesitation and a few paraphasias. The Boston naming test gave him much more trouble (score 45%). He seemed to have difficulty finding some of the words he needed, producing "horse-fish" for "seahorse", "succulents" for "cacti", and rejecting "igloo" which suggested itself for "pyramid". Equally, many of his tokens were subject to phonemic paraphasias ("steel...heel...sorry wheelchair"; "fussel...filter...funnel" "smecks...smiths...smink....sphinx"). Some of these were examples of metathesis or transposition (/'ɔtɔskʊp/ for "octopus", /ɪ'rɔsənəs/ for "rhinoceros", /'ækəbəs/ for "abacus") rather reminiscent of "O'clock a ten" and the tendency to reversal seen in repetition tasks (see 6.5.2.4 below). On several occasions, it appeared that he gave himself a better chance of correctly producing the word he wanted by "giving himself a run at it". He would situate the word in the middle of a phrase:

"/skɪzəz/ oh why can't I say 'scissors' "

"That's a very difficult word so I say 'mouth-organ' (2.0) 'harmonica' is the other word."

Another technique was to preface the word with "and a..." and thus cope fluently with the final, somewhat arcane, items of the Boston test:

"and a yoke; and a trellis; and a palette; and a protractor"

In his production of these last four items there was sometimes lengthening of 'and', sometimes of 'a'; they were thus not produced rhythmically. This was noted because it was observed in speech therapy clinics that aphasic speakers' fluency appears to improve sometimes when there is an element of rhythm about what they are saying. This was compared with Simon's performance on the PEPS Rhythm production tasks, where he scored low, and where it seemed as though a sense of rhythm did not assist his production. It would seem from this that, for Simon, medial position may be influential in diminishing production difficulties, but momentum is not.

Repetition

Simon had difficulty with PALPA No 12 and No 9, sentence repetition and word repetition (67% and 79% respectively). The tendency to transposition which was noted in a reception task (see 6.5.2.2) above, PALPA No.58, bears resemblance to an error which occurred frequently in the sentence repetition task (PALPA 12), i.e. a tendency to reverse the relations of the arguments; "The horse is pulling the man" was repeated as "The man is pulling the horse". Not all the errors in this task were as clear-cut as that, and several involved lexical substitutions and a change of voice (active-passive), but many showed this tendency. What was most striking about this was that whereas he was well aware of pronunciation errors and concerned to correct them, he apparently did not notice that he had made any error in:

- sentences where he reversed the sense, as in the example above, or where he turned passive constructions into active ones;
- sentences that had less sense than the original, e.g. "The man is pulling the man", or "The washing of the girl was by the dog";
- sentences with syntactic errors, e.g. "The man is more thin for the horse"

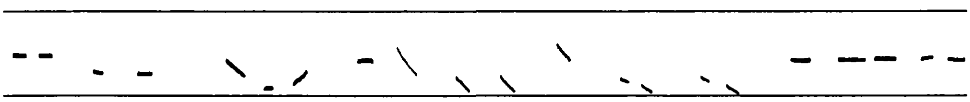
Lexical substitutions were sometimes corrected: "The man sorry horse" where the target was 'horse'; and sometimes introduced: “The dog sorry horse" where the target was 'dog'.

His errors in word repetition (PALPA No 9) did not convincingly demonstrate a tendency to transposition, but words of high imageability and high frequency were marginally easier to the word "member". In the WAB repetition exercise he had most difficulty with "No ifs, ands or buts," suggesting a difficulty with semantically empty words.

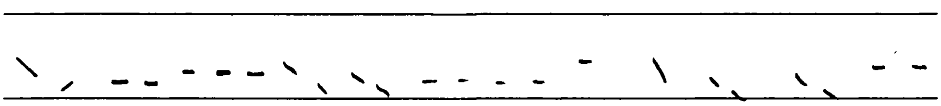
6.5.2.5 Conclusion for Simon

Although understanding appeared to be more or less intact, the repetition tasks in particular demonstrated a tendency to inadvertent transposition in production tasks. The tendency to phonemic paraphasia preoccupies him to the extent that phonetic precision is a problem for him where it is not for the non-fluent aphasics, although their segmental production is considerably less clear than his. One consequence of this is that other aspects of language may be neglected. Otherwise it seemed as though his prosodic skills might well be intact. The fragment of conversation shows how disconcerting he finds his inability to repeat accurately, although he apparently understood very well that it was not important in the context. After the task was over he made reference to the phrase, and in so doing uttered it with no difficulty; when this was pointed out to him it caused him no surprise. It can also be seen in the fragment that while he is capable of perfectly fluent and meaningful speech (such phrases as “doesn’t make much difference” and “but you didn’t do that”) and problem-free turnchange, there is also the blend “madlessly”, possibly a mixture of ‘hopelessly’ and ‘maddeningly’, which occurs in a stretch of speech which is halting and suggests word-finding difficulty; but where the intonation contour is maintained through the blend. A another possible blend occurs in the following fragment (Fig. 6-20), where ‘badly’ is apparently being used in its sense as intensifier, whereas he may instead (or also) have intended it to be a manner adverb:

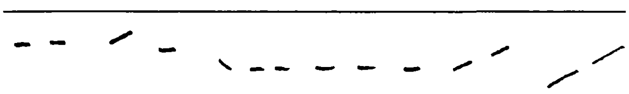
Fig. 6-20 Simon’s ‘telephone’ fragment



Simon: so I - [bə][wəd] . normally - I’d say [jɑ] [jɑ]. [jɑ] [mhm] [mhm] but - I think it so



badly . that I try not to use it ever - even on the [tel] . well [ʌhʌ] . [ʌhʌ] on the



teleph::one how terrible people say [hʌhʌ] - [mhm]

6.5.3 Individual profiles: Keith

Keith shows a few near-ceiling scores but otherwise a picture of severe deficit, especially on production.

Fig. 6-21 shows a sample of his conversation.

Fig. 6-21 Conversation with Keith

Therapist: and do you go back to Ireland=

Keith: no (.)[jɛ jɛ ə] (.) well (.)[ə] no - - well [ə] well(.) [mɪsɪz].[mɪsɪz]

{accel...}

Therapist right

Keith .'co'ming 'back 'a'gain=

{f,lento, syllabic............}

Therapist =right ok

Keith [jɛ] . [jɛ], =

Therapist =so is she over there still =

Keith =no(.) no

Therapist or you or she goes back =

Keith =no (0.9) (mumbling) 'she 'goes 'with 'me

{syllabic……………………………… }

{f,lento…}{f, alleg….}

Therapist right ⌈ok

Keith ⌊ [jɛ] . 'she 'goes 'with 'me =

{f, syllabic ………}

{lento……}{alleg…..}

Therapist right ok do you have any other family in Ireland

Keith [jɛ] . a [bədə] brother =

{f……}

Therapist a brother =

Keith [jɛ] . one brother [jɛ] =

{ral………..}

Therapist um - -

Keith [jɛ] =

Therapist did you like growing up there

Keith	ə . fifties =
	{p}
Therapist	wasn't a good time ((laughter))
	[jɛ] . fifty-two
Therapist	((laughter))
Keith	((laughter)) fifty-two . [jɛ] =
Therapist	and what job did you do .
Keith	oh - - a ((2 syllables)) [maikiʃ] . [maikiʃ]
	{p…………} *{ff……...}*
Therapist	=right (nods head)
	[jɛ] and a [maikiʃ] [jɛ] . stockin shoes shoes =
	{ff…………}
Therapist	shoes=
Keith	=no .
Therapist	no =

shoes ⌈shoes shoes .
{cresc ………… }

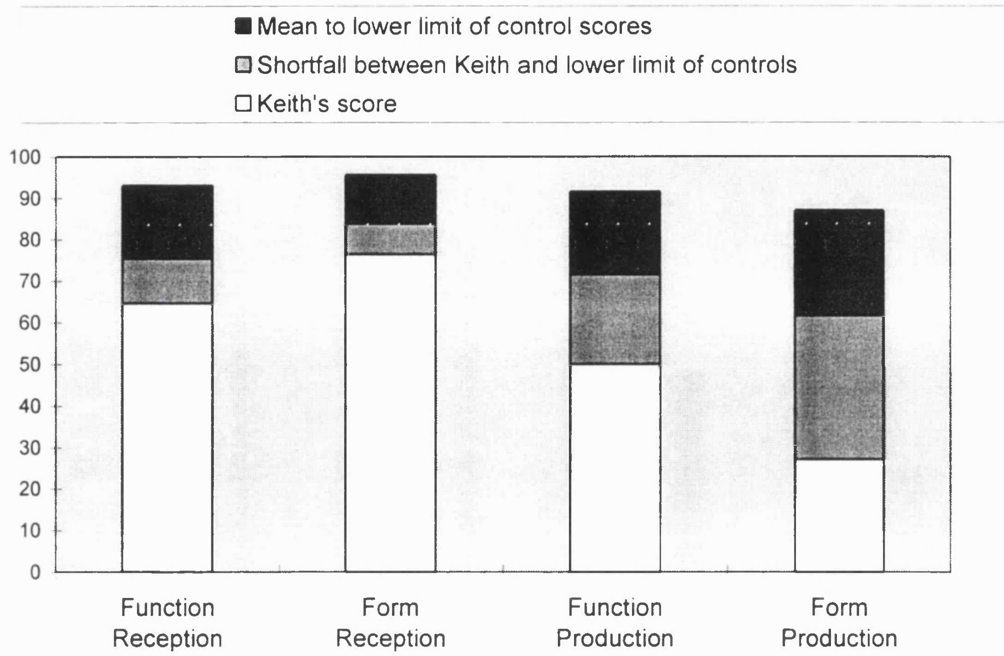
Therapist ⌊shoes

Keith [jɛ] shoes .

This fragment of typical conversation with Keith shows that communication is severely impaired. It does not seem excessive to claim that very little has been gained from this conversation: both participants appear to have had great difficulty in understanding the other at all. The conversation does not develop: turns by the therapist which pick up material from what Keith says ("so is she over there still" and "shoes" meet with apparent contradiction: "no", which in the second case is reversed). Keith repeats one intelligible phrase "she goes with me" with particular emphasis (loudness and syllabic rhythm) although there is every indication that the therapist understood what he said the first time. There are several cases of overlap and latched turns indicating uncertainty about whose turn it is to speak, and four distinct topic-changes which suggest an anxious eagerness to keep the conversation going. Repetition, loudness and wide pitch-movement (especially rise-falls) from Keith give the impression of frustration and impatience on his part, while the laughter from the therapist sounds uneasy and bewildered.

The chart below (Fig. 6-22) shows the comparison of Keith's scores with those of unimpaired participants in the broad prosodic categories. As with Sam's, Keith's scores are below the lower limits of unimpaired participants overall, but in Keith's scores the deficit is more marked.

Fig. 6-22 Overall mean scores in all prosodic modes compared with controls: Keith



and Table 6-4 shows in which tasks he scored below the abilities of unimpaired participants, and by how many standard deviations:

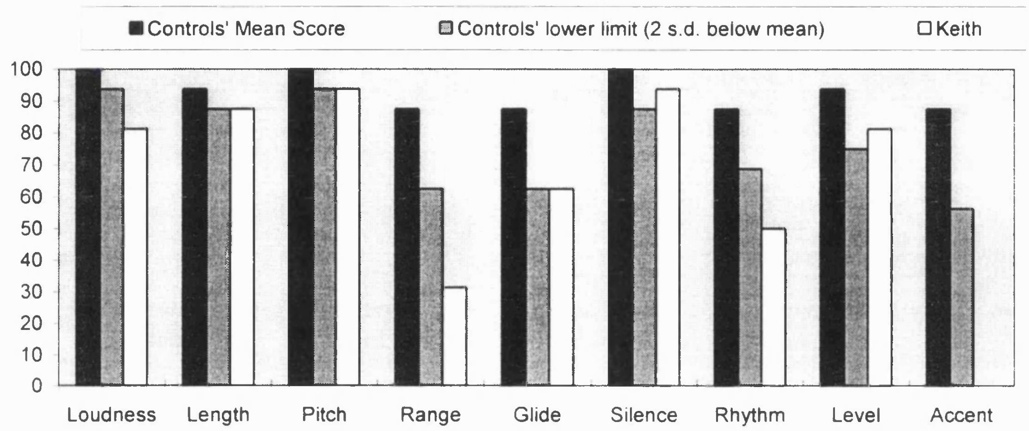
Table 6-4 Tasks in which Keith scores outside the range of normal ability, and by how many standard deviations

Elements	Function Reception	Form Reception	Function Production	Form Production
Loudness	3.36	6.74	1.20	
Length				3.79
Pitch		0.8	28	2.54
Range	2.67	2.83	2.5	4.12
Glide			6.29	3.08
Silence		1.28	4.53	7.58
Rhythm	1.94		2.59	
Level				3.94
Accent				2.56

6.5.3.1 PEPS Reception

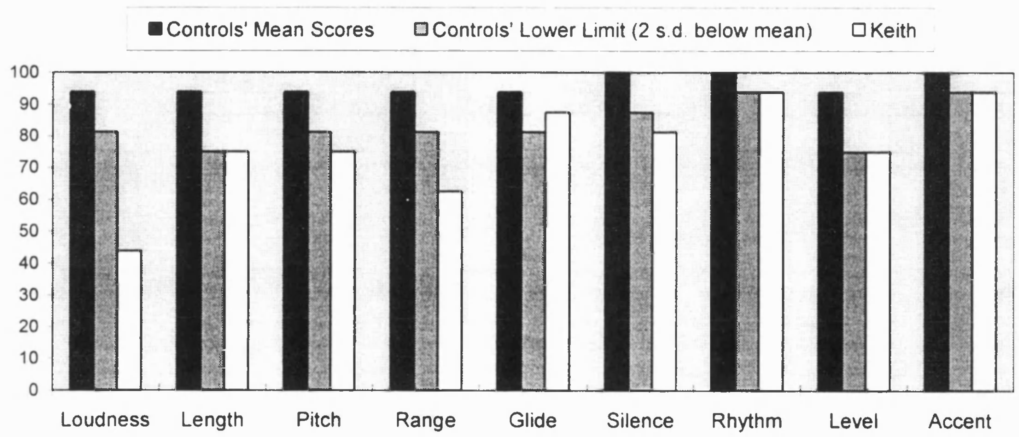
In prosodic function reception tasks, shown in Fig. 6-23 below, Keith shows a deficit, although this is masked by the greater problems he has in other modalities. He was unable to do one of the tasks (Accent: see 6.3.1).

Fig. 6-23 Keith's PEPS function reception scores



As for Sam, it is necessary to see whether this could be explained by poor form reception, and his scores as compared with unimpaired participants are shown in Fig. 6-24:

Fig. 6-24 Keith's PEPS form reception scores

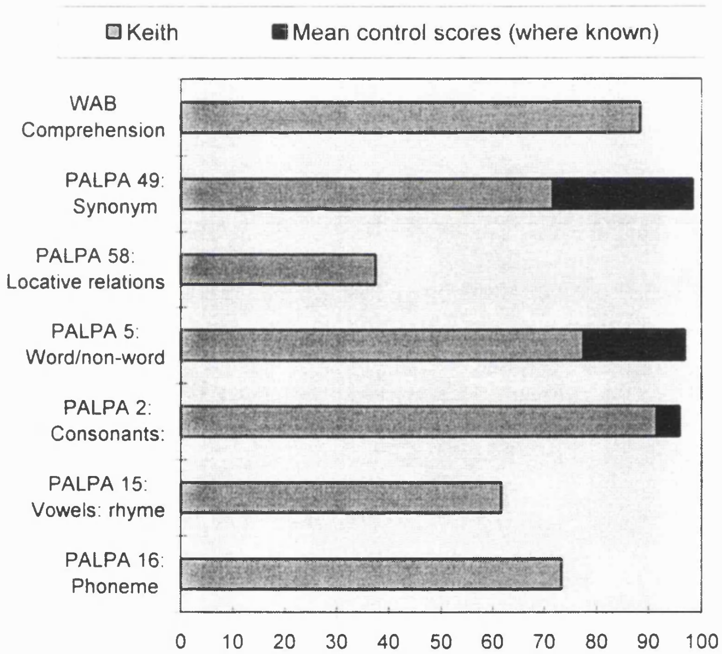


Unlike Sam, Keith scores at or below the lower limit of normal ability on form reception. He scored at chance on two of the form subtests (Loudness and Range) and showed a tendency to judge "same" items as "different" (19 out of 72: more than twice as many as any control participant). His scores were at chance level on three of the function tasks: Range, Glide and Rhythm, which were three of the ones where Sam scored at chance. This suggests deficit at the phonological level of processing but does not eliminate the possibility of deficit at the levels of semantics and syntax.

6.5.3.2 WAB and PALPA tests: reception

His WAB and PALPA scores are shown in Fig. 6-25

Fig. 6-25 Keith's WAB and PALPA Reception scores



In WAB comprehension, he scored low on the section dealing with sequential commands, which suggests a difficulty with locative relations, and his score on the PALPA task (No. 58) concerning the same topic was also low (37.5%) Here he made correct judgements for 6 out of 8 items involving living things, but for only 3 out of 16 abstract and inanimate items; he frequently wavered between the correct target and its reverse, often settling on the reverse; sometimes he chose between two other locative relations. This appears to indicate a difficulty with abstraction and with understanding prepositions, or possibly syntactic relations in general. Similarly, with auditory synonym judgements (PALPA No 49), where his score was 72%, he scored significantly better on words with high imageability (26 out of 30 items correct) than on words with low imageability (17 out of 30 correct).

In common with many aphasic speakers, Keith demonstrated a strong tendency to lexicalise: in PALPA 5 (auditory lexical discrimination) he judged 32 of the 80 non-words to be words. The tendency to lexicalise can be related to the element of reception in the Pitch function production task: participants have to request repetition of items which they do not understand, and half of the items are non-words, but Keith only once requested repetition, implying that he had heard and understood all but one of the items. These outcomes have together been taken as an indication of general lack of reliability in Keith's reception, and that he probably understands a good deal less than he appears to.

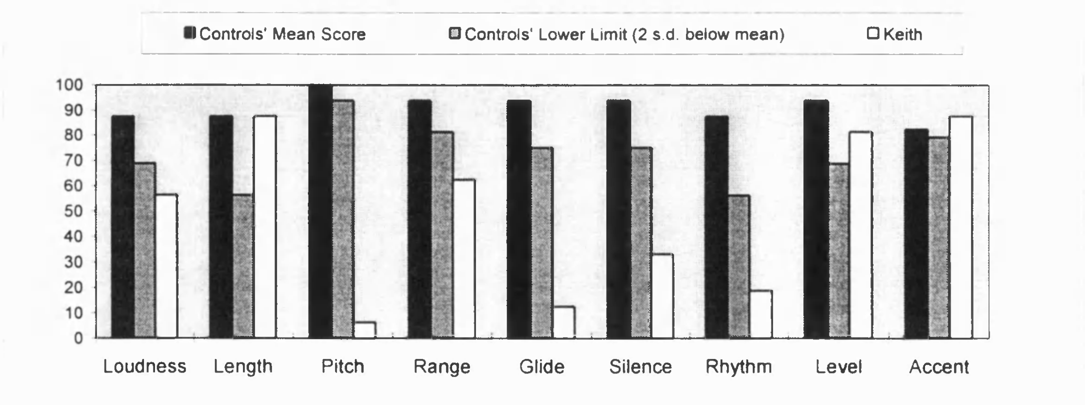
Where segmental tasks were concerned, Keith scored well within normal ability (92%) on the same-different consonant discrimination task (PALPA No 2), but on vowel discrimination (rhyme judgements, PALPA No 15) he scored 62%, not greatly above chance. The latter score bears comparison with his performance on some of the form reception tasks in the PEPS test. Phoneme identification (PALPA No 16) was also below normal ability at 73%.

The conclusion must be that Keith's reception ability is impaired in all modes.

6.5.3.3 Keith's PEPS Production scores

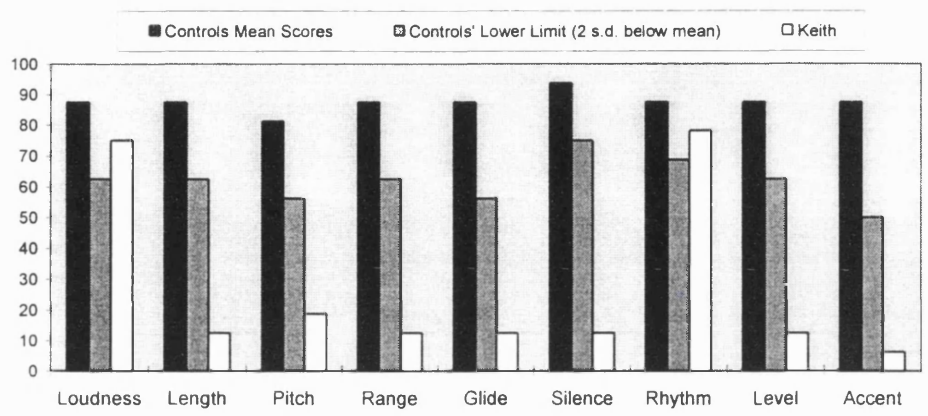
Keith's production also posed problems. He is often difficult to understand at word-level, and this is surprising in view of the fact that his articulatory difficulties appear to be mild. He often resorts to writing: although his spelling is faulty, the written word generally elucidates what he wants to say. The charts below, in Fig. 6-26 and Fig. 6-27, show little consistency in his scores on prosodic production tasks:

Fig. 6-26 Keith's function production scores



In three of these tasks (Length, Level and Accent) he is comfortably within the range of normal ability, but in the others he is between two and seven standard deviations below the lower limit.

Fig. 6-27 Keith's form production scores



In 7 of the 9 form production tasks he achieves little or no variation in the elements under test, whereas considerable variation (although not well deployed) is apparent in the function production tasks. In two tasks (Loudness and Rhythm) he is within the range of normal ability, but for all the others, including the ones where he showed unimpaired functional ability (Length, Level and Accent), he is 7 standard deviations below the lower limit. The discrepancy in Length tasks suggests that utterance-length may be a factor in his case as it was in Sam's, but this is belied by the Rhythm form production task (5-6 syllables), and by the function tasks for the Level and Accent tasks: in these, where he appeared to have grasped the communicative value of the tasks fully, utterance-length proved no obstacle. His low scores in the other form production tasks are attributable to his impaired ability in repetition tasks (see 6.5.3.4) which in turn could be attributable to his impaired reception ability (see 6.5.3.1).

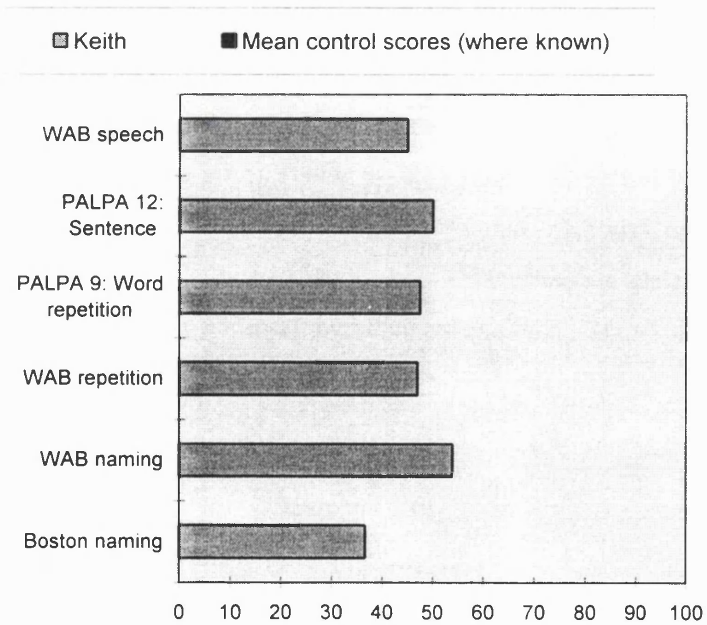
An interesting sidelight on Keith's use of accent is that on one occasion in conversation he needed to make exactly the same contrast of accentuation, using the same words, as required of him in the test (i.e. to correct the tester's candidate interpretation "fifty?" to "fifteen", with accent on the last syllable). In conversation he could not do it; in the test he could. The conversation preceded the test, and it is possible there was a learning effect from the conversational repair, although this participant did not often show learning effects. It is more likely that the test situation focused clearly enough on the need for accentuation for Keith to be able to manage it.

In general, it can be said that, apart from segmental faults, such as leaving out whole syllables, the accent-pattern of what he says is often unorthodox or too staccato to be understood: this is reflected in his very low score (6%) on Accent Form Production. He apparently has few strategies for modifying this, and it is proposed that his use of accent-patterns has a considerable detrimental effect on his intelligibility. He has a habit of stressing unstressed syllables when repeating words which he assumes (sometimes wrongly) the listener will have difficulty in understanding. This is misleading as to the focus of the utterance: it suggests to listeners that although they may have grasped the word, there is some particular significance in the syllable stressed by Keith that they have not grasped. This can lead to repair of an item which is not in need of repair, and consequent loss of the thread of the conversation.

6.5.3.4 WAB and PALPA production scores

Fig. 6-28 shows Keith's scores on WAB and PALPA production tasks

Fig. 6-28 Keith's WAB and PALPA production scores



Keith shows extremely low scores on all these tasks, achieving just over 50% in only one task (WAB naming) where unimpaired participants could be expected to score near 100%. In spontaneous connected speech his WAB speech test showed poor information content and fluency.

Naming

He scored low in the Boston naming test (37%) and on object naming, word fluency and sentence completion in WAB naming (54%). The nature of his errors suggest they are due more to word-finding difficulties than to problems at the phonological level.

Repetition

At the single-word level his repetition ability was low: both in the WAB (47%) and in PALPA No 9 (48%). In PALPA 12 (Sentence Repetition) some of his realisations of lexical items were so distant that no judgment could be made about whether his lexical target was correct. /bɛʃ / /bɛd / /bʌz / /bɔt / and /bɔd/ were all used for both 'girl' and 'dog'. This had consequences for word-order and overall meaning. Many lexical items were omitted. Short-term memory loss may have meant that he found it difficult to retain all of the longer phrases: the all-purpose non-words mentioned above were substituted for nouns occurring near the beginnings of his utterances, not near the end. Reversibility and directionality appeared not to be an issue, but his omission of function words was such that tenses, singular/plural distinctions, and active/passive constructions were mostly not differentiated, although the word "by" occurred (in the right place) four times. Furthermore, it emerged that Keith was indiscriminate in his use of the morpheme "-s". Since this can have four distinct functions (Quirk et al, 1985) it can create confusion even in single-word utterances, making communication with Keith subtly more problematic than communication with Sam. An example of this is the following exchange (Fig. 6-29) already quoted in 1.9.1.5:

Fig. 6-29 Keith's 'fifties' fragment

Therapist: did you like growing up there?

Keith: fifties

where his next remark was 'fifty-two', and it is suggested that he may have intended to say 'fifty' in the first instance.

Examination of the imitative tasks in PEPS form production tasks suggests that, as in Simon's case, he may not always have fully grasped the aim of the task. He frequently produced the same response on each item; his scores thus indicate that his repeated response occasionally chanced to be the same as the stimulus. Like Simon, he may well have felt that a successful utterance of the segments of the target word was all that was required; although as pointed out with reference to PALPA No 12, his imitation was very approximate.

6.5.3.5 Conclusions for Keith

Keith's problems appear to be generalised over the whole area of his language abilities. In spite of good eye-contact, and his responses of "yeah, yeah" and "no, no" which make it appear that he is following a conversation, the likelihood is that he understands much less than he appears to and may also not be intending to say some of the things which he utters very emphatically, as though he really meant them.

6.6 Conclusion

The findings are presented as brief summaries in answer to the questions posed at the beginning of the chapter (6.3)

6.6.1 Receptive and productive prosodic deficits in aphasia

Sam: The surprising conclusion for Sam's function reception is that it is significantly impaired, although his function production is less so. However, across the various tasks, there is a high degree (0.78) of correlation between his reception and production scores. Unlike most unimpaired participants his production, although apparently effortful, is better than his reception skills. His production ability seems to decrease with length of utterance, and repetition seems to be marred by articulatory dyspraxia rather than by poor reception skills.

Simon: Like Sam, across the battery Simon's scores on reception tasks show a high degree(0.8) of correlation with his scores on production tasks. He appears to have good reception skills, but phonemic paraphasias, while they have little impact in themselves on his intelligibility, are distracting and upset his communication as a whole. A tendency to transpose or reverse words (and phonemes) could be a cause of misunderstandings.

Keith: There is virtually no correlation (0.03) between Keith's reception and production scores, and both are very significantly below the lower limit of normal ability on all but a few tasks.

Further avenues of exploration are suggested, such as: the implications of big discrepancies between reception and production in certain elements as shown by scores on imitative tasks.

6.6.2 Interaction between prosody and other language processing deficits in aphasia

Sam: In functional PEPS tasks, particularly reception items, and semantic and syntactic other language tasks, there appeared to be some similarity of deficit, although the scores were not strictly speaking comparable; equally, at the formal level in both types of task, Sam's deficit appeared less severe (see 6.5.1) This suggests that Sam's problems may be parallel in language systems at each level, with a generalised deficit in the area of function reception and articulatory difficulties accounting for problems of form output.

Simon: Common factors in all his tests appear to be short-term memory or a tendency to transposition, with consequences for sequencing; some word-finding difficulty; and phonemic paraphasias. As with Sam, there appears to be no dissociation between prosody and other language skills.

Keith: Keith showed deficit in other language parameters that was as pervasive as his deficit in prosody: to this extent there is no dissociation between prosody and other language skills. In both, there were a few tests where he scored well, but in other language skills these were mostly basic tasks such as yes-no questions, auditory word recognition, and in prosody they bore little relation to his ability in related tasks. No systemic picture emerges.

6.6.3 Differential breakdown of phonetic and phonological aspects of prosody in aphasia

In Sam there is dissociation, with function worse than form, especially in reception tasks .

In Simon, function is also worse than form; but all above lower limit of normal range

In Keith, unlike the others, function is better than form in production; but the opposite case is true of reception scores, thus suggesting not only form-function dissociation but also reception-production dissociation.

6.6.4 Prosodic disorder: primary or secondary?

Sam:

The results suggest that Sam suffers from some deficit in reception of semantic function both prosodically and in other language processes. This would suggest that there is disturbance of receptive semantic processing which affects other aspects of language as well as prosody and that the difficulty in prosodic function reception is therefore not primarily a prosodic disorder. His prosodic production problems appear to stem mainly from his articulatory difficulties which affect his ability to use Length and Silence for prosodic function. There is no indication from his other language tests that he has any problem in the cognitive organisation of information into delimited units, nor any disturbance in his concept of focus.

Simon:

One of Simon's problems, it has been proposed, is that phonemic paraphasias can so distract him that they diminish his semantic reception and therefore to some extent his prosodic function reception also. His prosodic scores are within limits, and outside limits in only 6 subtests out of 36; this suggests that his problems are not likely to be ones of primary prosodic disorder. Although his form scores are better than his function scores, and reception better than production scores, his concern about lack of control over the forms of his production seemed to interrupt his concentration on function tasks, but not so much as to indicate that his prosody was generally disrupted.

Keith:

Keith's level of scores on all tasks so low that deficit in no particular aspect of language (syntactic, semantic, segmental or prosodic) suggests itself as the primary cause . Unlike the others, he appears to suffer from real lack of communication - i.e. he is not making himself understood, nor is it clear that he understands - whereas, despite their form scores being better than their function scores, with the other two there is the impression that language function is good, only mildly impeded by formal obstacles.

The performance of the PEPS test as a clinical assessment procedure is reviewed in chapter 7.

7. Conclusions

In concluding this study it is appropriate to assess:

- how far the aims of the study have been achieved;
- what contributions can be said to have been made to the study of prosody;
- what modifications might be made to the procedure
- what new issues have emerged.

7.1 Achievement of aims: the PEPS procedure as a clinical assessment procedure

It proved possible to devise a procedure which can be used with impaired and unimpaired participants and give an evaluation of a wide range of prosodic abilities. In 1.10 criteria for a prosodic assessment procedure were set out. The successes and shortcomings of the test in meeting these criteria are briefly reviewed here.

7.1.1 Assessing a wide range of prosodic features

The question was asked as to whether the features tested in the procedure adequately covered the range of forms of prosodic expression, or whether in the course of testing it appeared that there was another element or elements that needed to be assessed in order to give a complete profile of prosodic features. In addition, it can be questioned whether the tasks used in the test constituted an adequate assessment of each feature.

In the course of testing and scoring it emerged that the nine elements adequately covered the range of prosodic resources. Only occasionally did other prosodic features, not included in the test-set, have a supplementary role in disambiguation: examples were voice quality such as breathiness, and articulatory settings in general. For example, in the expression of surprise, breathiness often co-occurred with increased pitch-range, but for no participant was it consistently the case that utterances were easily distinguished for function (i.e. sounding surprised or not surprised) by means of an untested element (such as breathiness) and by no other elements.

In relation to the second of these questions, it is worth remembering that there was no attempt to test each element exhaustively; in all the functions where it might have a role: instead, it was decided to test one function for each element in four different modes. If a participant had scored consistently low on all of the four modes of one element, then it would have been advisable to test other functions associated with that element to find out what other aspects of language were affected. Given the four different modes of testing, however, it was very unlikely that a low score on a function task would indicate a deficit in that element, unless it was accompanied by a low score in the form tasks.

7.1.2 Range of communicative functions assessed

In the PEPS procedure, nine conversational tasks were used. As described in 2.3.6, these represented linguistic functions where the role of prosody is well-attested, although clearly there are many more functions in which prosody has a role (see 1.5).

In considering whether those functions were tested reliably, it is worth remembering that the decision was taken to test prosodic performance on short utterances only, and it is possible that what may appear as prosodic deficits on the assessment procedure may not be so apparent in longer utterances; this goes with the need to investigate the correlation between a score on the PEPS test with evidence from the same person's conversation. This has not been included in the scope of the present study, but an example of the way in which such a comparison could operate can be seen in 6.5.1.3, where the test-findings are related to specific conversational difficulties. From this example, it can be seen that hypotheses generated from the prosody test can be used to illuminate conversational problems, which could then be usefully grouped together with a view to rehabilitation.

7.1.3 Reception and production skills

The implications of this topic are considered below (7.2.3). As far as test results were concerned, reception skills appeared to bear little relationship to production skills (4.6). This may have been due to the fact that although attempts were made to relate them as closely as possible, the demands of the subtests were subtly different. For instance, participants who had difficulty in discerning the demands of a function reception task (e.g. whether an utterance signified two items or three) and thus scored low on function reception might have gone to some lengths to make their own distinctions as clear as possible in the function production tasks and thus achieved a high score. The converse is also possible: that those who had no difficulty with the reception task assumed that there would be no problem about the clarity of their meanings in the production tasks. This, however, does not diminish the importance of knowing how participants score on both reception and production tasks, and low scores on either by unimpaired participants suggest that there might be interest in an examination of the conversational skills of such people; for example, it would be interesting to discover whether a low score on the reception task for delimitation (Level) corresponds with a low ability to perceive prosodic end-of-turn signals in conversation.

7.1.4 The relationship between prosodic forms and functions

It was originally envisaged that the malfunctioning of one particular element across all four test-conditions (i.e. function, form, reception and production) might have been apparent in the participants with aphasia; this, however, was not the case, nor did their abilities in any one element emerge as significantly more impaired than in another. Such an outcome would have been a useful indication for the targeting of rehabilitation techniques. On the other hand, the emergence of dissociation between formal and functional ability in some of the elements indicates the necessity of testing at both levels, and this has implications for those studies (cited in 6.1) where only the forms of prosody were the subject of investigation.

It could be argued that all participants produced relatively low scores for what might be considered the easiest task: form production; and that this suggests that either the design of the task or the scoring was out of line with the other tasks. Since this pattern of scoring was true for the unimpaired participants as well as for two of the participants with aphasia, it is not a serious problem for establishing the relative ability of an impaired speaker; but it should be noted that prosodic forms which do not emerge in the course of production tasks may occur spontaneously in another test or in conversation, in which case they are clearly available to the speaker, and thus the form production task has achieved its purpose. It is also interesting to note that the elicitation of prosodic forms was considerably harder than expected. One result of this was that it emerged that imitation tasks, in which participants are given a recorded stimulus and asked to "copy exactly the way it is said on the tape", are likely to give a better indication of a participant's prosodic resources than elicitation, i.e. asking them to say a word as high in the voice as possible.

7.1.5 The establishing of a range of normal ability using the assessment procedure

The description of the range of normal ability (4.5.2) is one of the most useful outcomes of the study. In general terms, unimpaired participants could handle the procedure with ease and, in some cases, enthusiasm, and this is reflected in the near-ceiling scores. Although one consequence of ceiling effects is that the procedure is of limited use for determining differential ability in unimpaired participants, this has the advantage of avoiding floor effects with impaired participants. The fact that the participants with aphasia did show deficit by comparison with the skills of unimpaired participants suggests that prosodic impairment is one aspect of their language deficit, and a quantifiable one.

7.1.6 Testing in terms of ambiguity rather than anomaly

In 2.3.3 it was decided that ambiguity was a better criterion than anomaly, i.e. asking whether an utterance had this meaning or that was likely to be more effective than asking which sounded better or more normal. The effects of anomaly on communication were not included in this study and so no account can be given of the relationship between prosodic anomaly and ambiguity and their relative importance for intelligibility. The ambiguity criterion was satisfactory however in that the tasks could be made clear, and their relevance to communication was never challenged by participants. Furthermore, by keeping the task focused on communication rather than on norms, it was possible to avoid questions of what might be right for one variety or register of English and not for another.

7.1.7 Use of high-frequency tasks and short utterances

The use of high-frequency tasks (as explained in 2.3.5) was an advantage in testing for two reasons: they were easy to explain and had some credibility as skills that are often necessary. This was enhanced by the fact that the test items were short utterances in which prosody more often has a crucial role than in long utterances. It was also useful for assessing the participants with aphasia for whom, with limited output, prosody might be an underestimated resource; using the high-frequency tasks may have helped to make its possibilities clear to them, and also allowed the two non-fluent participants the possibility of producing responses which may have been impossible otherwise.

7.1.8 Controlling for other language factors

The use of ambiguity rather than anomaly as a yardstick for determining prosodic effectiveness made it clear what other factors had to be excluded to make the test truly an assessment of prosody rather than an assessment of skills in which prosody may or may not have played a part. It was clear from the results that although a few participants could not see the possibility of ambiguity in some utterances (as pointed out in 3.3.1) the fact that this occurred very seldom suggests that bias caused by semantic and syntactic factors was very limited.

7.1.9 Ascertaining speaker intention

Although there is room for refinement in this aspect of the procedure (described in 3.6.2), it represents an advance on studies which assume communicative function without ascertaining what the speaker intended, and thus diminishes the possibility of circularity in analysis (see 1.9.1.6). It also appears that there may be an unexpected advantage in visually representing the intended meaning. It was envisaged that the pictures would be quicker and clearer than verbalisations, and that they would facilitate communication for speakers with aphasia, which functions they fulfilled. Subsequent experiments with modifications to the procedure suggest that when participants are asked to verbalise their intended meaning, their prosodic rendition of the meaning of the meaning can be attenuated. For example, if a participant is asked to imitate the utterance "1 **2** 3" (accenting the '2'), and then immediately to say which number has been emphasised, the accentuation of '2' may be less apparent than when the intention is not verbalised.

7.1.10 PEPS as a clinical tool

The PEPS test has been used, either partly or in its entirety, by several trainee speech and language therapists for assessing prosody in people with speech and language disorders. An example is a study of 10 people with Parkinson's disease (Clayton, 1995). The experience was successful in that no major problems arose in the administration of the test, either for the therapist or for the clients, and produced new information on the reception ability of Parkinson's patients. Clayton's training in prosodic aspects of phonetics was minimal and her success using the test suggests that, as hoped, the procedure can be used by speech and language therapists with a minimum of training.

7.2 Contribution to the study of prosody

Prosody is generally agreed to be an elusive topic; this is attested by the lack of agreement among linguists about how to describe it and how to analyse it, as emerged in the first chapter of this study. One of the results of this study has been that the attempt to determine the role of prosody for impaired and unimpaired speakers has thrown into relief some of the issues that surround prosody, its classification and functions.

7.2.1 Taxonomy

The set of elements as defined in this study provides a somewhat fragmented view of prosody, and it remains open to discussion whether such a taxonomy would be well-adapted to capturing the generalisations that form the traditional considerations of intonation studies: types of 'head' (O'Connor and Arnold 1973), and tune-text associations (autosegmental-metrical theory).

For the purposes of analysing the short, ambiguous utterances considered in this study the classification of prosodic features as nine elements was found to be, on the whole, satisfactory. It was adequate for determining the prosodic exponency of responses and identifying the characteristics that seemed to be responsible for the clarity of a speaker's intention. In a few cases there was a need for describing articulatory setting or voice quality (e.g. breathiness), as a clue to speaker-intention (as shown in Appendix 15). It was often the case that the clarity of a speaker's intention was achieved not by a difference of pitch-pattern but by elements such as loudness, rate, range or silence, and this emphasises the importance of the findings of such authors as Local (1992), Couper-Kuhlen (1993), Butterworth (1980) and Crystal (1969) who have noted that these features, which have received less attention than strictly intonational ones, have an important role to play in conversational interaction.

7.2.2 Form function distinction

As mentioned already (7.1.4) the value of making this distinction was demonstrated in the study of the participants with aphasia, where low scores on form tasks did not necessarily correlate with low scores on function tasks. It was clear from the reception task results of unimpaired participants and two of those with aphasia that scores were frequently higher in the function tasks than in the form tasks, although form task scores overall (i.e. in both reception and production tasks) in unimpaired participants were higher. The fact that function scores were sometimes higher was interesting because the form tasks involved skills (distinguishing between same and different, and mimicking utterances) that might be thought basic to cognitive processing and therefore likely to function similarly well in all participants and even to survive a cerebro-vascular accident, whereas the former involved imagination about the context of the utterances: arguably a more sophisticated thought-process. In some cases, however, the possibility of such a contextualisation appeared to assist reception skills. This indicates the possibility of a resource which could be exploited in rehabilitation techniques.

7.2.3 Reception of prosody

In the case of the two participants with non-fluent aphasia the results implied that they had some problems with prosodic understanding, whereas both participants gave the impression in ordinary conversation of understanding prosody well. In the case of Sam, difficulty of understanding is not apparent in the fragment of conversation quoted, and the implications of his test results, that he might misunderstand prosody, would need to be investigated with further examination of his conversational ability. In the case of Keith, however, the hypothesis that he might understand much less than he admits to suggests a real possibility as to why the conversation quoted shows such an unsatisfactory lack of ordered progress. It is also noticeable that Keith does not ask for utterances to be repeated, nor does his interlocutor make any reference to the possibility that he might not have understood her: both these circumstances suggest that they are capable of collaborating in the impression that they understand each other, thus tending to keep the difficulties of understanding hidden. This vindicates the assessment of reception, since the fact that misunderstanding is not acknowledged does not mean that it does not occur.

7.3 Modifications to the procedure

It appears from the results (Appendix 5) that low performance on the test can seldom be attributed to low scores in individual elements, apparent across all four test-modes: this was true for participants with and without aphasia. In 5.9.1 the correlation between failure to use all the elements and communicative effectiveness as indicated by function production scores was noted: this suggests that the role of individual elements may be important across functions, and also when considered in relation to the role of other elements, but that it is not particularly illuminating to consider them *in vacuo.* These findings suggest that although a form-oriented approach may still be relevant for clinical assessment, given that the malfunctioning of any one element could cause unusual prosody and it would be useful to identify it, an approach based on functions rather than on forms is an interesting alternative. At the start of the present study, this approach was not considered because a comprehensive investigation of the linguistic functions of prosody did not seem feasible, whereas a comprehensive investigation of prosodic forms did. The sampling of communication of function by prosodic means would however be a possibility. Findings from the present study (4.9.4 and 5.9.2) have suggested which elements can be varied in the functions already selected for this study to achieve, perhaps, greater clarity of meaning. For instance, it appears likely from phonetic analysis of the results of the Level task (chunking) that prosodic delimitation is made clearer by differential use of lengthening, and that this can be replaced or enhanced by the use of silence and glide-presence. No attempt has been made in this study to evaluate the communicative effectiveness of using more or fewer elements within a prosodic function, but this would be useful for ascertaining the extent of intraprosodic cue-trading. The stimuli could be constructed in such a way that the relevant elements (as determined in 4.9.4 and 5.9.2) could be combined in controlled but differing proportions. Responses could involve multiple choice whereby the clarity of intention could be rated on a scale of effectiveness (e.g. stimulus sounds: 1. very surprised 2. slightly surprised 3. ambiguous 4. unsurprised 5. bored). One advantage of this approach would be to avoid the forced binary choice of function tasks, which would have two advantages: it would answer any criticism that the function reception tasks were unrepresentative because effected by variation within only one element, and it would reduce the necessity for having many items to rule out the possibility of chance scores. The results could be correlated with the number and intensity of the elements used in the utterance to convey the intention.

7.4 Emergence of new issues: further topics to be investigated

Several topics have emerged as areas for potential further research as result of this study. Two general areas that have been identified are prosody in the unimpaired and disordered prosody.

7.4.1 Prosody in the unimpaired

Examples of possible research topics in these areas follow:

- One major question raised by the present study and mentioned in 4.9: the variability in exponency of certain communicative functions, as shown in function production tasks. Some of these results were interesting in terms of what they added to accepted notions of prosodic exponency in such functions. For example, it is generally accepted that focus is achieved by accent-placement on the focused item, and that accent is signalled above all by pitch-factors (Fry 1958). In the Accent function production task, however, unmarked accent-placement was used in a significant number of cases, and it emerged furthermore that marked accent-placement could assume a variety of forms: combinations of loudness, lengthening, pitch-excursion up and down, silence before and after the accented item, with and without glide-presence (4.9). Similar variability of exponency could be seen for delimitation, in the Level function production task: participants tended to vary in the number of prosodic elements they deployed for these functions, and one obvious but unanswered question is whether the effectiveness of communication is dependent on the amount of prosodic resources deployed in an utterance.

- Diachronic changes in normal prosody, such as the finding from the present study that high falls could apparently be heard as questions. Another possible change to be investigated is the rising pitch-pattern (known as 'uptalk': Cruttenden 1995), and its implications. Experiments in modifying the PEPS procedure suggested that accent-placement is harder to hear in rising patterns than in falling ones: this has implications for the detection of focus in uptalk. There is also the question of the function of uptalk; whether it is a form of questioning, a new characteristic of narrative speech, or an indication of tentativeness, all of which have been suggested and have implications for people's assumptions concerning the functions of utterances when they are not familiar with the forms of them as well as presenting a challenge in terms of determining speaker intention.

- It is possible that the tasks developed in the test might be modified for use as exercises to improve awareness of prosodic factors, for example with foreign learners of English.

- Advances in computer-mediated communication (CMC) suggest that there is a need for quantifiable prosodic measurements that can be closely related to communicative function. Preliminary investigations are being conducted to discover whether findings from this study (such as the variability in prosodic exponency, 4.9.4 and 5.9.2) are applicable in the field of CMC.

7.4.2 Disordered prosody

This study has opened up a considerable number of avenues for developing research in prosody in disordered language and speech:

- An assessment procedure for children has been devised and data from normally developing children is being collected. The procedure builds on the techniques developed in this study, and several of the tasks in it are almost unchanged. The tasks are function-oriented rather than form-oriented (cf. 7.3), but the four-mode approach (form and function, reception and production) is used. Binary choices have also been retained, and the relationship between function and form reception tasks is enhanced by the use of stimuli consisting of the laryngograph signals of function reception task stimuli for form reception task. The procedure is approximately half the length of PEPS, testing four communicative functions. As with the PEPS study, it is envisaged that this will provide a range of norms against which children with speech and hearing difficulties can be assessed. It is possible that the new procedure can also be used as a shortened version for adults.

- Having established the existence and some of the nature of disordered prosody, the question arises of rehabilitation. One finding from the administration of the PEPS procedure was that participants were often surprised to find that they could make the proposed distinctions, using only prosodic as opposed to lexical and syntactic resources. One possibility is that awareness of these resources could be enhanced by listening and speaking exercises, and that this might provide a hitherto unexploited resource. It would be of particular benefit to those participants with aphasia whose level of articulatory or word-finding difficulty is such that they have very little usable language output.

- The relationship between prosodic skills and conversational or semantic-pragmatic disorders could be investigated. For instance, the ability to convey or perceive end-of-turn prosodic indications, questions as opposed to comments, the focus of talk and intended attitudes in conversation could be related to performance on prosodic tasks which make use of these functions. Other factors such as non-verbal skills would need to be taken into account, but there is research (as mentioned in 2.3.2) which suggests that in such conversational skills prosody is an important factor, sometimes appearing to override lexicosyntactic factors.

- Interest has been shown in the use of a prosody assessment procedure with people who have cochlear implants, largely for reception rather than production skills. The perception of segmental phonetic distinctions by such people has received much attention, but work with suprasegmental distinctions has been relatively neglected; it is now thought that it would similarly repay investigation.

The study can thus be seen to have achieved a high proportion of its aims and to have produced some options for development and further research in which interest is already being shown.

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APPENDIX 1: PEPS Test items and an example of a scoresheet

(for instructions, see Appendix 4.)

LOUDNESS

Function Reception		*Function Production*	*Form Reception*		*Form Production*	
Stimulus	Response	Item	Stimulus	Response	Item	Instruction
Be \quiet	Q	3	/sack (n)x 2	S	Tuesday	ff
I can't \hear you	L	4	/fit (p) fit (n)	D	Wednesday	f
Take \care	L	5	/set (p) set (pp)	D	Thursday	pp
I'm al\right	Q	6	/thick (f)x 2	S	Friday	p
I don't /mind	L	7	/fat (pp) x 2	S	Saturday	ff
How\are you?	Q	8	/ship (n) ship (f)	D	Hello	f
\Fine /thanks	Q	9	/sat (p) sat (n)	D	Okay	pp
\Here it /is	L	10	/shack (ff) x 2	S	Thank you	p
Wait a /bit	L		\pop (ff) pop (n)	D		
What's the /time	Q		\took (f) x 2	S		
Where did he /go	L		\cot (pp) x 2	S		
What did you /say	L		\put (n) put (pp)	D		
Who's \there	Q		\cock (f) cock ff)	D		
Mind the \door	Q		\tot (f) tot (p)	D		
Help your\self	L		\cook (p) x 2	S		
Which do you \want	L		\pot (pp) x 2	S		

Instructions and stimuli: f (forte) = loud; ff (fortissimo) = very loud; n = neutral; p (piano) = quiet; pp (pianissimo) = very quiet): x 2 = 2nd stimulus is a copy of the 1st

Responses: L = Loud, Q = quiet; S = same, D = Different

LENGTH

Function Reception		*Function Production*	*Form Reception*		*Form Production*	
Stimulus	Response	Item	Stimulus	Response	Item	Instruction
\Sure	R	Joe	\do (aa) do (a)	D	I	ll
\What	B	Kay	\me (a) x 2	S	J	l
/Right	B	Lee	\bore (aa) x 2	S	K	aa
/Who	R	Di	\moo (ll) x 2	S	L	a
\Good	R	Ray	\raw (l) raw (n)	D	M	ll
\Where	B	Guy	\bar (aa) x 2	S	N	l
/Fine	R	Roy	\bee (n) bee (a)	D	0	aa
/Why	B	Jay	\gnaw (ll) x 2	S	P	a
\Ah	R		/need (a) need (n)	D	more & more	copy
\How	R		/lord (ll) lord (l)	D	one to one	copy
/No	B		/barred (a) barred (aa)	D	on and on	copy
/When	R		/weed (1) x 2	S	he and she	copy
\Look	B		/herd (a) herd (n)	D	by the bye	copy
\Which	B		/mood (a) x 2	S	door to door	copy
/Yes	B		/bored (aa) x 2	S	up and up	copy
/Oh	R		/word (l) word (ll)	S	two by two	copy

Instructions and stimuli: 1 (lento) = slow; ll (lentissimo) = very slow; (n) = neutral a (allegro) = fast; aa (allegrissimo) = v. fast; x 2 = 2nd stimulus is a copy of the 1st

Responses: B = brisk, R = relaxed; S = Same, D = Different

PITCH

Function Reception

Item	Stimulus	Response
May	m..	N
July	m?	R
January	m..	N
March	m...	N
July	m?	R
September	m?	R
June	m..	N
October	m..	N
February	m..	N
December	m?	R

Form Production:

Item	Instruction
Q	hh
R	h
S	bb
T	h
U	hh
Y	bb
Z	b

Function Production

Item	Stimulus	Response
gammon	m..	N
peaʔ	m?	R
peak	m..	N
hammǝʔ	m?	R
hammer	m..	N
roʔ	m..	N
seeʔ	m?	R
garneʔ		
cooʔ		
bigǝʔ		
gawp		
ganch		
ryeʔ		
geyson		
mayʔ		
rayʔ		

Form Reception

Stimulus	Response
mad (h) x 2	S
nod (h) x 2	S
leg (h) leg (h)	D
rob (hh) rob (n)	D
nag (n) x 2	S
log (h) log (hh)	D
red (hh) x 2	S
nob (hh) nob (h)	D
nab (n) x 2	S
led (b) x 2	S
rod (h) rod (bb)	D
lad (b) x 2	S
rag (h) x 2	S
lob (b) lob (n)	D
lag (bb) lag (b)	D
mob (b) x 2	S

Items in the function reception task (months) are produced by the participant; items (unusual words and common words produced unclearly) in the function production task are produced by the tester.

Stimuli (prosodic variations of the utterance 'm') in the function reception task are produced by the tester, and in the function production task by the participant.

Instructions and stimuli: h= high; hh = very high; (n) = neutral; b = low (bass); bb = very low

Responses: N= next item, R = repeat item: S = Same, D = Different

RANGE

Function Reception		*Function Production*	*Form Reception*		*Form Production*	
Stimulus	Response	Item	Stimulus	Response	Item	Instruction
\ one n	U	where	\ pea n pea w	D	\ I hn	copy
/ two n	U	no	v paw n x 2	S	v J hn	copy
/ three n	U	90	v tea n tea w	D	/ K bn	copy
\ four w	S	good	/ tar w tar n	D	\ L hw	copy
/ five w	S	yes	^ tore w x 2	S	/ M bw	copy
\ six w	S	oh	v too n too w	D	v N hw	copy
\ seven n	U	ah	\ fee n x 2	S	^ 0 bn	copy
v eight w	S	fine	^ fur n x 2	S	^ Ø bw	copy
/ nine w	S		^ far n far w	D		
v ten n	U		/ key w x 2	S		
\ A n	U		/ car w car n	D		
/ B n	U		\ core w x 2	S		
\ C w	S		v coo n x 2	S		
/ D w	S		v par n par w	D		
v Ew	S		^ see w see n	D		
\ F n	U		/ saw w x 2	S		

Instructions and stimuli: w =wide; n = narrow; \ = fall; / = rise; v = fall-rise; ^ = rise-fall; - = level; h = high, b = low

Responses: (function reception) S = surprised, U = not surprised; (form reception) S = Same, D = Different

GLIDE

Function Reception		*Function Production*	*Form Reception*		*Form Production*	
Stimulus	Response	Item	Stimulus	Response	Item	Instruction
h v Monday	Q	8 o'clock	/ one x 2	S	h \ A	copy
the h \ 20th	A	8.30	v two / two	D	h / B	copy
h \ Tuesday	A	1 o'clock	\ three v three	D	h ^ C	copy
the h v3rd	Q	4.30	\ six x 2	S	h v D	copy
h v Friday	Q	4 o'clock	v five x 2	S	b \ E	copy
this h vweek	Q	9.30	v four x 2	S	h / F	copy
next h \ week	A	10 o'clock	\ seven / seven	D	h ^ G	copy
h \ Sunday	A	2 o'clock	v eight x 2	S	h v H	copy
o \ kay	A		\ m x 2	S		
\ found it	A		\ m / m	D		
w / no	Q		v m / m	D		
w / been there	Q		/ m x 2	S		
\ seen it	A		\ so x 2	S		
w / got it	Q		v so \ so	D		
\ no	A		/ so vso	D		
o w /kay	Q		/ so \ so	D		

Instructions and stimuli:

w =wide; n = narrow; \ = fall; / = rise; v = fall-rise; ^ = rise-fall; - = level; h = high, b = low

Responses: Q =questioning, A = affirming; S = Same, D = Different

SILENCE

Function Reception

Stimulus	Response
I'll have the pink one	C
I'll have(.) a blue one	U
I'll have a(.) yellow one	U
I'll have a black one	C
I'll have coffee please	C
I'll (.) have a big one	U
I'll have bread please	C
I'll have an apple please	C
I'll give a pound	C
I'll give(.) 2 pounds	U
I'll give(.) 5 pounds	U
I'll give 50p	C
I'll have tea please	C
I'll (.) have a little one	U
I'll have cake please	C
I'll have a(.) banana please	U

Function Production

Item

"I'll have a(n)......

.......sweet, please"

(colours: orange,

white, black, red,

purple, pink

yellow, green)

Form Production

on the telly	Copy
on the(.) door	Copy
on(.) the chair	Copy
on the (.) table	Copy
in the road	Copy
in(.) the garden	Copy
in the mug	Copy
on the wall	Copy

Form Reception

Stimulus	Response	
in the \sittingroom	in (.) the \s-room	D
in the(.) \kitchen	x 2	S
on(.) the \chair	on the \chair	S
on the \shelf	x 2	S
on the (.) \table	x 2	S
in the \bathroom	x 2	S
in (.) the \garden	in the \garden	D
on the \television	x 2	S
in the /cupboard	in the(.) cupboard	D
on(.) the /windowsill	x 2	S
on the wall	x 2	S
on, the(.) floor	on the floor	D
on (.) the plate	x 2	S
in the mug	in the(.) mug	D
in the (.) bottle	in the bottle	D
in the cup	in the cup	S

Stimuli: (.) = phonation break (silence)

Responses: C = certain, U = uncertain; S = Same, D = Different

RHYTHM

Function Reception

Stimulus	Response
We can't find the tape	1^{st}
There's NO TIME to TRY	Many
She LOVES BEing at HOME	Many
She won't go to school	1^{st}
He's NOT DOing WELL	Many
You WON'T FIND a SEAT	Many
She's not very happy	1^{st}
We DON'T WANT to BUY	Many
I don't like the sea	1^{st}
You CAN'T KEEP ON GOing	Many
It's NOT HARD to FIND	Many
I don't want to go	1^{st}
I CAN'T HEAR the MUsic	Many
She loves going away	1^{st}
There's no time to eat	1^{st}
They' re not going to win	1^{st}

Function Production

Item
I don't see why
I'm far too tired
He went last week
I don't eat meat
She's far too thin
He wrote 4 times
It's far too sweet
I don't want milk

Stimuli: upper case = syllable carrying rhythmic beat

Response: 1^{st} = sounds as if said for the first time;

Many = sounds as if it has been said many times before

RHYTHM (continued)

Form Reception

Stimulus		Response
Mary go and call the cattle home	(srh, rh)	D
Don John of Austria	(rh, srh)	D
The bonnets of bonny Dundee	(rh x 2)	S
And we will sit upon the rocks	(srh, rh)	D
This is my own, my native land	(srh x 2)	S
Come all ye jolly sailors bold	(rh x 2)	S
What immortal hand or eye	(rh, srh)	D
He smiled on those bold Romans	(srh x 2)	S
It was the schooner Hesperus	(srh, rh)	D
Mine eyes have seen the glory	(rh, srh)	D
Theirs not to reason why	(srh, rh)	D
The mountain sheep are sweeter	(rh x 2)	S
Do you remember an inn, Miranda?	(rh, srh)	D
My name is John Wellington Wells	(rh x 2)	S
Three fishers went sailing away	(srh x 2)	S
Oh to be in England	(srh x 2)	S

Form Production

Item	Instruction
Rain, rain, go away	copy
Come again another day	copy
Old King Cole was a merry old soul	copy
Hickory dickory dock	copy
The mouse ran up the clock	copy
Baa, baa, black sheep	copy
Have you any wool	copy
Jack & Jill went up the hill	copy

Stimuli: srh = speech-rhythm; rh = rhythmical

Response: S = same D = different

LEVEL

Function Reception		*Function Production*	*Form Reception*		*Form Production*	
Stimulus	Response	Item	Stimulus	Response	Item	Instruction
Sally. Ann & Julia	3	cream buns & cheese	- one / one	D	- A / A	copy
Billie-Jean & Susan	2	coffee cake & eggs	/ two x 2	S	/ M / M	copy
Mary-Jane & David	2	chocolate icecream & tea	\ three x 2	S	- I \ I	copy
Mary, Jo & Peter	3	chocolate biscuits & bread	/ four x 2	S	\ L \ L	copy
Anne. Marie & Jonny	3	chocolate icecream & honey	/ five -five	D	- E / E	copy
Sarah-Jane & Joan	2	coffee cake and cheese	- six \ six	D	/ N / N	copy
Anna-Clare & Louise	2	cream buns & jam	\ seven x 2	S	- 0 \ 0	copy
Mary. Ann & Fred	3	coffee cake & cream	- eight / eight	D	\ R \ R	copy
Chocolate. icecream & coffee	3		- nine \ nine	D		
Fruit-yogurt & honey	2		/ ten - ten	D		
Chocolate-biscuits & tea	2		- well x 2	S		
Cream. buns & coffee	3		\ so x 2	S		
Chocolate, cake & tea	3		\ ah - ah	D		
Coffee-icecream & water	2		- then x 2	S		
Cream-cheese & honey	2		/ oh x 2	S		
Chocolate. fudge and tea	3		- who \ who	D		

ACCENT

Function

Reception & Production

Item	Stimulus	Response
SE5 ITS	v **S** E 5 (?)	**S** E 5.
	I v **T** S (?)	I **T** S.
N7 1PB	v **N** 7 (?)	**N** 7.
	1 P v **B** (?)	1 P **B**.
W13 2SX	v **2** S X (?)	**2** S X.
	W thir v **teen** (?)	Wthir**teen**.
FY4 3LU	v **F** Y 4 (?)	**F** Y 4.
	3 v **L** U (?)	3 **L** U.
GU4 2PE	v **G** U 4 (?)	**G** U 4
	2 v **P** E (?)	2 **P** E.
HA7 9NK	H v **A** 7 (?)	H **A** 7.
	v **9** N K (?)	**9** N K.
MC6 8TR	v **M** C 6 (?)	**M** C 6
	v **8** T R (?)	**8** T R.
BS6 4FE	B v **S** 6 (?)	B **S** 6
	4 v **F** E (?)	4 **F** E.

Form

Reception

Stimulus	Response
thir**teen** x 2	S
inside x 2	S
unfair un**fair**	D
de**frost** x 2	S
un**kind** **un**kind	D
nine**teen** x 2	S
retake re**take**	D
impact x 2	S
dispute dis**pute**	D
increase in**crease**	D
research x 2	S
inborn x 2	S
six**teen** **six**teen	D
discharge dis**charge**	D
un**tie** x 2	S
fourteen four**teen**	D

Form

Production

Item	Instruction
return	say each word
demur	first neutrally.
below	then emphatically.
differ	
written	
dimmer	
billow	
defer	

v = step-up and fall-rise on queried (accented) digit. Digits/syllables in bold and underlined = accented

Function Reception task: participant is asked to say which digit was being queried after making the (function production task) response

(65) GS O' Nat. Cue Tape: K21 Date: 19.10.95
quiet voice

PEPS LOUDNESS.000

BR: Function Reception

Egs	LX	Cue	Hes	Res	V
1 Be quiet	30	P		p	1
2 can't hear you	6	f		f	1
3 Take care	6	f	|	f	1
4 I'm alright	20	p	|	p	1
5 I don't mind	7	f		f	1
6 How are you?	20	p		p	1
7 Fine thanks	20	p(f)		p	1
8 Here it is	10	mf		f	1
9 Wait a bit	10	mf		f	1
10 What's time?	25	p		f	1
11 Where'd he go	12	mf		f	1
12 What y'say?	12	mf		f	1
13 Who's there?	20	p		f	1
14 Mind the door	25	p(f)	|	p	1
15 Help yourself	5	F	|	f	1
16 Which d'y want	7	f		f	1
		TOTAL			16

Practice:

Egs	Cue	Hes	Res	V
Coffee plse	f		f	
There it is	p		p	

BP: Function Production

Egs	Fu	Lo	Le	Pi	Ra	Gl	V
"3"	ff	+	+	↑		ˏˇ	11
"4"	fp	−	o	↓		ˇˇ	11
"5"	pf	+	o	↑		ˏˇ	11
"6"	fp	−	o	↓		--	11
"7"	pp	−	o	↓		ˇˇ	11
"8"	pf	+	o	↑		ˏˊ	11
"9"	ff	+	o	↑		ˏˇ	11
"10"	pf	−	o	↓		ˋ\	11
			TOTAL				16

Practice:

Egs		Fu	Lo	Le	Pi	Ra	Gl	V
"1"	f	f					//	11
"2"	p	p						11

AR: Formal Reception

Egs	LX	C	H	R	V
sack	14,14	s		S	1
fit	30,20	d		d	1
set	35,45	d		d	1
thick	10,10	s		S	1
fat	30,30	s		S	1
ship	20,10	d		d	1
sat	30,20	d		d	1
shack	6.6	s		S	1
pop	8.20	d		d	1
took	14,14	s		S	1
cot	30,30	s		S	1
put	20,35	d		d	1
cock	12,7	d	\	d	1
tot	10,25	d		d	1
cook	25,25	s		S	1
pot	30,30	s		S	1
		TOTAL			16

Practice:

Egs	LX	C	H	R	V
sock	p,f	d		d	
shock	mf,mf	s		S	
shook	f,p	d		d	

AP: Formal Production

Egs	Inst	Lo	Le	Pi	Ra	Gl	Si	Ac	V
Tue	ff								10
Wed	mf								11
Thu	pp								11
Fri	mp								10
Sat	ff								11
Hello	mf								10
Okay	pp								11
Thanks	mp								11
Fri	mp								13
				TOTAL					

Practice:

Egs	Inst	Lo	Le	Pi	Ra	Gl	Si	Ac	V
Sun	ff								
	mf								
Mon									

pp
mp
wh

BR: Function Reception

	LX	Cue	Hes	Res	V
1 Sure	10	S	1	s	1
2 What	6	q	1	q	1
3 Right	5	q	1	q	1
4 Who	8	s	1	s	1
5 Good	8	s		S	1
6 Where	3	Q	1	q	1
7 Fine	10	S	1	s	1
8 Why	3	Q		q	1
9 Ah	15	S		s	1
# How	10	S	1	s	1
# No	3	Q		q	1
# When	7	s		S	1
# Look	2	Q	1	q	1
# Which	3	Q		q	1
# Yes	2	Q		q	1
# Oh	8	s		s	1
TOTAL					16

ific

Practice:

	Cue	Hes	Res	V
now	q		q	
oh	s		s	

BP: Function Production

Egs	B/I	Fu	Lo	Le	Pi	Ra	Gl	V
Joe	L	L	–		M L	M	✓	11
Kay	B	B	+	(+)	M H	M	✓	11
Lee	L	L	–		L M	M	✓	11
Di	B	B	+	(+)	M H	M	✓	11
Ray	L	L	–		ML	M	✓	11
Guy	B	B	+	(+)	MH	M	✓	11
Roy	B	B	+	(+)	HH	M	✓	11
Jay	L	L	–		ML	M	✓	11
TOTAL								16

Practice:

Egs	B/I	Fu	Lo	Le	Pi	Ra	Gl	V
Don	?		+	o	H		ˇ	
Jan	L		–	o	M		ˇ	

AR: Formal Reception

Egs	LX	C	H	R	V
do	2,4	d		d	1
me	4,4	s		s	1
bore	2,2	s		s	1
moo	11,11	s		S	1
raw just dif.	12,8	d	1	d	1
bar	3,3	s		S	1
bee	7,3	d		d	1
gnaw	12,12	s		S	1
need	4,7	d		d	1
lordj just	15,9	d	1	d	1
bard	3,2	d		d	1
weed	10,10	s		S	1
herd	4,7	d	1	d	1
mood	4,4	s		s	1
bawd think	3,3	s	1	S	1
word	15,18	d		S	0
TOTAL					15

Practice:

Egs	LX	C	H	R	V
more	s q	d		d	
lee	m m	s		S	
knee	q s	d		d	

AP: Formal Production

Egs	Le1	Le2	Pi1	Pi2	Gl1	Gl2	Si1	Si2	V
more&more									1
one to one									1
on & on									1
he and she									1
by the bye									1
doortodoor									1
up & up									1
two by two									1

Egs	Lo	Le	Pi	Ra	Gl	V	TOTAL
L SS					/	1	
M mS					/	1	
N qq					/	1	
O mq					✓	1	16
P SS					/	1	
Q mS					/	1	
R qq					/	1	
T mq					/	1	

TOTAL

Practice:

day to day

year by year

J SS mS

K qq mq

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BR: Function Reception

Egs	Cue	He	Lo	Le	Pi	Ra	Gl	V	Egs
1	→							1	woon
2	?							1	farmer
3	→							1	rawning
4	→							1	reap
5	?	1						1	noobing
6	?	1						1	rerp
7	→							1	lorbing
8	→							1	coop
9	?	1						1	May
10	→							1	March
11	→							1	August
12	?	1						1	April
13	→							1	July
14	→							1	June
15	?							1	Oct
16	→							1	Sept

→ TOTAL 16

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BP: Function Production

Egs	H	Respon	Lo	Le	Pi	Ra	Gl	V
woon		gan R	-	+	M	W	/	1
farmer		R c	-	+	L	N	-	1
rawning	1	pea c	-	+	L M	N	-	1
reap		han c	-	+	L	N	-	1
noobing	1	ro R	-	+	M	W	/	1
rerp		R c	-	+	ML	N	-	1
lorbing		see c	-	+	ML	N	-	1
coop	1	gar c	-	+	ML	N	-	1
May		coo R	-	+	M	W	/	1
March		R c	-	-	M	N	-	1
August	1	big R	-	+	M	W	/	1
April		R c	-	+	L	N	-	1
July	1	gaw c	-	o	L	N	-	1
June	1	gan R	-	o	M	W	/	1
Oct		R c	-	o	M	N	-	1
Sept		ri R	-	-	M	W	/	1

R

TOTAL 16

AR: Formal Reception

Egs	LX	Cue	Hes	Res	V
mad	99.99	S		s	1
nod	48.48	S		s	1
leg	99.47	D		d	1
rob	110.60	D		d	1
lag	47.47	S		s	1
6 log	10.5.11	D	1	s	0
red	10.9×2	S		s	1
8 knob	11. 10.8	D		s	0
nab	70.70	S		s	1
led	40.40	S		s	1
rod	50.45	D		d	1
lad	46.46	S		s	1
rag	80.80	S		s	1
lob	50.60	D		d	1
lag	46.49	D		d	1
mob	47.47	S		s	1

TOTAL 14

AP: Formal Production

Egs	Inst	Lo	Le	Pi	Ra	Gl	V
Q	HH					-	11
R	mH					-	11
S	LL					-	11
T	mL					-	11
U	HH					/	11
V	mH					-	11
Y	LL					,	11
Z	mL					-	11

16

TOTAL

Practice:

→	→	?	→	→	?	?	→

Egs	Respon	Lo	Le	Pi	Ra	Gl	V
lorm	gam R				W	/	
lean							
meb	saw R				W	/	

M =

Egs	LX	Cue	Hes	Res	V
did	L\.H\	D		d	
bed	H/. m/	D		s	0
dead	L/. L/	S		s	

Egs	Inst						
me	HH mH						
you	LL mL						

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BR: Function Receptior BP: Function Production

Egs	LX	Cue	Hes	Res	V
1 one	N\	U	1	u	1
2 two	N/	U		u	1
3 three	N/	U		u	1
4 four	W\	S	1	u	0
5 five	W/	S		S	1
6 six	W\	S		S	1
7 seven	N~	U		u	1
definitely 8 eight	W~	S		S	1
9 nine	W/	S	1	u	0
10 ten	N~	U		u	1
11 A	N\	U		u	1
12 B	N/	U	1	u	1
13 C	W\	S	1	u	0
14 D	W/	S	1	u	0
15 E	W~	S		S	1
16 F	N\	U		u	1

TOTAL 12

Egs	S/U	Fu	Lo	Le	Pi	Ra	Gl	V
where	u	u	-	+	M	N	—	11
no	u	y	-	+	M	N	—	11
90	u	y	—	+	M	N	—	11
good	S	S	—	+	L	W	/	11
yes	S	S	o	o	M	W	/	11
oh	u	y	o	o	L	W	\	10
ah	u	y	o	+	L	N	-	11
fine	S	S	+	+	L	W	/	11

TOTAL 15

AR: Formal Reception

Egs	LX	Cue	Hes	Res	V
pea	NW\	d	1	d	1
paw	NN~	s		S	1
tea (ruminant	NW~	d	\	d	1
tar	WN/	d		d	1
tore	WW^	s		S	1
too	NW~	d		d	1
fee	NN\	s		S	1
fur	NN^	s		S	1
poor	NW~	d		d	1
key	WW/	s		S	1
car	WN/	d		d	1
core *	WW\	s		S	1
coo	NN~	s		S	1
par	NW~	d		d	1
see	WN^	d \		d	1
sore	WW/	S		S	1

TOTAL 16

AP: Formal Production

Egs	Lo	Le	Pi	Ra	Gl	V
I					\	11
J					✓	11
K					-	11
L					\	11
M					/	11
N					✓	11
O					^	11
P					∧	11

16

TOTAL

\ \ / / ✓ ✓ ^ ∧

Practice:

		Cue	Hes	Res	V
40	N\	U		u	
50	W/	S		S	

Egs	S/U	Fu	Lo	Le	Pi	Ra	Gl	V
80	S				M	W	/	
yes. what	U						\	

Egs	LX	Cue	Hes	Res	V
law	NW\	d		d	
day	WW~	s		S	
pay	NN/	s		S	

Egs	Lo	Le	Pi	Ra	Gl	V
G/						
H\						

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more a test of ... a picture.

BR: Function Reception

Egs	LX	C	H	R	V
1 Mon?	ss~	Q	/	Q	1
2 20th.	ss \	A	\	A	1
3 Tues.	ss \	A\	\	A	1
prob 4 3rd?	ss~	Q/		Q	1
5 Fri?	ss~	Q	/	Q	1
6 this wk?	ss~	Q		Q	1
7 Sun.	ss\	A	\	A	1
8 nx wk.	ss\	A\	\	A	1
9 okay.	\	A	/	A	1
10 found.	\	A		A	1
11 no?	/	Q	\ /	Q	1
12 been?	/	Q	\	Q	1
13 seen it.	\	A	/	A	1
14 got it?	H /	Q	/	Q	1
15 no.	H \	A	/	A	1
16 okay?	H /	Q	-	Q	1

TOTAL 16

BP: Function Production

Egs	Q/A	Fu	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
8 o'c	A	A			M	W				D	11
8.30	Q	Q			M	W	-/			D	11
1 o'c	A	A			M	N	\-			D	11
4.30	Q	Q			H	W	-/			F	11
4 o'c	A	A			M	W	-			D	11
9.30	Q	Q			M	W	/			D	11
10 o'c	Q	Q			H	W	/			D	11
2 o'c	A	A			M	W	\-			P	11

Sounded like D in life, P in recording.

16

TOTAL

AR: Formal Reception

Egs	LX	Cue	He	Res	V
h 1	r r	s	/	S	1
h 2	~ r	d /	/	d	1
h 3	f ~	d /	/	d	1
h 6	f f	s		S	1
h 5	~ ~	s /		S	1
h 4	~ ~	s –	\	S	1
h 7	f r	d	/	d	1
h 8	~ ~	s		S	1
I m	f f	s /	/	S	1
I m	f r	d	/	d	1
I m	~ r	d	/	d	1
I m	r r	s		S	1
I so	f f	s		S	1
→ I so	~ f	d	\	d	1
I so	r ~	d		d	1
I so	r f	d	\	d	1

TOTAL 16

AP: Formal Production

Egs	Inst	Lo	Le	Pi	Ra	Gl	V
(H) A \ ~						\	11
(L) B / ~						/	11
(H) C / ~						^	11
D ~ /						∨	11
E ^ \						\	11
F ~ \						/	11
(L) G \ ~						^	11
H ^ /						∨	11

16

TOTAL

Practice:

Vict~oria?	Q		Q	
Kings \ X.	A	/	A	
Water/loo?	Q		A	
\Liv St.	A		A	

Egs	Q/A	Fu	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
9 o'c	A				M	W	-\				
2.30	Q				M	W	-/				

right f r	d		d	
fine r f	d		d	
no f f	s		S	

Q / ~
R \ ~ /
S ~ / ∧
T ^ \ ✓

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~~Page 1~~

BR: Function Reception

Egs	LX	Cue	Hes	Res	V
1 pink one	n	C	/	u	0
2 blue-one	p	U	/	u	1
3 yellow-one	p	U	1 /	u	1
4 black one	n	C	1 /	C	1
5 coffee pl	n	C	/	C	1
6 big-one	p	U	1 /	u	1
7 bread pl	n	C	1 /	C	1
8 apple pl	n	C	/	C	1
9 a pound	n	C	1 /	C	1
10 2-pounds	p	U	(1)	u	1
11 5-pounds	p	U		u	1
12 50 p	n	C	1	C	1
13 tea pl	n	C	(1) /	C	1
14 little-one	p	U	(1)	u	1
15 cake pl	n	C	(1)	C	1
16 banana-pl	p	U	(1)	u	1
		TOTAL	15		

BP: Function Production

Egs	C/U	Fu	Lo	Le	Pi	Gl	Si	Ac	Rh	V
5 red	✓u			+		\	0			11
I'll have a red one : fast										
6 ora gre	✓C			−		\	0			11
I'll have a green one : fast										
1 whi	✓C			−		\	0			11
I'll have a white one : fast										
3 bla	✓C			−		\	0			11
I'll have a black one : fast										
8 pur	✓u			+		\	0			11
I'll have a mauve one										
2 yel	✓u			+		\	0			11
I'll have a yellow one — fast										
4 gre	u ?u			+		\	0			11
I'll have a green one — fast										
7 pink	✓C			−		\	0			11
I'll have a pink one : fast										16
				TOTAL						

AR: Formal Reception

Egs	LX	Cue	H	R	V
sit-rm	n p	d	/	d	1
kitchen	p p	s	/	S	1
chair	p n	d /	/	d	1
shelf	n n	s /	/	S	1
table	p p	s	/	S	1
bthrm	n n	s	/	S	1
7 garden	p n	d		S	0
TV	n n	s	/	S	1
cupbd	n p	d /	/	d	1
w'sill	p p	s /		S	1
wall	n n	s /		S	1
floor (s)	p n	d \	\	d	1
plate	p p	s		S	
mug	n p	d		d	1
bottle	p n	d \		d	1
cup	n n	s		S	1
			TOTAL	15	

AP: Formal Production

Egs	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac
telly: n						0		11
door: p						1		11
a the –								
chair: p						1		11
on –								
wall: n						0		11
table: p						1		11
the –								
road: n						0		11
in the								
garden: p								11
in –								
mug : n						0		11
							TOTAL	16

Practice:

by bike	C		C		
by - car	U		u		
fruit up	u				
fruit or	C				
sink	p n d		d		
road	p p s		S		
card	n n s	/	S		
on - the card					
on the paper					

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BR: Function Receptior BP: Function Production

Egs	C	H	R	V
1 Can't find tape	1		l	l
2 No time to try	M		M	l
3 Loves home	M	l	M	l
4 Won't go sch.	1		l	l
5 Not doing well	M		M	l
6 Won't find seat	M		M	l
7 Not v happy	1		l	l
8 Don't want buy	M		M	l
9 Don't like sea	1		l	l
10 Cant keep on	M		M	l
11 Not hard find	M		M	l
12 Dont want go	1	l	l	l
13 Cant hear music	M		M	l
14 Loves away	1	l	l	l
15 No time eat	1		l	l
16 Not going win	1		l	l
TOTAL 16				

Egs	Fu	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
dont see why	1		–			✓		0	F	ll
I don't see : why										
far too tired	1		–			ʌ		0	P	ll
I'm, far too tired										
went last wk	1		–			\		0	D	ll
He went last week										
dont eat meat	M		+		W	\			P	ll
I don't !eat meat										
far too thin	1		–			ʌ			P	ll
she's, far too thin										
wrote 4 times	M		+		W	⌒	l	✓		ll
He wrote 4 times (gl ✓)										
far too sweet	M		+		W	⌒		✓		ll
It's, far too !! sweet (gl ✓)										
dont want milk	M		+		W	⌒	l	(✓)		ll
I don't want . milk (gl ✓)										
TOTAL 16										

AR: Form. Recep AP: Formal Production

Egs	C	H	R	V
Mary	d ar		d	l
Don John	d ra		d	l
Bonny D	s r		S	l
sit rocks	d ar		d	l
nat land	s a		S	l
sailors	s r		S	l
immortal	d ra		d	l
bold Ro	s a		S	
schooner	d ar		d	l
glory	d ra		d	
reason	d ar		d	l
mountain	s r		S	l
Miranda	d ra		d	l
Wellingt	s r		S	l
fishers	s a		S	l
England	s a		S	l
TOTAL 16				

Egs	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
Rain..away									10
Come...day									ll
Old...soul									ll
Hick...dock									lll
mus..clock									ll
Baa..sheep									10
have...wool									ll
Jack&Jill									ll
TOTAL 14									

Practice:

Egs	C	H	R	V
Haven't said	m		M	
Isn't in tonight	o		l	

l

Egs	Fu	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
far too young	1								P	
don't like tea gl ✓	M								F	

Egs	C	H	R	V
I remem	s a		S	
Bull&Busl	d ra		d	
stately S	d ar		S	

Egs	Lo	Le	Pi	Ra	Gl	Si	Rh	Ac	V
See saw									
cock horse									

BR: Function Recep

Egs	C	H	R	V
laughs 1 S, A & J	3		3	1
2 B-J & S	2		2	1
3 M-J & D	2		2	1
4 M, J & P	3		3	1
5 A, M & J	3		3	1
6 S-J & J	2		2	1
7 A-C & L	2		2	1
8 M, A & F	3		3	1
9 Ch, I & c	3		3	1
10 F-y & h	2		2	1
11 Ch-b & t	2		2	1
12 Gi, Bu & c	3		3	1
13 Ch, C & t	3		3	1
14 Co-i & w	2		2	1
15 Cr-ch & h	2		2	1
16 Ch, F & t	3		3	1

TOTAL 16

BP: Function Production

Length

Egs	Fu	Pi1	Pi2	Gl1	Gl2	Si1	Si2	Ac	V
Cr bu & ch (cream)	3	+	+	/	/	1	2		11
Co ca & eg (Coffee)	3	+	+	/	/	1	2		11
Ch i-c & t	3	+	+	/	/	1	2		11
Ch bi & br (chock = fast)	2	-	+	-	/	0	2		11
Ch i-c & h	2	-	+	-	/	0	2		11
Co ca & ch (coffee = fast)	2	-	+	-	/	0	2		11
Cr bu & ja (cream)	3	+	0	/	/	1	2		11
Co ca & cr (coffee = fast)	2	-	+	-	/	0	2		11

TOTAL 16

AR: Form.Recep.

Egs	C	H	R	V
"1"	d -/		d	1
"2"	s /		S	1
"3"	s \		S	1
"4"	s /		S	1
"5"	d /-		d	1
"6"	d -\		d	1
"7"	s \		S	1
"8"	d -/		d	1
"9"	d -\		d	1
"10"	d /-		d	1
well	s -		S	1
so	s \		S	1
ah	d \-		d	1
then	s -		S	1
oh	s /		S	1
who	d -\		d	1

TOTAL 16

AP: Formal Production

Egs		L&R	Lo	Le	Pi	Ra	Gl	V
A -	— /							11
B /	/ /							11
C -	— \							11
D \	\ \							11
E / h	— /							11
F - h	/ /							11
G\ h	— \							11
H - h	\ \							11

16

TOTAL

BR Practice

	C	H	R	V
P, S & P	3		3	
M-M & J	2		2	

BP: Practice

Egs	Fu	Pi1	Pi2	Gl1	Gl2	Si1	Si2	Ac	V
Ch bi & tea	3			/	/	1	2		
Co ca & bu	2			—		0	2		

AR: Practice

Egs	C	H	R	V
June	d /-		d	
Joan	d -/		d	
Joe	s \		S	

AP Practice

Egs								
I /	— / / /							
J \	— \ \ \							

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BR & P: Function Reception & Production

Egs	C	H	R	V	Candidate	Lo	Le	Pi	Ra	Gl	Si	Ac	V
1 SE5 1TS	S		S	1			S̄			S̀	S.		1
2 1TS	T		T	1				↑T		T̀			1
3 N7 1PB	N		N	1		"N				Ǹ	?		1
4 1PB	B		B	1		"B				B̀			1
5 W13 2SX	13		3	1		"3	3̄			3̀			1
6 2SX	2		2	1						2̀			1
7 FY4 3LU	F		F	1			F̄			F̀	F.		1
8 3LU	L		L	1	ú		L̄			Ľ	L.		1
9 GU4 2PE	G		g	1			S̄			g̀	g.		1
10 2PE	P		P	1				↑p		p̀			1
11 HA7 9NK	A		A	1	9					À			1
12 9NK	9	\	9	1						9̀	9.		1
13 MC6 8TR	M		M	1			M̄			M̀	M.		1
14 8TR	8		8	1			8̄			8̀.	8.		1
15 BS6 4FE	S		S	1	S̀ 6			↑S		S̀	S.		1
16 4FE	F		F	1				↑F		F̀	F.		1
TOTAL				16						TOTAL			16

AR: Formal Recepti AP: Formal Production

Egs	C	H	R	V
thirteen	s 2		S	1
inside	s 1		S	1
unfair	d 12		d	1
defrost	s 2		S	1
unkind	d 21		d	1
nineteen	s 2		S	1
retake	d 12		d	1
impact	s 1		S	1
dispute	d 12		d	1
increase	d 12		d	1
research	s 1		S	1
inborn	s 1		S	1
sixteen	d 21		d	1
discharge	d 12		d	1
untie	s 2		S	1
fourteen	d 12		d	1
TOTAL				16

Egs		1st syllable Lo	1st syllable Le	1st syllable Pi	1st syllable Ra	2nd Syllable Lo	2nd Syllable Le	2nd Syllable Pi	2nd Syllable Ra	V
return	\ \						+	↑	W	11
demur	\ \								W	10
below	\ \							↑	W	11
differ	\ \			↑	W					11
written	\ \			↑	W					11
dimmer	\ \	+		↑	W					11
billow	\ \		+	↑	W					11
defer	\ \							↑	W	11
40-14	\ _sorry-\								W	1
80-18	8 –\									1
50-15	4 –\									1
90-19	6				4			\		1
17-18	2				\					1
18-19	3				\					1
13-14	1.				\					1
14-15	4				\					1
TOTAL										

l5

BR & P Practice

NW3 2HG

	C	H	R	V
NW3	3		3	
2HG	H		H	

AR Practice

Egs	C	H	R	V
imprint	d 12		d	
remake	s 1		S	
implant	d 21		d	

AP Practice

Egs		Lo	Le	Pi	Ra	Lo	Le	Pi	Ra	V
cocoa	/ \				W					
dodo	\ \									
70-17								^		
16-17					\					

ˈsɪkstaɪ

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~~Rmmt~~

APPENDIX 2: Matrices of monosyllables

These matrices were devised to find suitable items for the PEPS reception tasks. They comprise monosyllabic words in common use in English, including (in parentheses) abbreviations, names, names of letters, slang, low frequency, dialectal and some technical words. Regional pronunciation, as in /bu:k/ , /du:k/ and /lʊv / is not taken into account. Where homophones are available, the commonest or probably most useful word is shown. Since the words were to be used with subjects who might have articulatory difficulties, ease of articulation was a preliminary selection criterion. Consonants are therefore all 'simple': plosives, fricatives (voiced and voiceless), nasal and lateral continuants and semi-consonants; no affricates or clusters. Vowels are likewise simple: diphthongs are not included. Only some of the charts are included here.

IPA is used for stems and affixes (affixes are also in bold); orthographic spelling for citations.

Consonant + long vowel

	i	ɜː	ɑː	ɔː	uː
0	E	err	R	or	ooh
p	pea	purr	(Pa)	pour	pooh
t	tea	0	tar	tore	too
k	key	cur	car	core	coo
b	bee	burr	bar	bore	boo
d	D	0	(Da)	door	do
g	(ghi)	0	0	gore	goo
m	me	0	(Ma)	more	moo
n	knee	0	0	gnaw	(noo)
l	lee	0	0	law	loo
r	0	0	0	raw	rue
h	he	her	hah	whore	who
w	we	were	0	war	woo
j	ye	0	(yah)	your	you
s	see	sir	0	saw	sue
f	fee	fur	far	four	0
θ	0	0	0	thaw	0
ʃ	she	(shirr)	(Shah)	shore	shoo
z	0	0	0	0	zoo
v	V	0	0	0	0
ð	thee	the	0	0	0

Consonant + long vowel + voiced plosive:

	ɑ:d	i:d	u:d	ɔ:d	ɜ:d
0	0	0	0	(awed)	(erred)
p	(0)	(peed)	0	pawed	purred
t	tarred	0	0	toured	(turd)
k	card	keyed	(cooed)	cord	curd
b	barred	bead	(booed)	bored	bird
d	0	deed	(dude)	0	0
g	guard	0	0	(gored)	(gird)
m	marred	mead	mood	(Maud)	0
n	(nard)	need	0	gnawed	(nerd)
l	lard	lead	lewd	lord	0
r	0	reed	rude	roared	0
h	hard	heed	0	whored	heard
w	0	weed	wooed	ward	word
j	yard	0	you'd	(yawed)	0
s	0	seed	(sued)	(sword)	(sirred)
f	(fard)	feed	food	ford	furred
θ	0	0	0	thawed	third
ʃ	(shard)	0	shooed	shored	(shirred)
v	0	0	0	0	0

ɑ:b	**i:b**	**u:b**	**ɔ:b**	**ɜ:b**	orb, curb, barb, (boob), daub, garb, herb, verb (Saab/sahib) (Serb) (farb)
ɑ:g	**i:g**	**u:g**	**ɔ:g**	**ɜ:g**	berg, moog, morgue, league

Consonant + short vowels + voiceless plosives:

	ɪt	et	æt	ʌt	ɔt	ʊt	ɪp	ep	æp	ʌp	ɔp
0	it	ate	at	0	0	0	0	0	0	up	(op)
p	pit	pet	pat	(putt)	pot	put	pip	(pep)	(pap)	pup	pop
t	(tit)	0	(tat)	(tut)	tot	0	tip	0	tap	(tup)	top
k	kit	0	cat	cut	cot	0	(kip)	0	cap	cup	(cop)
b	bit	bet	bat	but	0	0	0	0	(bap)	0	(bop)
d	0	debt	(DAT)	0	dot	0	dip	(dep)	0	0	0
g	(git)	get	(gat)	gut	got	0	0	0	gap	0	0
m	(mitt)	met	mat	(mutt)	0	0	0	0	map	0	mop
n	knit	net	gnat	nut	knot	0	nip	0	nap	0	0
l	lit	let	0	0	lot	0	lip	0	lap	0	lop
r	0	0	rat	rut	rot	0	rip	(rep)	rap	0	0
h	hit	(het)	hat	hut	hot	0	hip	0	(hap)	(hup)	hop
w	wit	wet	0	0	what	0	whip	0	0	0	(wop)
j	0	yet	0	0	0	0	0	(yep)	yap	(yup)	0
s	sit	set	sat	0	(sot)	soot	sip	0	sap	sup	sop
f	fit	0	fat	0	0	foot	0	0	0	0	(fop)
ʃ	(shit)	0	(shat)	shut	shot	0	ship	0	(Shap)	0	shop
z	(0)	0	0	0	0	0	zip	0	(zap)	0	0
v	0	vet	vat	0	0	0	0	0	0	0	0
ð	0	0	that	0	0	0	0	0	0	0	0

θ: 0

Consonant + short vowels + voiceless plosives (cont):

		ʊp	ɪk	ek	æk	ʌk	ɔk	ʊk
p	0	pick		peck	pack	(Puck)	(pock)	0
t	0	tick		(tech)	tack	tuck	(tock)	took
k	0	kick		0	0	0	cock	cook
b	0	0		beck	back	buck	0	book
d	0	(Dick)		deck	0	duck	dock	0
m	0	(Mick)		(mec)	(mac)	muck	mock	0
n	0	nick		neck	(knack)	0	knock	nook
l	0	lick		0	lack	luck	lock	look
r	0	rick		(reck)	rack	(ruck)	rock	rook
h	0	(hick)		(heck)	hack	(Huck)	hock	hook
w	0	wick		0	whack	0	(wok)	0
j	0	0		0	yak	(yuk)	0	0
s	0	sick		0	sack	suck	sock	0
f	0	0		0	0	(fuck)	0	0
θ	0	thick		0	0	0	0	0
ʃ	0	0		0	0	(0)	shock	shook

g, z, v, ð: 0

Consonant + long vowel + voiceless plosive

	ɑ:k	i:k	u:k	ɔ:k	ɜ:k	ɑ:t	i:t	u:t	ɔ:t	ɜ:t
0	ark	(eke)	0	(orc)	irk	art	eat	0	ought	0
p	park	peak	0	pork	(perk)	part	peat	0	port	pert
t	0	teak	0	talk	(Turk)	tart	teat	toot	taught	0
k	0	0	0	cork	kirk	cart	0	coot	caught	curt
b	bark	beak	0	(balk)	(berk)	0	beat	boot	bought	(Bert)
d	dark	0	0	(dork)	(dirk)	dart	0	0	0	dirt
g	0	(geek)	0	0	0	0	0	0	0	(girt)
m	mark	meek	0	0	murk	mart	meet	moot	mort	0
n	(nark)	0	(nuke)	0	0	0	neat	0	nought	0
l	lark	leak	(Luke)	0	lurk	0	(leat)	lute	0	0
r	0	reek	0	0	0	0	0	root	0	0
h	hark	0	0	hawk	0	heart	heat	hoot	0	hurt
w	0	week	0	walk	work	0	wheat	0	wart	(wort)
j	0	0	0	(York)	0	0	0	0	0	0
s	(0)	seek	0	0	0	0	seat	suit	sort	0
f	0	0	0	fork	0	(fart)	feet	0	fort	0
θ	0	0	0	0	0	0	0	0	thought	0
ʃ	shark	(chic)	0	0	shirk	0	sheet	shoot	short	shirt

z, v, ð: 0

Appendix 3. PEPS production task materials

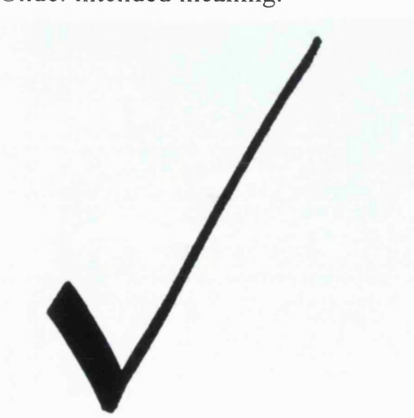
For sections where verbal items were stipulated for participants' responses in production tasks (see Appendix 1) these were printed on cards which were laminated and spirally bound in the given sequence.

For function production tasks where the items or intended meanings were best represented as pictures, illustrations were given as shown below.

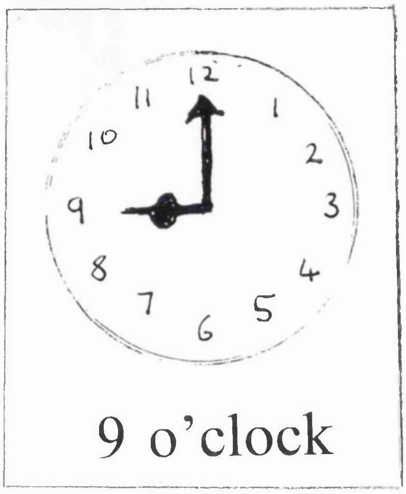
Length: intended meaning: brisk and lazy pictures:

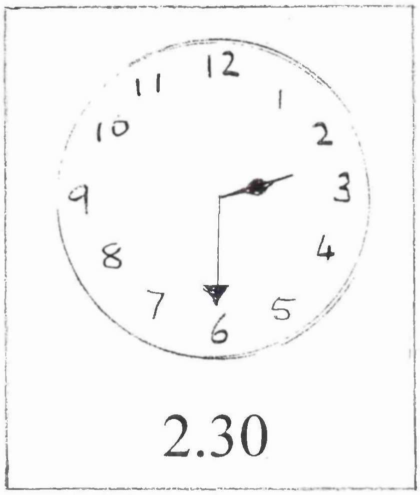
Range: intended meaning: surprised and not surprised pictures

Glide: intended meaning:



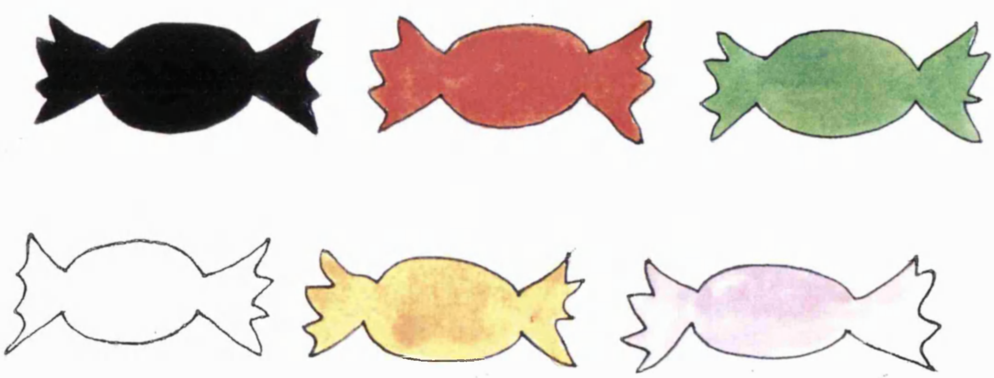
Glide: clock-times:



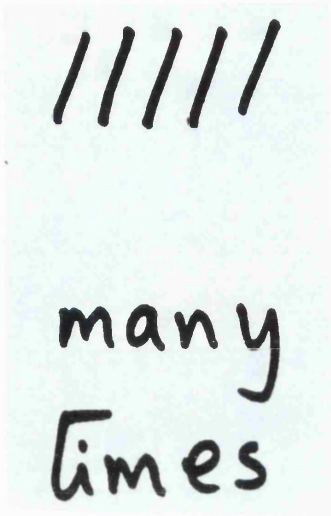


Silence: intended meaning: certain and uncertain pictures

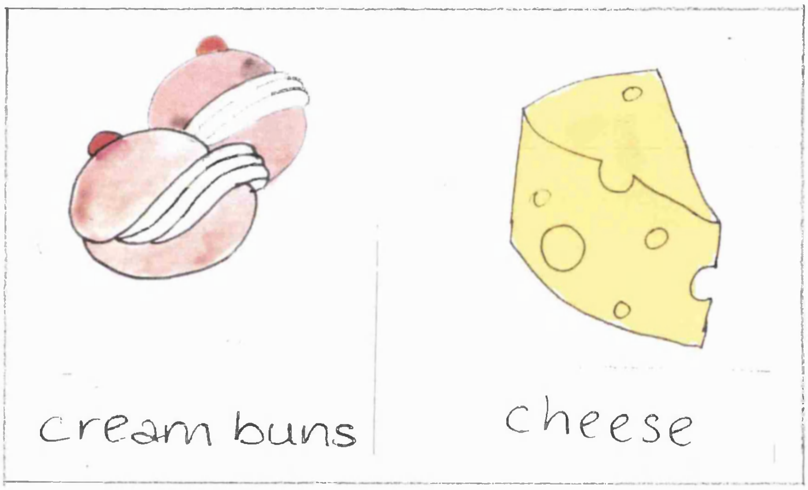
Silence: items (choice of sweet-colours)



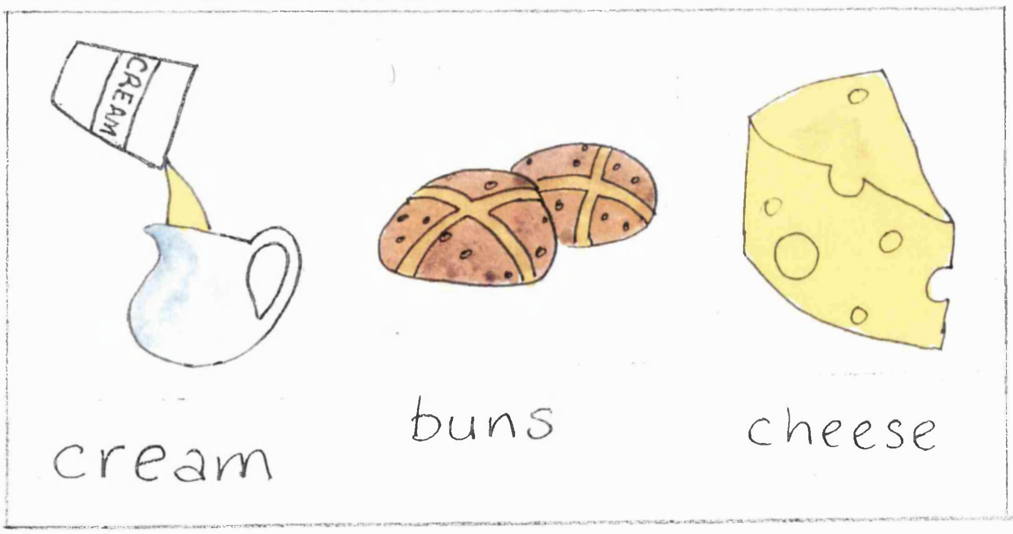
Rhythm: many times and first time



Level: 2 items of food and drink:



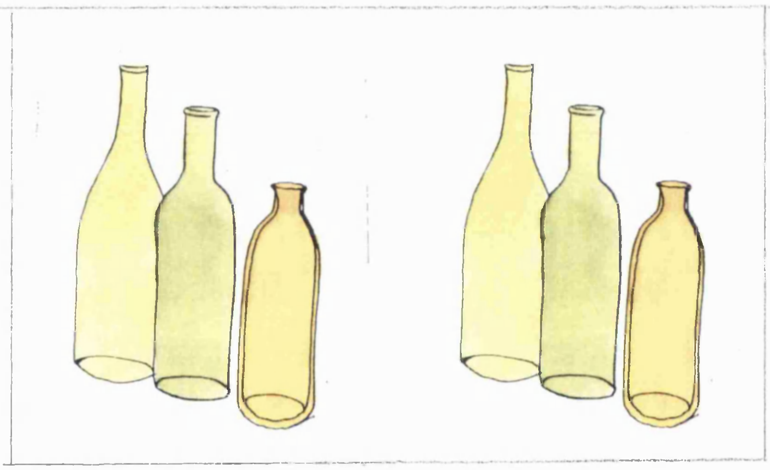
Level task: 3 items of food and drink:



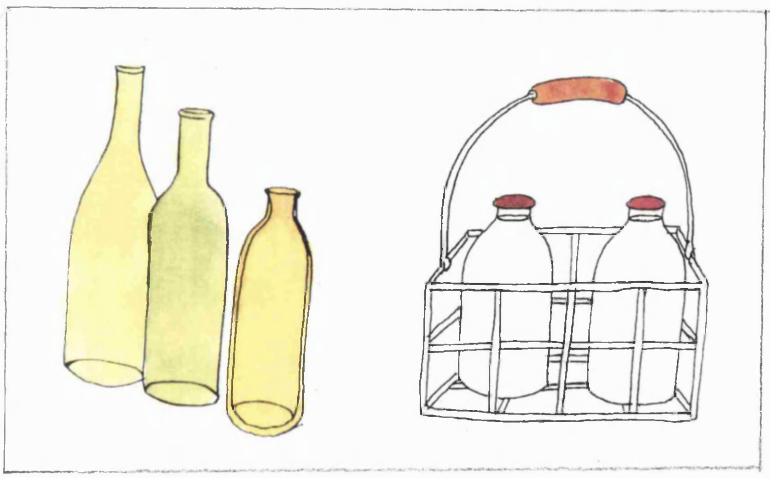
The other items for the Level task were similarly depicted.

Level: intended meaning:

Same



Different



APPENDIX 4: PEPS Instructions (For test items, see Appendix 1.)

Loudness

Function reception: Is this being said loudly or quietly? Say "Loud" or "Quiet."

[Each function reception task began with two demonstrations of the contrast of function being tested, e.g. "Listen: this is being said loudly. This is being said quietly. This is loud. This is quiet"; and two or three practice items, introduced thus: "Now tell me what you think about this."]

Function production: Say the numbers loudly or quietly according to the gesture I make: if I out my hand to my ear, I want you to speak more loudly; if I put my finger to my lips I want you to speak more quietly.

Form reception: You'll hear the same word said twice. This time it's said the same way both times [Stimulus]. But this time it's said differently the second time [Stimulus]. I want you to listen to the way the words are said in each pair and tell me whether they're said the same way or differently; say "Same" or "Different".

[This was the same for each of the form reception tasks.]

Form production: Say this word as loudly as you can; the next not quite so loudly as your loudest; the next as quietly as you can; and the next a bit louder than your quietest. (Repeat)

Length

Function reception: Is this is being said in a brisk way or a relaxed way? Say "Brisk" or "Relaxed."

Function production: Here is a picture of a person looking relaxed, and one of a person looking brisk. I'm going to show one or the other to you for each name you say. Each time you turn over a card for a new name, look at the picture I show you, and then say the name in the way suggested by the picture. Don't tell me what you see in the picture.

Form production: Say this letter as slowly as you can; the next not quite so slowly as your slowest; the next as quickly as you can; and the next not quite so quickly as your quickest. And now you'll hear some phrases such as "more and more" and "on and on", and I want you to repeat each one as soon as you hear it.

Pitch

Function reception: Listen to the way I say "m", and if you think I want you to continue, say the next month. If you think I want you to repeat it, say it again.

Function production: Listen to the words I say. If you're sure you know what I said, say "m" in such a way that you're showing me you've understood and are ready for me to go on to the next word. If you're not sure of the word, say "m" in such a way that I repeat it.

Form production: Say this letter at as high a pitch as you can; the next not quite so high as your highest; the next as low as you can; and the next not quite so low as your lowest.

Range

Function reception: Does this sound surprised or not surprised?

Function production: Here is a picture of a person looking surprised, and one of a person looking unsurprised. I'm going to show one or the other to you for each word you say. Each time you turn over a card for a new word, look at the picture I show you, and then say the word in the way suggested by the picture. Don't tell me what you see in the picture.

Form production: [These instructions were the same for all form production tasks after this, except for variations as indicated.] You'll hear some words/numbers/letters said on the tape. Say each word as soon as you hear them. Try to copy exactly the way it is said.

Glide

Function reception: Imagine yourself in a room where someone else is on the telephone. You hear one half of the conversation, and try to decide whether the person speaking is asking questions or giving answers with the words you hear.

Function production: Here is a question-mark and here's a tick. Each time you turn over a card for a new clock-face, look and see whether I'm showing you a question-mark or a tick. If I'm showing you a tick, say the time shown on the clock-face as if confirming it. If I'm showing you a question-mark, say the time as if questioning it.

Silence

Function reception: Does this sound certain or uncertain?

Function production: Here's a picture of a person looking certain and one of someone looking uncertain, and here are some pictures of sweets. Choose a colour of sweet, look at the picture I'm showing you, and say: "I'd like a (the colour you've chosen) sweet" in the way shown on the picture.

Form production: Say these phrases as soon as you hear them. Try to copy exactly the way that they're said. If you hear a gap, put one in. If not, don't.

Rhythm

Function reception: Does this sound as though it's being said for the first time or as though it's been said many times before?

Function production: Here is a symbol for 'once', or 'the first time', and here's a symbol for 'many times'. I'm going to show one or the other to you for each phrase you say. Each time you turn over a card for a new phrase, look at the symbol I show you, and then say the phrase in the way suggested by the symbol. Don't tell me which symbol you see.

Form production: Say these lines from nursery rhymes as you hear them. Try to copy the way that they're said, i.e. say them as rhythmically as possible.

Level

Function reception: Does this sound as though I'm talking about 2 people/items or 3?

Function production: Here's a card with a 2 on it and one with a 3, and here are some cards with picture-strips showing things to eat and drink. I'll show a you a 2 or a 3 for each card of picture-strips you turn over. If I show you a 2, say the top picture-strip [a 'list' of two items]; if I show you a 3, say the bottom line of picture-strips [a list of three items].

Form production: Say these pairs of letters as soon as you hear them. Try to copy exactly the way that they're said.

Accent

Function reception: [Demonstration: recording of a person reading out a postcode, of the tester repeating the first half, querying the first letter in it.] Which letter or number was I querying? [Demonstration of a number in the second half of the postcode being similarly queried.]

Function production: Say that part of the postcode again, making really clear the letter or number that I was querying. [Taped demonstration of this].

Form production: Say these words first in a neutral way and then really emphasising them.

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti	Age	Sex		Ed		C-o		LOUDNESS				LENGTH				PITCH	
cipant	Age	m	f	S	U	n	r	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd
Sa	16	m		?		n		14	16	16	15	12	14	13	2	12	15
Si	16	m			u	n		15	14	15	16	15	16	13	16	9	3
Ke	16	m		s		n		13	9	7	12	14	14	12	2	15	1
Numbers scoring <12								0	1	1	0	0	0	0	2	1	2
Numbers scoring <5								0	0	0	0	0	0	0	2	0	2
Chance scores								0	1	1	0	0	0	0	0	1	0
Mean-2stdevs(lower bound of normality								14.57	10.90	13.39	10.16	13.96	9.21	12.44	9.59	14.57	14.88
Rounded ditto								15	11	13	10	14	9	12	10	15	15
								FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd
1	38		f		U	n		16	13	16	16	16	16	16	16	16	16
2	26	m			U	n		16	13	16	15	16	12	16	14	16	16
3	63		f		U	n		15	16	15	15	16	16	15	14	16	16
4	45	m			U	n		16	15	16	10	16	16	15	16	16	16
5	35		f	S		n		16	10	15	9	12	5	13	13	11	15
6	57	m			U	n		16	12	14	8	16	13	12	13	16	
7	43		f	S		n		16	15	15	15	16	14	14	16	16	16
8	43		f		U	n		16	14	15	15	16	13	16	16	16	16
9	23	m		S		n		14	13	14	12	15	15	16	13	16	16
10	60		f	S		n		14	12	15	16	16	16	11	12	16	15
11	54		f	S		n		16	16	15	14	16	12	13	13	16	16
12	63	m		S		n		16	14	15	14	16	15	16	16	16	16
13	47		f		U	n		16	14	16	12	16	14	14	16	16	16
14	44		f		U	n		16	12	16	16	15	12	13	15	16	16
15	22		f		U	n		14	16	16	15	16	14	14	14	16	15
16	23		f		U		r	16	12	13	13	16	12	15	14	16	16
17	43		f	S			r	16	12	16	15	15	13	14	12	16	16
18	20	m			U		r	16	16	16	12	15	16	12	11	16	16
19	66		f	S			r	16	13	14	12	15	12	13	14	16	15
20	18		f		U		r	16	10	15	15	16	11	15	10	15	16
21	19		f	S			r	16	11	16	11	15	8	16	14	16	15
22	33	m			U		r	16	16	15	15	14	15	14	11	16	16
23	19	m			U		r	16	14	15	14	16	11	16	12	16	16
24	18		f		U		r	16	13	15	14	16		16	15	16	16
25	21		f		U		r	16	15	15	12	15	14	15	14	16	16
26	44	m			U		r	15	13	15	12	15	14	16	16	16	16
27	18	m			U		r	16	14	16	15	16	16	15	16	16	16
28	38	m			U	n		16	16	14	15	15	14	14	14	15	16
29	39	m			U		r	16	13	15	15	15	11	16	16	16	16
30	24	m		S			r	16	8	16	11	16	4	16	11	16	16
31	24	m		S			r	16	14	15	16	14	13	16	12	16	16
32	27		f		U	n		15	14	15	16	16	16	15	16	16	16
33	46		f	S		n		16	12	15	14	16	10	15	14	16	16
34	42	m			U	n		16	13	16	14	15	15	15	16	16	16
35	58	m		S		n		16	15	14	15	16	16	15	8	16	15
36	55		f	S			r	16	16	15	12	15	16	14	14	16	16
37	21		f		U	n		16	16	16	16	16	13	14	13	16	16
38	21		f	S		n		16	16	15	12	16	13	16	13	16	16
39	34		f		U	n		16	14	15	14	16	15	15	16	16	16
40	45	m			U	n		14	16	15	13	16	14	15	15	16	16
41	25		f		U	n		16	16	16	11	16	14	13	16	16	16
42	24	m		S		n		16	16	15	16	15	12	13	9	15	16
43	59		f	S		n		16	13	16	14	16	14	15	15	16	16
44	33	m		S		n		16	13	15	16	15	15	14		16	16
45	33		f		U		r	16	14	15	14	15	15	14	16	16	16
46	65		f	S		n		15	16	15	16	16	16	14	16	16	16
47	33	m			U	n		16	15	15	14	16	16	15	13	16	16
48	21	m		S			r	15	15	16	14	15	12	15	14	16	16
49	64		f	S			r	16	12	16	16	16	16	16	12	16	16
50	60		f	S			r	16	14	16	16	16	16	15	13	16	16
51	37		f	S			r	16	12	15	14	14	15	15	13	16	16
52	67	m		S			r	16	14	15	10	14	14	16	14	15	12
53	66		f		U		r	16	15	15	14	16	16	14	12	16	16
54	53		f	S			r	16	16	15	16	15	16	16	15	16	16
55	53	m		S			r	16	13	16	11	13	12	15	11	15	16
56	52	m		S			r	16	14	16	14	15	12	15	15	16	16
57	47		f	S			r	16	15	14	13	16	15	14	16	16	16
58	47	m			U		r	16	15	15	16	15	16	15	16	16	16
59	40	m		S		n		13	13	16	12	16	14	15	14	16	16
60	61		f	S		n		15	16	15	16	16	16	13	15	15	16
61	47	m			U		r	16	15	16	15	15	16	16	15	16	16
62	34	m			U	n		15	13	13	12	15	16	13	12	16	16
63	36		f	S			r	16	14	16	15	16	16	16	14	16	16

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti			RANGE				GLIDE				SILENCE			
cipant	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
Sa	15	11	11	12	8	13	9	9	13	10	10	12	15	8
Si	15	16	15	12	14	15	13	10	13	11	16	16	16	16
Ke	12	3	5	10	10	2	10	2	14	2	15	5	13	2
Num	0	2	2	1	2	1	2	3	0	3	1	1	0	2
Num	0	1	0	0	0	1	0	1	0	1	0	0	0	1
Cha	0	1	2	1	2	0	2	2	0	2	1	1	0	1
Mean-	12.76	8.96	10.21	12.52	13.08	9.93	9.50	11.93	12.81	8.95	13.78	11.97	14.08	12.43
Round	13	9	10	13	13	10	10	12	13	9	14	12	14	12
	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
1	16	16	15	16	16	13	16	14	16	16	15	16	15	15
2	16	12	15	13	16	13	16	16	16	13	16	12	16	14
3	16	13	16	15	15	14	15	16	16	16	16	14	16	16
4	16	14	15	15	15	12	16	15	16	15	15	16	16	15
5	11	7	15	14	12	9	7	9	11	7	12	16	14	11
6	12	13	14	15	15	9	16	16	16	12	14	14	16	14
7	16	16	15	14	15	16	15	16	15	16	15	15	16	16
8	16	9	13	14	16	16	15	15	15	16	16	15	16	16
9	16	14	16	16	15	13	16	16	16	12	16	16	16	16
10	14	10	10	14	14	16	15	16	16	14	16	14	16	14
11	15	12	16	15	13	14	15	16	15	15	14	13	14	14
12	16	13	15	13	16	16	16	15	16	16	16	15	16	14
13	16	12	16	16	16	14	16	16	16	13	13	16	16	16
14	15	16	15	16	16	16	15	14	16	13	16	15	16	16
15	16	12	12	16	16	15	15	16	15	14	16	16	16	16
16	16	14	14	15	16	15	16	16	16	15	15	11	16	14
17	13	14	16	12	15	13	14	16	16	14	16	16	15	16
18	16	16	16	16	14	13	15	15	16	15	16	16	14	15
19	13	10	11	16	15	12	12	12	13	10	16	16	15	15
20	15	12	15	16	16	11	15	16	16	12	16	11	16	16
21	14	9	16	16	15	10	13	16	14	9	16	15	16	14
22	12	12	12	16	13	14	15	16	13	12	14	15	15	9
23	16	10	14	14	16	16	15	16	15	15	16	13	16	16
24	16	7	16	15	16	15	10	16	16	15	16	16	16	16
25	16	12	16	16	16	14	15	16	15	14	15	16	16	16
26	16	14	13	16	15	15	15	14	16	15	15	16	16	16
27	16	12	15	16	16	15	16	12	15	15	16	16	16	15
28	16	15	14	16	16	13	15	15	16	13	15	15	16	16
29	16	14	14	15	16	15	16	16	14	11	16	11	16	16
30	16	11	13	14	16	12	14	16	15	14	13	16	16	16
31	16	11	14	13	15	14	15	15	15	15	15	13	15	16
32	16	14	16	16	15	13	16	15	16	16	16	16	16	16
33	14	10	16	16	16	15	15	16	16	11	16	15	16	16
34	16	16	15	16	16	16	16	16	16	16	16	16	16	15
35	16	12	11	13	14	13	15	16	14	10	15	13	16	15
36	14	15	15	14	14	15	14	16	15	14	16	14	15	14
37	16	11	14	14	16	12	15	16	15	13	15	16	16	16
38	16	14	16	16	16	14	16	16	16	16	15	16	16	13
39	16	13	15	16	16	15	15	16	15	14	16	16	16	16
40	15	14	12	14	13	13	16	16	16	13	13	14	16	15
41	16	15	14	16	16	14	15	16	16	14	16	13	14	16
42	16	14	15	12	16	8	11	16	15	9	16	14	16	16
43	16	16	12	14	16	15	10	14	15	15	15	15	16	16
44	16	14	12	15	16	13	13	14	13	13	16	13	16	16
45	16	16	15	16	15	16	13	16	15	16	16	16	15	16
46	15	16	12	16	15	14	16	16	15	11	16	16	16	15
47	16	16	14	16	15	13	10	16	15	13	14	10	15	16
48	14	12	9	15	14	9	9	16	16	7	16	11	16	16
49	15	10	12	15	15	14	11	16	14	11	16	13	14	12
50	16	16	13	14	16	14	15	16	15	15	16	16	16	14
51	15	14	16	16	16	15	14	16	15	14	16	15	16	16
52	16	11	13	15	15	13	10	13	14	13	16	16	16	16
53	16	16	15	16	15	14	14	16	14	11	16	15	16	16
54	12	13	12	15	15	15	6	11	14	15	16	16	16	14
55	13	11	9	14	15	15	7	12	13	14	16	16	16	16
56	16	15	15	13	16	16	16	15	15	15	16	15	15	14
57	16	16	12	16	15	16	16	16	16	14	16	16	16	16
58	15	13	12	16	15	16	16	15	15	14	16	16	16	16
59	16	12	15	15	16	12	15	9	16	13	16	12	16	13
60	15	16	12	15	15	13	13	16	15	14	16	15	16	14
61	16	14	16	16	16	16	14	15	14	16	14	14	16	16
62	12	10	14	14	12	14	13	14	14	10	16	14	14	14
63	15	15	12	15	16	12	13	9	15	13	15	13	16	15

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti	RHYTHM				LEVEL				ACCENT			
cipant	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
Sa	5	2	13	8	12	6	15	9	9	11	11	9
Si	12	13	15	8	12	15	16	13	16	16	16	13
Ke	8	3	15	13	13	13	12	2		15	15	1
Num	2	2	0	2	0	1	0	2	1	1	1	2
Num	0	2	0	0	0	0	0	1	0	0	0	1
Cha	2	0	0	2	0	1	0	1	1	1	1	1
Mean	11.44	9.24	15.06	10.53	11.78	11.07	12.05	9.97	8.64	11.20	15.09	8.16
Round	11	9	15	11	12	11	12	10	9	11	15	8
	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
1	16	13	16	15	16	16	16	16	15	16	16	11
2	16	16	16	13	16	16	15	9	16	16	16	15
3	16	16	16	16	16	16	16	15	16	16	16	16
4	16	15	16	16	16	16	14	14	16	16	16	16
5	10	10	16	11	9	16	13	11	5	10	15	8
6	14	13	15	13	15	16	14	11	15		16	15
7	16	13	16	16	13	13	16	16	16	14	16	16
8	15	11	16	15	15	12	16	16	14	16	16	16
9	15	16	16	12	16	12	16	16	14	16	16	16
10	16	15	16	11	15	16	14	15	14	16	16	14
11	15	14	16	12	16	15	11	14	14	15	15	8
12	16	13	16	16	16	7	15	15	15	14	16	11
13	16	14	16	16	16	16	14	14	16	16	16	10
14	16	16	16	15	14	14	16	16	16	14	16	12
15	16	4	16	16	14	16	16	14	15	16	16	6
16	15	13	16	14	16	15	15	16	16	14	16	11
17	14	14	16	12	15	14	16	14	15	15	16	14
18	14	16	16	15	16	16	15	14	15	13	16	16
19	12	9	16	15	11	15	13	13	16	10	16	13
20	14	12	16	14	14	14	16	14	12	16	16	13
21	12	10	15	12	14	15	15	13	13	12	16	11
22	16	11	15	10	16	16	10	9	16	7	15	9
23	15	16	14	12	16	15	15	15	15	14	16	12
24	11	16	16	16	15	16	16	16	16	16	16	12
25	16	14	16	15	16	15	16	15	16	16	15	13
26	16	15	16	16	16	16	16	15	16	16	16	16
27	15	14	16	12	14	16	15	15	16	16	16	11
28	16	13	16	16	16	14	13	12	16	16	16	16
29	15	16	16	15	16	16	16	15	16	16	16	15
30	13	9	15	6	16	14	16	13	13	15	16	15
31	13	7	15	16	16	15	15	14	12	14	16	16
32	13	11	16	13	13	14	16	15	15	14	16	14
33	16	16	16	11	16	16	13	15	16	16	16	14
34	16	16	16	14	15	16	15	14	16	15	16	14
35	13	13	16	15	15	16	13	9	12	13	16	16
36	15	15	16	11	14	14	14	14	16	14	16	14
37	14	15	16	16	14	13	16	15	16	16	16	13
38	15	16	16	15	15	14	16	16	15	15	16	16
39	16	16	16	13	16	15	15	13	14	15	16	15
40	16	12	15	14	16	16	14	11	15	14	16	12
41	15	16	16	14	16	13	14	13	16	15	16	12
42	15	15	16	14	14	12	16	13	14	11	15	15
43	15	13	16	14	13	14	12	14	13	14	16	14
44	16	14	16	15	15	12	14	11	13	15	16	16
45	16	16	16	15	16	16	16	16	16	14	16	16
46	15	16	16	16	14	11	14	13	16	16	16	16
47	15	12	16	15	16	16	14	12	8	15	16	13
48	15	13	16	13	15	14	15	13	9	13	15	7
49	12	12	16	12	16	15	15	13	11	14	16	16
50	14	16	16	16	14	16	16	16	16	15	16	15
51	12	14	16	15	14	14	14	15	15	10	16	14
52	15	15	16	13	13	15	14	13	10	16	16	16
53	13	15	16	12	16	16	16	15	15	13	16	6
54	14	16	16	15	12	16	12	15	9	16	15	16
55	13	12	16	13	14	16	14	9	9	12	16	16
56	16	16	16	16	16	16	16	15	16	16	16	12
57	15	15	16	16	16	16	16	15	16	14	16	15
58	15	15	16	15	15	16	16	15	16	15	16	16
59	15	14	16	16	14	16	16	14	15	14	16	16
60	15	13	16	15	14	16	16	16	16	16	16	16
61	15	16	16	16	16	16	16	16	16	16	16	15
62	12	15	15	14	15	13	12	15	10	14	15	16
63	12	14	16	13	13	9	14	9	13	16	14	16

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti	Age	Sex		Ed		C-o		LOUDNESS				LENGTH				PITCH	
cipant	Age	m	f	S	U	n	r	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd
Sa	16	m		?		n		14	16	16	15	12	14	13	2	12	15
Si	16	m			u	n		15	14	15	16	15	16	13	16	9	3
Ke	16	m		s		n		13	9	7	12	14	14	12	2	15	1
Numbers scoring < 12								0	1	1	0	0	0	0	2	1	2
Numbers scoring < 5								0	0	0	0	0	0	0	2	0	2
Chance scores								0	1	1	0	0	0	0	0	1	0
Mean-2stdevs(lower bound of normality								14.57	10.90	13.39	10.16	13.96	9.21	12.44	9.59	14.57	14.88
Rounded ditto								15	11	13	10	14	9	12	10	15	15
								FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd
64	33		f	S			r	16	15	15	16	15	16	16	15	15	16
65	62	m		S		n		16	16	16	13	16	16	15	16	16	16
66	40		f		U		r	16	16	15	15	15	16	14	16	16	16
67	60	m		S		n		16	13	16	15	16	16	16	15	16	16
68	23	m			U	n		16	14	14	7	16	10	15	12	14	16
69	54		f		U	n		16	16	16	15	16	16	15	13	16	16
70	44	m		S			r	16	15	12	14	15	14	15	14	16	16
71	55	m		S			r	16	16	16	16	16	15	14	15	16	16
72	61		f		U		r	16	16	16	16	16	16	14	13	16	16
73	33	m		S		n		16	14	14	14	15	16	16	13	16	16
74	52	m			U		r	16	15	15	16	16	16	14	16	16	16
75	63	m		S		n		16	15	14	16	16	16	15	16	16	16
76	63	m			U		r	16	15	16	13	16	15	15	15	16	15
77	58		f		U		r	16	16	14	13	16	13	15	16	16	16
78	27		f	S			r	16	13	16	14	16	9	16	9	16	16
79	65	m		S			r	16	16	16	14	16	16	16	16	16	16
80	57	m		S		n		14	16	12	16	16	16	13	16	16	16
81	18		f		U		r	16	16	16	16	15	16	16	15	16	16
82	20	m		S		n		16	13	16	14	16	11	16	15	16	16
83	18	m			U	n		16	13	15	14	16	15	16	10	16	16
84	20	m			U		r	16	16	16	14	16	16	15	11	16	16
85	20	m		S			r	16	14	15	11	14	14	16	13	16	16
86	19		f	S			r	16	16	16	15	16	16	15	15	16	16
87	59	m			U	n		16	16	16	16	14	16	16	11	15	16
88	23		f	S		n		16	14	14	15	16	14	12	7	15	16
89	20	m			U	n		16	16	15	16	16	12	14	10	16	16
90	27		f	S			r	16	15	15	14	16	12	15	15	16	16
Totals								1420	1282	1365	1258	1395	1249	1329	1228	1424	1413
Count	90	45	45	46	44	45		90	90	90	90	90	89	90	89	90	89
Max								16	16	16	16	16	16	16	16	16	16
Min								13	8	12	7	12	4	11	7	11	12
Mean								15.78	14.24	15.17	13.98	15.50	14.03	14.77	13.80	15.82	15.88
Std dev								0.595	1.67	0.89	1.97	0.77	2.41	1.16	2.11	0.63	0.50

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti	RANGE				GLIDE				SILENCE					
cipant	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
Sa	15	11	11	12	8	13	9	9	13	10	10	12	15	8
Si	15	16	15	12	14	15	13	10	13	11	16	16	16	16
Ke	12	3	5	10	10	2	10	2	14	2	15	5	13	2
Num	0	2	2	1	2	1	2	3	0	3	1	1	0	2
Num	0	1	0	0	0	1	0	1	0	1	0	0	0	1
Cha	0	1	2	1	2	0	2	2	0	2	1	1	0	1
Mean-	12.76	8.96	10.21	12.52	13.08	9.93	9.50	11.93	12.81	8.95	13.78	11.97	14.08	12.43
Round	13	9	10	13	13	10	10	12	13	9	14	12	14	12
	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
64	14	16	15	16	14	16	12	15	16	15	15	16	16	16
65	14	16	12	15	16	16	16	16	16	16	15	16	15	16
66	16	16	15	16	16	15	16	16	16	15	16	15	16	16
67	16	16	14	16	15	14	15	16	15	15	16	14	16	14
68	15	11	14	12	14	14	16	16	15	12	16	16	16	16
69	16	16	14	15	16	9	15	16	16	8	16	16	16	16
70	14	14	12	13	15	9	13	16	14	9	14	16	16	14
71	16	16	14	16	16	16	14	16	16	13	16	16	16	16
72	16	16	16	16	16	14	15	15	16	15	16	16	16	16
73	16	16	10	13	15	16	14	13	16	14	16	16	16	16
74	16	15	16	15	16	16	16	16	15	13	16	16	16	15
75	15	16	16	16	16	15	16	16	15	16	16	15	15	16
76	15	15	16	15	15	11	16	16	13	8	15	14	14	12
77	16	14	13	16	16	15	16	14	16	14	16	16	16	16
78	16	11	16	16	16	14	13	14	15	14	16	16	15	14
79	16	14	12	16	16	13	14	16	16	12	16	16	16	13
80	15	16	12	16	13	16	12	16	14	16	16	16	16	16
81	16	15	15	16	15	15	15	16	16	16	16	15	16	16
82	15	11	15	13	16	14	15	14	15	15	16	15	16	16
83	16	14	15	13	14	15	14	16	16	15	16	16	16	16
84	16	13	14	14	15	13	8	14	14	14	16	16	16	15
85	16	16	9	14	16	16	15	15	16	16	16	16	16	16
86	16	8	16	16	16	15	13	16	14	16	14	16	15	16
87	16	16	11	14	16	15	15	14	16	12	16	16	16	16
88	11	11	16	15	11	13	14	15	10	10	15	15	11	13
89	16	13	15	12	14	12	11	16	16	16	16	16	16	14
90	15	16	15	14	15	12	14	15	14	14	16	16	16	14
Tota	1373	1209	1256	1343	1368	1245	1266	1359	1357	1214	1396	1344	1408	1360
Count	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Max	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Min	11	7	9	12	11	8	6	9	10	7	12	10	11	9
Mean	15.26	13.43	13.96	14.92	15.20	13.83	14.07	15.10	15.08	13.49	15.51	14.93	15.64	15.11
Std d	1.25	2.36	1.87	1.20	1.06	1.94	2.28	1.59	1.13	2.27	0.86	1.48	0.78	1.32

APPENDIX 5. Ranges and means of scores for all participants in all subtests

Parti	RHYTHM				LEVEL				ACCENT			
cipant	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
Sa	5	2	13	8	12	6	15	9	9	11	11	9
Si	12	13	15	8	12	15	16	13	16	16	16	13
Ke	8	3	15	13	13	13	12	2		15	15	1
Num	2	2	0	2	0	1	0	2	1	1	1	2
Num	0	2	0	0	0	0	0	1	0	0	0	1
Cha	2	0	0	2	0	1	0	1	1	1	1	1
Mean-	11.44	9.24	15.06	10.53	11.78	11.07	12.05	9.97	8.64	11.20	15.09	8.16
Round	11	9	15	11	12	11	12	10	9	11	15	8
	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd	FnRec	FnProd	FmRec	FmProd
64	15	15	16	16	16	16	15	16	16	12	16	16
65	16	16	16	14	16	16	16	16	16	16	16	15
66	16	16	15	16	16	16	16	15	16	16	16	8
67	13	14	15	16	15	15	15	13	12	13	16	10
68	16	12	16	13	14	9	15	14	10	16	16	16
69	14	14	16	15	15	16	15	13	16	16	16	
70	14	14	16	16	15	16	14	7	12	12	15	14
71	15		16	16	16	16	16	16	16	16	16	15
72	13	12	16	16	16	16	16	16	16	16	16	16
73	14	16	16	16	13	10	16	16	15	15	16	14
74	15	16	16	13	16	16	16	13	16	16	16	13
75	16	16	15	13	15	16	16	16	16	16	16	13
76	14	14	16	16	14	16	11	15	13	15	16	11
77	8	12	16	12	15	16	15	16	11	14	16	16
78	15	16	16	15	10	11	16	15	14	16	16	13
79	13	16	16	16	16	16	15	13	15	16	16	16
80	16	16	16	16	13	16	16	15	12	14	15	15
81	16	13	16	15	15	15	16	16	16	15	16	16
82	14	14	16	13	14	16	16	15	13	16	16	16
83	16	15	16	13	16	16	14	14	16	15	16	16
84	12	9	15	16	15	16	14	15	14	16	15	13
85	14	11	16	16	15	16	15	16	5	15	16	8
86	14	15	16	15	10	16	16	16	10	14	16	16
87	15	16	16	11	16	16	15	15	12	16	16	15
88	14	12	15	16	12	13	11	11	6	13	16	13
89	16	12	16	16	15	13	16	16	13	15	16	8
90	15	16	16	15	14	16	15	11	11	16	16	9
Tota	1309	1235	1426	1285	1330	1333	1337	1263	1257	1305	1427	1212
Count	90	89	90	90	90	90	90	90	90	89	90	89
Max	16	16	16	16	16	16	16	16	16	16	16	16
Min	8	4	14	6	9	7	10	7	5	7	14	6
Mean	14.54	13.88	15.84	14.28	14.78	14.81	14.86	14.03	13.97	14.66	15.86	13.62
Std d	1.55	2.32	0.39	1.87	1.50	1.87	1.40	2.03	2.66	1.73	0.38	2.73

APPENDIX 6

Audiometry with correlations for impaired and unimpaired participants aged 52-67

Number of participant R=right ear, L=left ear	500Hz	1 kHz	2 kHz	4 kHz	Average for each ear	Better ear for PTA
Sam R	25	10	30	35	25	R
Sam L	20	15	35	40	27.5	
Keith R	15	10	10	30	16.25	R
Keith L	60	60	70	80	67.5	
Simon R	5	5	5	25	10	R
Simon L	5	10	10	20	11.25	
10L	10	5	0	10	6.25	L
10R	10	10	10	10	10	
11L	15	20	20	15	17.5	
11R	15	20	20	15	17.5	
12L	35	25	30	50	35	
12R	35	25	25	50	33.75	R
19L	35	30	40	50	38.75	L
19R	50	40	50	50	47.5	
36L	-5	-5	5	20	3.75	L
36R	5	5	10	35	13.75	
3L	5	10	15	20	12.5	L
3R	5	15	20	15	13.75	
43L	5	5	10	30	12.5	L
43R	20	15	5	25	16.25	
46L	0	0	20	35	13.75	
46R	5	10	10	15	10	R
49L	25	20	30	50	31.25	
49R	20	10	20	50	25	R
52L	10	15	35	65	31.25	
52R	15	20	20	55	27.5	R
53L	15	15	30	35	23.75	
53R	15	15	25	20	18.75	R
54L	0	0	-5	5	0	L
54R	5	5	0	0	2.5	
55L	5	0	10	25	10	L
55R	10	5	10	30	13.75	
56L	0	15	10	15	10	
56R	0	5	5	10	5	R
60L	10	10	5	0	6.25	
60R	5	0	0	0	1.25	R
65L	10	0	15	40	16.25	
65R	-5	0	-5	25	3.75	R
69L	0	0	0	5	1.25	L
69R	10	10	0	15	8.75	
71L	5	10	25	35	18.75	
71R	5	5	10	5	6.25	R
72L	20	5	15	15	13.75	
72R	15	0	0	10	6.25	R
74L	20	15	20	20	18.75	
74R	20	10	10	25	16.25	R
75L	25	20	35	70	37.5	
75R	20	10	5	35	17.5	R
76L	20	45	70	70	51.25	
76R	20	0	10	25	13.75	R
77L	5	10	30	30	18.75	L
77R	35	30	25	50	35	
80L	5	5	25	45	20	L
80R	10	5	30	75	30	

APPENDIX 6

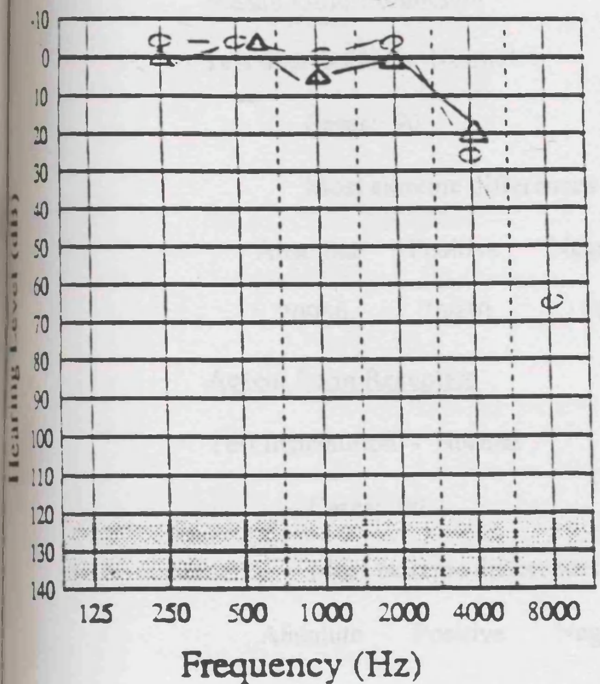
Audiometry with correlations for impaired and unimpaired participants aged 52-67

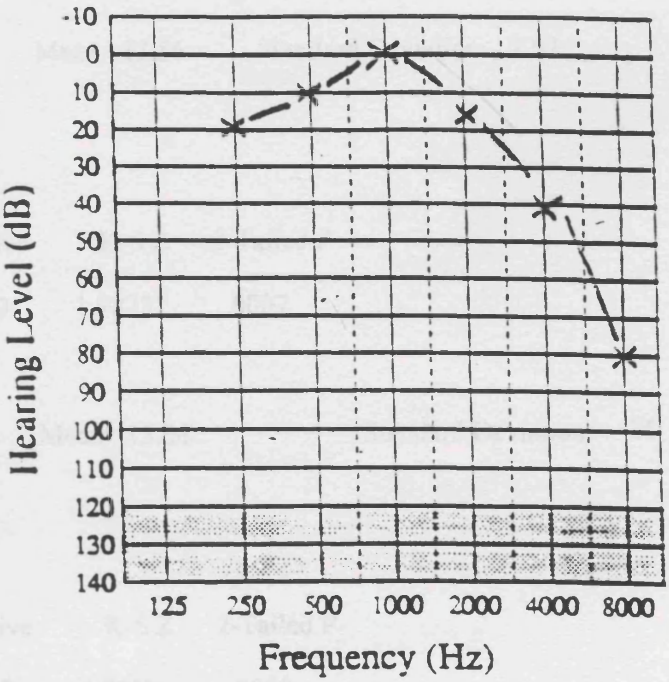
Participant No. in order of age	Age	PTA (better ear)	4kHz	8kHz	Function Reception	Form Reception
Simon	48	10	20	50	85.42	90.97
Keith	52	16.3	30	45	64.58	63.19
Sam	63	25	20	50	65.28	81.25
56 male	52	5	20	10	98.61	97.92
74 male	52	16.3	20	30	99.31	97.22
54 female	53	0	5	5	80.56	90.57
55 male	53	10	25	25	77.78	93.06
11 female	54	17.5	15	10	95.83	88.19
69 female	54	1.25	5	35	95.63	98.61
36 female	55	3.75	20	30	95.14	92.36
71 male	55	6.25	5	25	96.53	98.61
80 male	57	20	45	60	88.19	90.28
77 female	58	18.8	30	NR	88.19	97.22
35 male	58	7.5	20	20	89.58	93.06
87 male	59	6.25	10	20	90.28	99.31
43 female	59	12.5	25	15	87.5	95.83
10 female	60	6.25	10	20	91.67	91.67
50 female	60	6.25	20	20	94.44	98.61
67 male	60	21	25	35	92.36	97.22
60 female	61	1.25	0	5	91.67	95.14
72 female	61	6.25	10	25	97.22	98.61
65 male	62	3.75	25	65	96.53	97.22
12male	63	33.8	50	65	98.61	98.61
75 male	63	17.5	35	60	99.31	95.14
76 male	63	13.8	25	45	94.44	90.97
3 female	64	12.5	15	15	98.61	97.22
49 female	64	25	50	60	87.5	95.14
46 female	65	10	15	50	94.44	94.44
79 male	65	35	65	65	93.06	99.31
19 female	66	38.8	50	55	86.81	88.89
53 female	66	18.8	20	35	95.14	95.83
52 male	67	27.5	55	55	84.72	95.83
Correlation between PTA and Form Reception:					-0.07	
Correlation between PTA and Func Reception:					-0.08	
Correlation between age and PTA:					0.54	
Correlation between age and Function Reception:					0.06	
Correlation between age and Form Reception:					0.09	

Audiogram 22.

Pure tone: air conduction; bone conduction.

Name: Graham (65) 62 yrs Date: 21/11/95





Masking Details

Masking Details

	Right	Left
Air conduction, masked if necessary	O	X
Air conduction, not masked (shadow point)	●	⧗
Bone conduction, not masked		△
Bone conduction, masked	[	]
Uncomfortable loudness level	└	┘

Remarks Presbyacutic raised threshold in high freqs above 2KHz —

Audiometer Kamplex AD17

Calibration standards AC BC

Tested by M Glaser

APPENDIX 7: Kolmogorov - Smirnov Goodness of Fit Test

21 Jun 96 SPSS for MS WINDOWS Release 6.1.

The 2-tailed P value shows whether the difference between normal distribution and the observed data in the sample is significant (<.05). In all cases the difference is significant.

<u>Accent Form Production</u>

Test distribution - Normal Mean: 13.56 Standard Deviation: 3.02

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.20950	.20950	-.19463	1.9875	.0007

<u>Accent Form Reception</u>

Test distribution - Normal Mean: 15.86 Standard Deviation: .38

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.51327	.35339	-.51327	4.8693	.0000

<u>Accent Function Production</u>

Test distribution - Normal Mean: 14.44 Standard Deviation: 2.43

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.26117	.26117	-.24971	2.4777	.0000

<u>Accent Function Reception</u>

Test distribution - Normal Mean: 13.97 Standard Deviation: 2.66

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.23992	.22252	-.23992	2.2761	.0001

Length Form Production

Test distribution - Normal Mean: 13.64 Standard Deviation: 2.55

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.17779	.17779	-.16656	1.6866	.0068

Length Form Reception

Test distribution - Normal Mean: 14.77 Standard Deviation: 1.16

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.23515	.14418	-.23515	2.2309	.0001

Length function production

Test distribution - Normal Mean: 13.88 Standard Deviation: 2.82

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.22584	.22584	-.19506	2.1425	.0002

Length Function Reception

Test distribution - Normal Mean: 15.50 Standard Deviation: .77

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.36470	.25752	-.36470	3.4599	.0000

Glide Form Production

Test distribution - Normal   Mean: 13.49   Standard Deviation: 2.27

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.18908	.13429	-.18908	1.7938	.0032

Glide Form Production

Test distribution - Normal   Mean: 15.08   Standard Deviation: 1.13

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.23933	.20804	-.23933	2.2704	.0001

Glide Function Production

Test distribution - Normal   Mean: 15.10   Standard Deviation: 1.59

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.32581	.28530	-.32581	3.0909	.0000

Glide Function Reception

Test distribution - Normal   Mean: 14.07   Standard Deviation: 2.28

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.25871	.19847	-.25871	2.4543	.0000

Level Form Production

Test distribution - Normal Mean: 14.03 Standard Deviation: 2.03

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.21633	.16637	-.21633	2.0523	.0004

Level Form Reception

Test distribution - Normal Mean: 14.86 Standard Deviation: 1.40

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.23716	.20729	-.23716	2.2499	.0001

Level Function Production

Test distribution - Normal Mean: 14.84 Standard Deviation: 1.85

Cases: 89

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.31894	.26533	-.31894	3.0089	.0000

Level Function Reception

Test distribution - Normal Mean: 14.78 Standard Deviation: 1.50

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.21504	.20718	-.21504	2.0400	.0005

Pitch Form Production

Test distribution - Normal Mean: 13.49 Standard Deviation: 2.26

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.15594	.13376	-.15594	1.4794	.0251

Pitch Form Reception

Test distribution - Normal Mean: 15.26 Standard Deviation: 1.25

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.35755	.27578	-.35755	3.3921	.0000

Pitch Function Production

Test distribution - Normal Mean: 15.70 Standard Deviation: 1.74

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.46826	.43174	-.46826	4.4423	.0000

Pitch Function Reception

Test distribution - Normal Mean: 15.82 Standard Deviation: .63

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.48914	.38864	-.48914	4.6404	.0000

Rhythm Form Production

Test distribution - Normal Mean: 14.28 Standard Deviation: 1.87

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.22792	.17885	-.22792	2.1622	.0002

Rhythm Form Reception

Test distribution - Normal Mean: 15.83 Standard Deviation: .40

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.50461	.33983	-.50461	4.7872	.0000

Rhythm Function Production

Test distribution - Normal Mean: 13.73 Standard Deviation: 2.73

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.20359	.20359	-.17217	1.9315	.0012

Rhythm Function Reception

Test distribution - Normal Mean: 14.54 Standard Deviation: 1.55

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.23768	.17413	-.23768	2.2548	.0001

Silence Form Production

Test distribution - Normal   Mean: 15.10   Standard Deviation: 1.33

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.32802	.24976	-.32802	3.1119	.0000

Silence Form Reception

Test distribution - Normal   Mean: 15.64   Standard Deviation: .78

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.44170	.32497	-.44170	4.1903	.0000

Silence Form Production

Test distribution - Normal   Mean: 14.94   Standard Deviation: 1.48

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.28449	.23773	-.28449	2.6989	.0000

Silence Function Reception

Test distribution - Normal   Mean: 15.51   Standard Deviation: .86

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.40307	.28582	-.40307	3.8238	.0000

Loudness Form Production

Test distribution - Normal   Mean: 14.00   Standard Deviation: 1.92

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.21111	.14875	-.21111	2.0028	.0007

Loudness Form Reception

Test distribution - Normal   Mean: 15.17   Standard Deviation: .89

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.25906	.17456	-.25906	2.4577	.0000

Loudness Function Production

Test distribution - Normal   Mean: 14.27   Standard Deviation: 1.69

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.17851	.15320	-.17851	1.6935	.0065

Loudness Function Reception

Test distribution - Normal   Mean: 15.79   Standard Deviation: .59

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.50641	.36026	-.50641	4.8042	.0000

Range Form Production

Test distribution - Normal Mean: 13.82 Standard Deviation: 1.95

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.16078	.13159	-.16078	1.5253	.0191

Range Form Reception

Test distribution - Normal Mean: 15.20 Standard Deviation: 1.06

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.27434	.22566	-.27434	2.6026	.0000

Range Function Production

Test distribution - Normal Mean: 14.96 Standard Deviation: 1.19

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.26570	.18986	-.26570	2.5206	.0000

Range Function Reception

Test distribution - Normal Mean: 13.96 Standard Deviation: 1.87

Cases: 90

Most extreme differences

Absolute	Positive	Negative	K-S Z	2-Tailed P
.21157	.13736	-.21157	2.0072	.0006

APPENDIX 8: Effect of gender on overall, form, function, production, and reception PEPS scores.

Mann-Whitney U - Wilcoxon Rank Sum W Test

OVERALL

Mean Rank

47.81	45 female
43.19	45 male

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
908.5	2151.5	-.8395	.4012

FORM

Mean Rank

47.61	45 female
43.39	45 male

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
917.5	2142.5	-.7671	.4430

FUNCTION

Mean Rank

47.42	45 female
43.58	45 male

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
926.0	2134.0	-.6985	.4848

PRODUCTION

Mean Rank

47.92	45 female
43.08	45 male

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
903.5	2156.5	-.8800	.3789

RECEPTION

Mean Rank

46.68	45 female
44.32	45 male

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
959.5	2100.5	-.4281	.6686

APPENDIX 9 Mann-Whitney test for effect of age on PEPS subtests

Mann-Whitney U - Wilcoxon Rank Sum W Test

significant results on 3 age ranges: young, middle and old

Young - Middle comparison

Accent Function Reception

Mean Rank

26.15	30 young
34.85	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
319.5	784.5	-2.0121	.0442

Length Form Production

Mean Rank

23.90	30 young
37.10	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
252.0	717.0	-2.9748	.0029

Length Function Production

Mean Rank

24.75	30 young
36.25	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
277.5	742.5	-2.5929	.0095

Length Function Reception

Mean Rank

34.88	30 young
26.12	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
318.5	1046.5	-2.1954	.0281

Pitch Form Production

Mean Rank

24.28	30 young
36.72	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
263.5	728.5	-2.8032	.0051

Rhythm Function Reception

Mean Rank

26.30	30 young
34.70	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
324.0	789.0	-1.9436	.0519

Range Form Production

Mean Rank

26.28	30 young
34.72	30 middle

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
323.5	788.5	-1.9011	.0573

Young - Old comparison

Length Form Production

Mean Rank

25.73	30 young
35.27	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
307.0	772.0	-2.1396	.0324

Length Function Production

Mean Rank

22.30	30 young
38.70	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
204.0	669.0	-3.7910	.0002

Level Function Production

Mean Rank

25.08	30 young
35.92	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
287.5	752.5	-2.6646	.0077

Pitch Form Production

Mean Rank

24.03	30 young
36.97	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
256.0	721.0	-2.9109	.0036

Pitch Form Reception

Mean Rank

34.13	30 young
26.87	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
341.0	1024.0	-1.9008	.0573

Range Function Reception

Mean Rank

36.12	30 young
24.88	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
281.5	1083.5	-2.5412	.0110

Middle - Old comparison

Length Function Reception

Mean Rank

25.53	30 middle
35.47	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
301.0	766.0	-2.5110	.0120

Pitch Function Production

Mean Rank

33.03 30 middle

27.97 30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
374.0	991.0	-2.0173	.0437

Rhythm Function Reception

Mean Rank

35.07 30 middle

25.93 30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
313.0	1052.0	-2.1068	.0351

Silence Function Reception

Mean Rank

26.17 30 middle

34.83 30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
320.0	785.0	-2.3026	.0213

Loudness Function Production

Mean Rank

25.68	30 middle
35.32	30 old

Cases: 60 Total

Corrected for ties

U	W	Z	2-Tailed P
305.5	770.5	-2.1942	.0282

APPENDIX 10. Effect of education on overall, form, function, production, and reception scores on PEPS.

Mann-Whitney U - Wilcoxon Rank Sum W Test

OVERALL

Mean Rank

38.64	46 secondary
52.67	44 university

Cases: 90 Total

		Corrected for ties	
U	W	Z	2-Tailed P
696.5	2317.5	-2.5475	.0109

FORM

Mean Rank

42.66	46 secondary
48.47	44 university

Cases: 90 Total

		Corrected for ties	
U	W	Z	2-Tailed P
881.5	2132.5	-1.0541	.2918

FUNCTION

Mean Rank

35.97 46 secondary

55.47 44 university

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
573.5	2440.5	-3.5419	.0004

PRODUCTION

Mean Rank

41.60 46 secondary

49.58 44 university

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
832.5	2181.5	-1.4495	.1472

RECEPTION

Mean Rank

35.84 46 secondary

55.60 44 university

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
567.5	2446.5	-3.5915	.0003

APPENDIX 10b: Effects of age considered with educational achievement

Kruskal-Wallis 1-Way Anova

OVERALL

Mean Rank	
28.31	13 young secondary
39.00	12 middle secondary
44.83	21 old secondary
46.18	17 young university
58.86	18 middle university
52.56	9 old university

Cases: 90 Total

			Corrected for ties		
Chi-Square	D.F.	Significance	Chi-Square	D.F.	Significance
11.7626	5	.0382	11.7703	5	.0381

FORM

Mean Rank	
34.46	13 young secondary
44.21	12 middle secondary
46.86	21 old secondary
41.97	17 young university
57.17	18 middle university
43.33	9 old university

Cases: 90 Total

			Corrected for ties		
Chi-Square	D.F.	Significance	Chi-Square	D.F.	Significance
6.3688	5	.2720	6.3776	5	.2712

FUNCTION

Mean Rank

27.12	13 young secondary
34.08	12 middle secondary
42.52	21 old secondary
48.24	17 young university
60.28	18 middle university
59.50	9 old university

Cases: 90 Total

			Corrected for ties		
Chi-Square	D.F.	Significance	Chi-Square	D.F.	Significance
17.5327	5	.0036	17.5576	5	.0036

PRODUCTION

Mean Rank

30.27	13 young secondary
38.54	12 middle secondary
50.36	21 old secondary
40.03	17 young university
58.64	18 middle university
49.50	9 old university

Cases: 90 Total

			Corrected for ties		
Chi-Square	D.F.	Significance	Chi-Square	D.F.	Significance
11.5051	5	.0422	11.5147	5	.0421

RECEPTION

Mean Rank

34.08	13 young secondary
37.42	12 middle secondary
36.02	21 old secondary
55.59	17 young university
57.00	18 middle university
52.83	9 old university

Cases: 90 Total

			Corrected for ties		
Chi-Square	D.F.	Significance	Chi-Square	D.F.	Significance
13.1294	5	.0222	13.1561	5	.0220

Mann-Whitney U - Wilcoxon Rank Sum W Test

Comparison of young and middle-aged secondary school leavers

OVERALL

Mean Rank

11.38	13 young secondary
14.75	12 middle secondary

Cases: 25 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
57.0	177.0	.2701	-1.1429	.2531

FORM

Mean Rank

11.88	13 young secondary
14.21	12 middle secondary

Cases: 25 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
63.5	170.5	.4371	-.7898	.4297

FUNCTION

Mean Rank

11.85	13 young secondary
14.25	12 middle secondary

Cases: 25 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
63.0	171.0	.4371	-.8173	.4138

PRODUCTION

Mean Rank

12.04	13 young secondary
14.04	12 middle secondary

Cases: 25 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
65.5	168.5	.5033	-.6803	.4963

RECEPTION

Mean Rank

12.23	13 young secondary
13.83	12 middle secondary

Cases: 25 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
68.0	166.0	.6114	-.5446	.5861

Comparison of young and old secondary school leavers

OVERALL

Mean Rank

14.12	13 young secondary
19.60	21 old secondary

Cases: 34 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
92.5	183.5	.1200	-1.5598	.1188

FORM

Mean Rank

14.31	13 young secondary
19.48	21 old secondary

Cases: 34 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
95.0	186.0	.1480	-1.4726	.1409

FUNCTION

Mean Rank

13.81 13 young secondary

19.79 21 old secondary

Cases: 34 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
88.5	179.5	.0891	-1.7030	.0886

PRODUCTION

Mean Rank

12.96 13 young secondary

20.31 21 old secondary

Cases: 34 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
77.5	168.5	.0352	-2.0925	.0364

RECEPTION

Mean Rank

17.54 13 young secondary

17.48 21 old secondary

Cases: 34

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
136.0	228.0	1.0000	-.0177	.9858

Comparison of middle-aged and old secondary school leavers

OVERALL

Mean Rank

15.83	12 middle secondary
17.67	21 old secondary

Cases: 33 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
112.0	190.0	.6184	-.5241	.6002

FORM

Mean Rank

16.79	12 middle secondary
17.12	21 old secondary

Cases: 33 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
123.5	201.5	.9266	-.0936	.9254

FUNCTION

Mean Rank

14.92	12 middle secondary
18.19	21 old secondary

Cases: 33 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
101.0	179.0	.3646	-.9367	.3489

PRODUCTION

Mean Rank

14.33	12 middle secondary
18.52	21 old secondary

Cases: 33 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
94.0	172.0	.2424	-1.1992	.2305

RECEPTION

Mean Rank

17.83	12 middle secondary
16.52	21 old secondary

Cases: 33 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
116.0	214.0	.7261	-.3746	.7079

Comparison of young and middle-aged university graduates

OVERALL

Mean Rank

14.62	17 young university
21.19	18 middle university

Cases: 35 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
95.5	248.5	.0570	-1.8998	.0575

FORM

Mean Rank

14.26	17 young university
21.53	18 middle university

Cases: 35 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
89.5	242.5	.0349	-2.0992	.0358

FUNCTION

Mean Rank

14.94	17 young university
20.89	18 middle university

Cases: 35 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
101.0	254.0	.0893	-1.7200	.0854

PRODUCTION

Mean Rank

13.65	17 young university
22.11	18 middle university

Cases: 35 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
79.0	232.0	.0139	-2.4446	.0145

RECEPTION

Mean Rank

16.79	17 young university
19.14	18 middle university

Cases: 35 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
132.5	285.5	.5034	-.6782	.4977

Comparison of young and old university graduates

OVERALL

Mean Rank

12.94	17 young university
14.56	9 old university

Cases: 26 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
67.0	131.0	.6340	-.5125	.6083

FORM

Mean Rank

13.41	17 young university
13.67	9 old university

Cases: 26 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
75.0	123.0	.9579	-.0810	.9355

FUNCTION

Mean Rank

12.15	17 young university
16.06	9 old university

Cases: 26 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
53.5	144.5	.2198	-1.2428	.2139

PRODUCTION

Mean Rank

12.44	17 young university
15.50	9 old university

Cases: 26 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
58.5	139.5	.3388	-.9711	.3315

RECEPTION

Mean Rank

13.85	17 young university
12.83	9 old university

Cases: 26 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
70.5	115.5	.7512	-.3242	.7458

Comparison of middle-aged and old university graduates

OVERALL

Mean Rank

14.47 18 middle university

13.06 9 old university

Cases: 27 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
72.5	117.5	.6679	-.4377	.6616

FORM

Mean Rank

15.11 18 middle university

11.78 9 old university

Cases: 27 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
61.0	106.0	.3224	-1.0309	.3026

FUNCTION

Mean Rank

13.78 18 middle university

14.44 9 old university

Cases: 27 Total

	Exact		Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
77.0	130.0	.8599	-.2066	.8363

PRODUCTION

Mean Rank

14.83	18 middle university
12.33	9 old university

Cases: 27 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
66.0	111.0	.4632	-.7721	.4401

RECEPTION

Mean Rank

14.28	18 middle university
13.44	9 old university

Cases: 27 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
76.0	121.0	.8205	-.2580	.7964

Comparison of young secondary school leavers and university graduates

OVERALL

Mean Rank

11.46	13 young secondary
18.59	17 young university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
58.0	149.0	.0279	-2.1992	.0279

FORM

Mean Rank

14.08	13 young secondary
16.59	17 young university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
92.0	183.0	.4570	-.7758	.4379

FUNCTION

Mean Rank

10.92	13 young secondary
19.00	17 young university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
51.0	142.0	.0119	-2.4932	.0127

PRODUCTION

Mean Rank

13.00	13 AGEED = 1 young secondary
17.41	17 AGEED = 4 young university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
78.0	169.0	.1833	-1.3615	.1733

RECEPTION

Mean Rank

10.85	13 young secondary
19.06	17 young university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
50.0	141.0	.0105	-2.5371	.0112

Comparison of middle-aged secondary school leavers and university graduates

OVERALL

Mean Rank

11.58	12 middle secondary
18.11	18 middle university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
61.0	139.0	.0479	-1.9910	.0465

FORM

Mean Rank

13.38	12 middle secondary
16.92	18 middle university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
82.5	160.5	.2852	-1.0813	.2796

FUNCTION

Mean Rank

10.21	12 middle secondary
19.03	18 middle university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
44.5	122.5	.0058	-2.6921	.0071

PRODUCTION

Mean Rank

11.83	12 middle secondary
17.94	18 middle university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
64.0	142.0	.0649	-1.8643	.0623

RECEPTION

Mean Rank

11.17	12 middle secondary
18.39	18 middle university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
56.0	134.0	.0276	-2.2055	.0274

Comparison of old secondary school leavers and university graduates

OVERALL

Mean Rank

14.86 21 old secondary

17.00 9 old university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
81.0	153.0	.5630	-.6114	.5410

FORM

Mean Rank

15.93 21 old secondary

14.50 9 old university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
85.5	130.5	.6892	-.4079	.6833

FUNCTION

Mean Rank

13.86 21 old secondary

19.33 9 old university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
60.0	174.0	.1255	-1.5641	.1178

PRODUCTION

Mean Rank

15.55	21 old secondary
15.39	9 old university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
93.5	138.5	.9646	-.0453	.9639

RECEPTION

Mean Rank

13.67	21 old secondary
19.78	9 old university

Cases: 30 Total

		Exact	Corrected for ties	
U	W	2-Tailed P	Z	2-Tailed P
56.0	178.0	.0856	-1.7441	.0811

APPENDIX 11 Regression analysis

* * * * M U L T I P L E   R E G R E S S I O N * * * *

showing the extent to which years of education predict reception scores

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
RECEP	94.302	3.993	
ED	.489	.503	Education

N of Cases = 90

Correlation, 1-tailed Sig:

	RECEP	ED
RECEP	1.000	.348
	.	.000
ED	.348	1.000
	.000	.

Equation Number 1   Dependent Variable..   RECEP

Block Number 1. Method: Enter   ED

Variable(s) Entered on Step Number

1..   ED   Education

Multiple R   .34817

R Square   .12122

Adjusted R Square   .11123

Standard Error   3.76441

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	172.01742	172.01742
Residual	88	1247.02828	14.17078

F =   12.13889   Signif F = .0008

----------------- Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ED	2.765682	.793803	.348167	3.484	.0008
(Constant)	92.950000	.555032		167.468	.0000

End Block Number 1 All requested variables entered.

Equation Number 1 Dependent Variable.. RECEP

Casewise Plot of Standardized Residual

Outliers = 3. *: Selected M: Missing

```
        -6.   -3. 3.   6.
 Case #  O:.......: :........:O  RECEP     *PRED      *RESID
    5  .  *    ..     .  75.0    92.9500   -17.9500
   88  .     *..      .  81.6    92.9500   -11.3500
```

2 Outliers found.

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	92.9500	95.7157	94.3021	1.3902	90
*RESID	-17.9500	5.6600	.0000	3.7432	90
*ZPRED	-.9726	1.0168	.0000	1.0000	90
*ZRESID	-4.7683	1.5036	.0000	.9944	90

Total Cases = 90

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
RECEP	94.772	3.025	
ED	.494	.503	Education

N of Cases = 87

Correlation, 1-tailed Sig:

	RECEP	ED
RECEP	1.000	.389
	.	.000
ED	.389	1.000
	.000	.

Equation Number 1 Dependent Variable.. RECEP

Descriptive Statistics are printed on Page 14

Block Number 1. Method: Enter ED

Variable(s) Entered on Step Number

1.. ED Education

Multiple R .38884

R Square .15120

Adjusted R Square .14121

Standard Error 2.80341

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	118.99789	118.99789
Residual	85	668.02594	7.85913

F = 15.14136 Signif F = .0002

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ED	2.339207	.601155	.388844	3.891	.0002
(Constant)	93.615909	.422631		221.508	.0000

End Block Number 1 All requested variables entered.

>Note # 12650

>No outliers found. No casewise plot produced.

Equation Number 1 Dependent Variable.. RECEP

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	93.6159	95.9551	94.7721	1.1763	87
*RESID	-8.1959	4.9941	.0000	2.7871	87
*ZPRED	-.9829	1.0057	.0000	1.0000	87
*ZRESID	-2.9235	1.7814	.0000	.9942	87

Total Cases = 87

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
FUNC	92.665	4.019	
ED	.494	.503	Education

N of Cases = 87

Correlation, 1-tailed Sig:

	FUNC	ED
FUNC	1.000	.345
	.	.001
ED	.345	1.000
	.001	.

Equation Number 1 Dependent Variable.. FUNC

Block Number 1. Method: Enter ED

Variable(s) Entered on Step Number

1.. ED Education

Multiple R .34458

R Square .11873

Adjusted R Square .10837

Standard Error 3.79545

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	164.97384	164.97384
Residual	85	1224.46093	14.40542

F = 11.45220 Signif F = .0011

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ED	2.754271	.813883	.344579	3.384	.0011
(Constant)	91.303636	.572185		159.570	.0000

End Block Number 1 All requested variables entered.

Equation Number 1 Dependent Variable.. FUNC

Casewise Plot of Standardized Residual

Outliers = 3. *: Selected M: Missing

-6. -3. 3. 6.

Case # O:........: :........:O FUNC *PRED *RESID

6 . *.. . 81.6 94.0579 -12.4579

1 Outliers found.

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	91.3036	94.0579	92.6649	1.3850	87
*RESID	-12.4579	7.6564	.0000	3.7733	87

*ZPRED	-.9829	1.0057	.0000	1.0000	87
*ZRESID	-3.2823	2.0172	.0000	.9942	87

Total Cases = 87

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
FUNC	92.817	3.712	
ED	.494	.503	Education

N of Cases = 87

Correlation, 1-tailed Sig:

	FUNC	ED
FUNC	1.000	.380
	.	.000
ED	.380	1.000
	.000	.

Equation Number 1 Dependent Variable.. FUNC

Block Number 1. Method: Enter ED

Variable(s) Entered on Step Number

1.. ED Education

Multiple R .38015

R Square .14451

Adjusted R Square .13445

Standard Error 3.45306

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	171.20561	171.20561
Residual	85	1013.50836	11.92363

F = 14.35852 Signif F = .0003

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ED	2.805809	.740463	.380148	3.789	.0003
(Constant)	91.429773	.520568		175.634	.0000

End Block Number 1 All requested variables entered.

>No outliers found. No casewise plot produced.

Equation Number 1 Dependent Variable.. FUNC

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	91.4298	94.2356	92.8166	1.4109	87
*RESID	-7.3998	7.5302	.0000	3.4329	87
*ZPRED	-.9829	1.0057	.0000	1.0000	87
*ZRESID	-2.1430	2.1807	.0000	.9942	87

Total Cases = 87

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
OVERALL	92.360	3.564	
ED	.494	.503	Education

N of Cases = 87

Correlation, 1-tailed Sig:

	OVERALL	ED
OVERALL	1.000	.271
	.	.006

ED	.271	1.000
	.006	.

Equation Number 1 Dependent Variable.. OVERALL

Block Number 1. Method: Enter ED

Variable(s) Entered on Step Number

1.. ED Education

Multiple R .27076

R Square .07331

Adjusted R Square .06241

Standard Error 3.45121

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	80.09315	80.09315
Residual	85	1012.42394	11.91087

F = 6.72437 Signif F = .0112

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ED	1.919096	.740067	.270759	2.593	.0112
(Constant)	91.411136	.520290		175.693	.0000

End Block Number 1 All requested variables entered.

>No outliers found. No casewise plot produced.

Equation Number 1 Dependent Variable.. OVERALL

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	91.4111	93.3302	92.3597	.9650	87
*RESID	-9.6411	6.2689	.0000	3.4311	87

*ZPRED	-.9829	1.0057	.0000	1.0000	87
*ZRESID	-2.7936	1.8164	.0000	.9942	87

Total Cases = 87

Listwise Deletion of Missing Data

	Mean	Std Dev	Label
PROD	89.831	4.956	
AGE	40.069	16.245	age

N of Cases = 87

Correlation, 1-tailed Sig:

	PROD	AGE
PROD	1.000	.286
	.	.004
AGE	.286	1.000
	.004	.

Equation Number 1 Dependent Variable.. PROD

Block Number 1. Method: Enter AGE

Variable(s) Entered on Step Number

1.. AGE age

Multiple R .28645

R Square .08206

Adjusted R Square .07126

Standard Error 4.77610

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	173.32538	173.32538

Residual	85	1938.94993	22.81118

F = 7.59827 Signif F = .0071

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
AGE	.087390	.031703	.286455	2.756	.0071
(Constant)	86.329878	1.369634		63.031	.0000

End Block Number 1 All requested variables entered.

>No outliers found. No casewise plot produced.

Equation Number 1 Dependent Variable.. PROD

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	87.9029	92.1850	89.8315	1.4197	87
*RESID	-11.6872	8.6271	.0000	4.7483	87
*ZPRED	-1.3585	1.6578	.0000	1.0000	87
*ZRESID	-2.4470	1.8063	.0000	.9942	87

Total Cases = 87

APPENDIX 12. Effect of cue order on overall, form, function, production, and reception scores on PEPS

Mann-Whitney U - Wilcoxon Rank Sum W Test

OVERALL

Mean Rank

46.01	45 normal
44.99	45 reverse

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
989.5	2070.5	-.1857	.8527

FORM

Mean Rank

44.89	45 normal
46.11	45 reverse

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
985.0	2020.0	-.2221	.8243

FUNCTION

Mean Rank

47.22	45 normal
43.78	45 reverse

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
935.0	2125.0	-.6258	.5314

PRODUCTION

Mean Rank

44.81	45 normal
46.19	45 reverse

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
981.5	2016.5	-.2503	.8024

RECEPTION

Mean Rank

47.90	45 normal
43.10	45 reverse

Cases: 90 Total

Corrected for ties

U	W	Z	2-Tailed P
904.5	2155.5	-.8724	.3830

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

ticip	ACCENT						Reception				
No.	Function			Form			scores	Effect			
	Sta	En	Dif	Sta	En	Diff.		Learn	Fatigu	Total	
62	2	4	2	4	5	1	85.4	2	1	3	
63	4	5	1	4	5	1	91.7	0	0	0	
64	5	5	0	5	5	0	94.8	0	0	0	
65	5	5	0	5	5	0	96.9	0	0	0	
66	5	5	0	5	5	0	97.9	1	0	1	
67	3	4	1	5	5	0	94.8	0	0	0	
68	5	3	-2	5	5	0	93.1	1	2	3	
69	5	5	0	5	5	0	97.2	0	0	0	
70	4	3	-1	4	5	1	89.6	1	0	1	
71	5	5	0	5	5	0	97.6	0	0	0	
72	5	5	0	5	5	0	97.9	0	0	0	
73	5	4	-1	5	5	0	93.8	1	0	1	
74	5	5	0	5	5	0	98.3	0	0	0	
75	5	5	0	5	5	0	97.2	0	0	0	
76	4	5	1	5	5	0	92.7	1	1	2	
77	4	5	1	5	5	0	92.7	1	0	1	
78	4	5	1	5	5	0	95.1	1	0	1	
79	5	5	0	5	5	0	96.2	1	0	1	
80	4	4	0	4	5	1	89.2	3	1	4	
81	5	5	0	5	5	0	98.3	0	0	0	
82	4	4	0	5	5	0	96.2	0	0	0	
83	5	5	0	5	5	0	97.2	0	0	0	
84	5	4	-1	4	5	1	91.3	1	1	2	
85	3	1	-2	5	5	0	91	0	2	2	
86	5	2	-3	5	5	0	92	0	1	1	
87	4	4	0	5	5	0	94.8	0	0	0	
88	4	2	-2	5	5	0	81.6	3	3	6	
89	5	3	-2	5	5	0	94.8	0	1	1	
90	4	4	0	5	5	0	93.8	0	0	0	
	410	397		443	447						
	-13			4			[1]	[2]			
>0 di			16			7					
<0 di			19			3	44	37	No. of subtests showing [1]learn [2]fatigue effects		
>1dif			1			0		0.15	Correlation coefficient between learning and fatigue effects		
<-1di			8			0	0	2	Nos. of subjs [1]learning [2]tiring in >3 subtests		
>-2 d			0			0	2	3	Nos. of subjs [1]learning [2]tiring in >2 subtests		
<-2 d			3			0	7	7	Nos. of subjs [1]learning [2]tiring in >1 subtest		
>+3			0			0	3	5	Max. no. of subtests in which a subject [1]learned [2] tired		
<-3 d			0			0	0	0	Min. no. of subtests in which a subject [1]learned [2]tired		
Maxi			2			1	0.49	0.41	Mean no. of subtests in which a subject [1]learned [2]tired		
Mini			-3			-1		-0.8	Correlation coefficient between recep scores and practice effects		
							44	:No. of subtests in which subjects scored +2 or more at end			
							37	:No. of subtests in which subjects scored -2 or less at end			

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

The pages of the spreadsheet forming this appendix are shown in reverse order.

ticip	GLIDE						SILENCE						RHYTHM						LEVEL					
No.	Function			Form			Function			Form			Function			Form			Function			Form		
	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff
60	4	5	1	4	5	1	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0
61	5	4	-1	4	5	1	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
62	4	4	0	4	4	0	5	5	0	5	3	-2	3	5	2	4	5	1	5	5	0	3	4	1
63	4	5	1	5	5	0	5	5	0	5	5	0	4	3	-1	5	5	0	4	3	-1	5	4	-1
64	4	4	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	4	-1
65	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
66	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0
67	5	4	-1	4	5	1	5	5	0	5	5	0	3	4	1	5	5	0	4	5	1	4	5	1
68	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	4	5	1
69	5	4	-1	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0	5	4	-1	5	5	0
70	5	4	-1	4	5	1	4	5	1	5	5	0	4	5	1	5	5	0	4	5	1	5	4	-1
71	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
72	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	5	5	0
73	4	5	1	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0	4	3	-1	5	5	0
74	5	5	0	4	5	1	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0
75	5	5	0	4	5	1	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
76	5	5	0	4	4	0	5	5	0	5	4	-1	3	5	2	5	5	0	5	3	-2	3	4	1
77	5	5	0	5	5	0	5	5	0	5	5	0	1	4	3	5	5	0	4	5	1	5	5	0
78	4	4	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	2	4	2	5	5	0
79	4	5	1	5	5	0	5	5	0	5	5	0	2	5	3	5	5	0	5	5	0	5	4	-1
80	4	3	-1	3	5	2	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0
81	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
82	5	5	0	5	4	-1	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	5	5	0
83	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0
84	4	1	-3	4	5	1	5	5	0	5	5	0	2	5	3	4	5	1	4	5	1	4	4	0
85	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	4	5	1
86	4	4	0	4	5	1	4	5	1	4	5	1	4	5	1	5	5	0	4	3	-1	5	5	0
87	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	4	5	1
88	5	5	0	4	1	-3	5	5	0	4	1	-3	4	4	0	4	5	1	4	4	0	2	5	3
89	3	3	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
90	4	5	1	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	4	-1
	401	405		412	432		435	439		444	429		387	429	208	443	449	208	413	423		414	420	
	4			20			4			-15			42			6			10			6		
>0 di			21			28			11			3			28			6			20			22
<0 di			15			7			8			13			7			0			13			17
>1dif			3			3			1			0			14			0			6			2
<-1di			7			2			1			4			0			0			3			2
>-2 d			2			0			1			0			6			0			0			1
<-2 d			1			2			0			1			0			0			0			0
>+3			1			0			0			0			1			0			0			0
<-3 d			0			0			0			0			0			0			0			0
Maxi			4			2			3			1			4			1			2			3
Mini			-3			-3			-2			-3			-1			0			-2			-2

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

ticipant	LOUDNESS						ENGTH						PITCH						RANGE					
No.	Function			Form			Function			Form			Function			Form			Function			Form		
	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff
60	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	5	2	-3	4	5	1
61	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
62	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	4	4	0	5	4	-1	4	4	0
63	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	4	4	0	5	5	0
64	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	4	5	1
65	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	3	-1	5	5	0
66	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0	5	5	0	5	5	0	5	5	0
67	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	4	-1
68	5	5	0	5	4	-1	5	5	0	5	5	0	5	3	-2	5	4	-1	4	4	0	4	4	0
69	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
70	5	5	0	3	4	1	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	4	5	1
71	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0
72	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0
73	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	4	1	5	4	-1
74	5	5	0	5	4	-1	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0
75	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0
76	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	4	5	1
77	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
78	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
79	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0
80	5	3	-2	4	4	0	5	5	0	4	4	0	5	5	0	5	5	0	4	3	-1	3	5	2
81	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
82	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	4	5	1	5	5	0
83	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
84	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
85	5	5	0	5	4	-1	5	4	-1	5	5	0	5	5	0	5	5	0	4	2	-2	5	5	0
86	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
87	5	5	0	5	5	0	4	5	1	5	5	0	5	4	-1	5	5	0	3	3	0	5	5	0
88	5	5	0	5	4	-1	5	5	0	2	4	2	5	4	-1	3	5	2	5	5	0	3	4	1
89	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	4	5	1	4	5	1
90	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	4	5	1
	448	442		444	424		437	440		427	429		449	442		441	433		395	406		416	435	
	-6			-20			3			2			-7			-8			11			19		
>0 differences			2			4			12			15			1			6			25			25
<0 differences			7			24			9			13			6			13			19			8
>1differences			0			0			0			2			0			1			8			3
<-1difference			1			0			0			2			2			2			2			1
>-2 difference			0			0			0			0			0			0			0			0
<-2 difference			0			0			0			0			0			0			1			0
>+3 differenc			0			0			0			0			0			0			0			0
<-3 difference			0			0			0			0			0			0			0			0
Maximum dif			1			1			1			2			1			2			2			2
Minimum diff			-2			-1			-1			-2			-2			-2			-3			-2

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

ticip	ACCENT						Reception			
No.	Function			Form			scores	Effect		
	Sta	En	Dif	Sta	En	Diff.		Learn	Fatigu	Total
1	5	5	0	5	5	0	98.6	0	0	0
2	5	5	0	5	5	0	99.3	0	0	0
3	5	5	0	5	5	0	98.3	0	0	0
4	5	5	0	5	5	0	97.9	0	0	0
5	1	2	1	5	4	-1	75.3	0	5	5
6	4	5	1	5	5	0	92.4	0	0	0
7	5	5	0	5	5	0	96.2	0	0	0
8	5	4	-1	5	5	0	96.5	1	0	1
9	4	4	0	5	5	0	96.9	0	0	0
10	4	5	1	5	5	0	91.7	1	0	1
11	5	3	-2	5	4	-1	92	0	5	5
12	5	5	0	5	5	0	98.6	0	0	0
13	5	5	0	5	5	0	97.6	0	0	0
14	5	5	0	5	5	0	96.9	0	0	0
15	4	5	1	5	5	0	95.5	0	0	0
16	5	5	0	5	5	0	96.9	0	0	0
17	5	5	0	5	5	0	95.1	0	0	0
18	5	5	0	5	5	0	95.1	1	2	3
19	5	5	0	5	5	0	87.8	2	0	2
20	5	4	-1	5	5	0	95.1	1	0	1
21	4	4	0	5	5	0	93.1	0	0	0
22	5	5	0	5	4	-1	89.2	1	1	2
23	5	4	-1	5	5	0	96.5	0	0	0
24	5	5	0	5	5	0	95.5	1	0	1
25	5	5	0	5	5	0	97.6	0	0	0
26	5	5	0	5	5	0	96.9	0	0	0
27	5	5	0	5	5	0	97.6	0	0	0
28	5	5	0	5	5	0	95.5	1	0	1
29	5	5	0	5	5	0	97.6	0	0	0
30	4	4	0	5	5	0	94.4	1	0	1
31	4	3	-1	5	5	0	93.4	1	0	1
32	5	4	-1	5	5	0	96.2	1	0	1
33	5	5	0	5	5	0	97.2	0	0	0
34	5	5	0	5	5	0	98.3	0	0	0
35	4	5	1	5	5	0	91.3	2	0	2
36	5	5	0	5	5	0	93.8	1	0	1
37	5	5	0	5	5	0	96.2	0	0	0
38	5	5	0	5	5	0	98.3	0	0	0
39	4	5	1	5	5	0	97.2	0	0	0
40	4	5	1	5	5	0	93.4	1	0	1
41	5	5	0	5	5	0	96.2	0	0	0
42	3	4	1	5	5	0	93.4	0	0	0
43	5	4	-1	5	5	0	91.7	1	1	2
44	5	4	-1	5	5	0	93.1	1	0	1
45	5	5	0	5	5	0	96.2	0	1	1
46	5	5	0	5	5	0	94.4	1	0	1
47	4	1	-3	5	5	0	91	1	1	2
48	4	4	0	4	5	1	88.9	0	1	1
49	4	4	0	5	5	0	91.3	2	1	3
50	5	5	0	5	5	0	96.5	0	1	1
51	5	5	0	5	5	0	94.1	0	1	1
52	5	2	-3	5	5	0	90.3	2	1	3
53	5	5	0	5	5	0	95.5	1	0	1
54	4	3	-1	4	5	1	85.8	0	2	2
55	3	4	1	5	5	0	85.4	1	0	1
56	5	5	0	5	5	0	98.3	0	0	0
57	5	5	0	5	5	0	96.5	0	0	0
58	5	5	0	5	5	0	95.8	0	0	0
59	4	5	1	5	5	0	96.5	1	0	1
60	5	5	0	5	5	0	93.4	0	1	1
61	5	5	0	5	5	0	97.2	0	0	0

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

ticip	GLIDE						SILENCE						RHYTHM						LEVEL					
No.	Function			Form			Function			Form			Function			Form			Function			Form		
	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff
1	5	5	0	5	5	0	5	4	-1	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
2	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
3	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
4	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1
5	3	1	-2	5	2	-3	5	3	-2	5	4	-1	3	4	1	5	5	0	2	3	1	4	4	0
6	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	4	5	1	4	5	1	5	5	0
7	5	5	0	4	5	1	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
8	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0
9	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
10	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	4	5	1
11	5	5	0	4	5	1	4	4	0	5	3	-2	4	5	1	5	5	0	5	5	0	5	3	-2
12	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
13	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
14	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
15	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
16	5	5	0	5	5	0	5	4	-1	5	5	0	4	5	1	5	5	0	5	5	0	4	5	1
17	4	5	1	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
18	5	5	0	5	5	0	5	5	0	5	3	-2	3	5	2	5	5	0	5	5	0	4	5	1
19	4	4	0	3	5	2	5	5	0	5	4	-1	3	3	0	5	5	0	3	3	0	4	3	-1
20	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0
21	4	5	1	4	5	1	5	5	0	5	5	0	3	3	0	4	5	1	4	5	1	5	4	-1
22	4	5	1	3	5	2	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	3	3	0
23	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0	4	5	1
24	3	3	0	5	5	0	5	5	0	5	5	0	1	5	4	5	5	0	5	5	0	5	5	0
25	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
26	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
27	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0	5	4	-1
28	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2
29	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
30	5	5	0	5	5	0	4	3	-1	5	5	0	3	5	2	5	5	0	5	5	0	5	5	0
31	4	5	1	5	5	0	5	5	0	5	4	-1	3	5	2	5	5	0	5	5	0	5	4	-1
32	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0	5	4	-1	5	5	0
33	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
34	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
35	5	4	-1	3	3	0	5	4	-1	5	5	0	2	5	3	5	5	0	5	5	0	4	4	0
36	4	5	1	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	4	5	1	5	4	-1
37	5	5	0	4	5	1	4	5	1	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0
38	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0
39	4	5	1	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1
40	5	5	0	5	5	0	2	5	3	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
41	4	5	1	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	5	5	0	4	5	1
42	3	3	0	5	4	-1	5	5	0	5	5	0	4	5	1	5	5	0	4	5	1	5	5	0
43	4	2	-2	4	5	1	4	5	1	5	5	0	5	5	0	5	5	0	3	5	2	3	4	1
44	2	5	3	4	4	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	4	5	1
45	5	3	-2	4	5	1	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
46	5	5	0	4	5	1	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	4	4	0
47	3	5	2	5	5	0	5	4	-1	5	4	-1	5	4	-1	5	5	0	5	5	0	4	5	1
48	4	2	-2	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	4	5	1
49	5	3	-2	4	5	1	5	4	-1	4	4	0	2	5	3	5	5	0	5	5	0	5	4	-1
50	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	3	-2	5	5	0
51	4	5	1	4	5	1	5	5	0	5	5	0	3	4	1	5	5	0	5	3	-2	4	5	1
52	1	5	4	4	5	1	5	5	0	5	5	0	4	5	1	5	5	0	5	4	-1	5	4	-1
53	4	5	1	4	3	-1	5	5	0	5	5	0	3	5	2	5	5	0	5	5	0	5	5	0
54	2	0	-2	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	4	3	-1	5	3	-2
55	2	3	1	5	4	-1	5	5	0	5	5	0	4	4	0	5	5	0	5	4	-1	5	4	-1
56	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
57	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
58	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
59	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0

APPENDIX 13: PRACTICE EFFECTS: scores in start- and end-zones of subtests

ticipant	LOUDNESS						ENGTH						PITCH						RANGE					
No.	Function			Form			Function			Form			Function			Form			Function			Form		
	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff	tar	En	iff
1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
2	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
3	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1
4	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
5	5	5	0	5	5	0	3	4	1	5	4	-1	5	3	-2	5	3	-2	5	4	-1	3	4	1
6	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	4	-1	5	5	0	5	4	-1
7	5	5	0	5	5	0	4	5	1	5	4	-1	5	5	0	5	5	0	5	4	-1	5	5	0
8	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	5	5	0
9	5	5	0	5	4	-1	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
10	5	4	-1	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	2	4	2	4	4	0
11	5	5	0	5	5	0	5	5	0	5	3	-2	5	5	0	5	5	0	5	5	0	5	3	-2
12	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
13	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
14	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	4	-1	5	5	0
15	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0
16	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
17	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0	4	5	1	5	5	0	4	5	1
18	5	5	0	5	5	0	5	4	-1	5	3	-2	5	5	0	5	5	0	5	5	0	5	4	-1
19	5	5	0	5	4	-1	4	5	1	4	5	1	5	5	0	5	4	-1	3	5	2	4	5	1
20	5	5	0	5	4	-1	5	5	0	4	5	1	4	5	1	5	4	-1	4	5	1	5	5	0
21	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	4	5	1	4	5	1	4	5	1
22	5	5	0	5	5	0	5	4	-1	5	4	-1	5	5	0	5	3	-2	4	4	0	3	4	1
23	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
24	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
25	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
26	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
27	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
28	5	5	0	5	4	-1	4	5	1	5	4	-1	5	5	0	5	5	0	4	5	1	5	5	0
29	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1	5	5	0
30	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
31	5	5	0	5	4	-1	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
32	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
33	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
34	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
35	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	3	-1	3	5	2
36	5	5	0	5	4	-1	4	5	1	5	5	0	5	5	0	5	4	-1	4	5	1	3	5	2
37	4	5	1	5	5	0	5	5	0	4	5	1	5	5	0	5	5	0	5	4	-1	5	5	0
38	5	5	0	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
39	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0
40	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	4	0	4	5	1
41	5	5	0	5	5	0	5	5	0	4	4	0	5	5	0	5	5	0	4	5	1	5	5	0
42	5	5	0	5	4	-1	5	5	0	4	4	0	5	4	-1	5	5	0	5	4	-1	5	5	0
43	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	4	1	5	5	0
44	5	5	0	5	5	0	5	4	-1	4	5	1	5	5	0	5	5	0	3	4	1	5	5	0
45	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
46	5	4	-1	5	4	-1	5	5	0	5	4	-1	5	5	0	5	5	0	2	4	2	5	5	0
47	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	4	5	1
48	4	5	1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	3	0	5	4	-1
49	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	3	5	2	4	5	1
50	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0
51	5	5	0	5	4	-1	5	4	-1	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0
52	5	5	0	5	4	-1	5	5	0	5	5	0	5	4	-1	5	5	0	3	5	2	5	4	-1
53	5	5	0	5	4	-1	5	5	0	4	5	1	5	5	0	5	5	0	4	5	1	5	5	0
54	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	3	4	1	5	5	0	4	5	1
55	5	5	0	5	5	0	4	5	1	5	4	-1	5	5	0	4	5	1	2	4	2	4	5	1
56	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0
57	5	5	0	4	5	1	5	5	0	4	5	1	5	5	0	5	5	0	4	4	0	4	5	1
58	5	5	0	5	4	-1	5	5	0	4	5	1	5	5	0	5	4	-1	4	4	0	5	5	0
59	5	4	-1	5	5	0	5	5	0	5	5	0	5	5	0	5	5	0	5	4	-1	5	5	0

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	86	86	86	Agreem't	Maximum	%	No. of	No. of
Judge:	score	S	B	A	score	agreem't	Agreem't	items	subjects
Rhythm 1	2	2	2	1					
Form 2	2	2	2	1					
3	2	1	2	1					
4	3	2	2	2					
5	3	2	2	2					
6	3	2	2	2					
7	2	2	1	2					
8	3	2	2	2					
	20	out of		24	166	189	87.83	70	9
Level 1	3	2	2	2					
Form 2	3	2	2	2					
3	3	2	2	2					
4	3	2	2	2					
5	3	2	2	2					
6	2	2	1	2					
7	3	2	2	2					
8	3	2	2	2					
	23	out of		24	172	192	89.58	72	9
Accent 1	2	2	2	1					
Form 2	1	2	2	0					
3	2	2	2	1					
4	2	2	2	1					
5	3	2	2	2					
6	3	2	2	2					
7	2	2	2	1					
8	1	2	2	0					
	16	out of		24	162	192	84.38	72	9

Mean % agreement of 3 judgments		1263
on 1263 items:	90.21	Total no.
Maximum agreement on any one subtest:	98.44	of items
Minimum agreement on any one subtest:	80.83	given 3
Mean % agreement of 3 judgments		judgments
on form production subtests:	86.90	
Mean % agreement of 3 judgments		
on function production subtests:	93.92	

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No		matc	86	86	86	Agreem't	Maximum	%	No. of	No. of
Judge:		score	S	B	A	score	agreem't	Agreem't	items	subjects
Part 2	1		1	1						
more	2	2	1	1	1					
& more'	3	2	1	1	1					
	4	2	1	1	1					
	5	2	1	1	1					
	6	2	1	1	1					
	7	2	1	1	1					
	8	2	1	1	1					
		14	out of		14	167	204	81.86	110	9
Pitch	1		2	2						
Form	2		0	0						
	3		2	2						
	4		0	0						
	5		2	2						
	6		0	0						
	7		2	2						
	8		0	0						
						97	120	80.83	47	6
Range	1	3	2	2	2					
Form	2	3	1	1	1					
	3	2	2	2	1					
	4	3	2	2	2					
	5	3	2	2	2					
	6	2	2	1	1					
	7	3	2	2	2					
	8	2	2	2	1					
		21	out of		24	162	192	84.38	72	9
Glide	1	3	2	2	2					
Form	2	3	2	2	2					
	3	3	2	2	2					
	4	3	2	2	2					
	5	3	2	2	2					
	6	2	2	1	1					
	7	3	2	2	2					
	8	2	2	1	2					
		22	out of		24	171	192	89.06	72	9
Silence	1	3	2	2	2					
Form	2	3	2	2	2					
	3	3	2	2	2					
	4	3	2	2	2					
	5	3	2	2	2					
	6	3	2	2	2					
	7	3	2	2	2					
	8	3	2	2	2					
		24	out of		24	183	192	95.31	72	9

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	86	86	86	Agreem't	Maximum	%	No. of	No. of
Judge:	score	S	B	A	score	agreem't	Agreem't	items	subjects
Rhythm 1	4	?	1	1					
Function 2	6	1	1	1					
3	4	m	?	m					
4	6	m	m	m					
5	6	1	1	1					
6	4	m	?	m					
7	6	1	1	1					
8	6	m	m	m					
	42	out of		48	340	384	88.54	72	9
Level 1	6	2	2	2					
Function 2	6	2	2	2					
3	6	3	3	3					
4	6	2	2	2					
5	6	3	3	3					
6	6	3	3	3					
7	6	3	3	3					
8	6	2	2	2					
	48	out of		48	370	378	97.88	71	9
Accent 1	2	y	y	y					
Function 2	2	y	y	y					
3	2	y	y	y					
4	2	y	y	y					
5	2	y	y	y					
6	2	y	y	y					
7	2	y	y	y					
8	2	y	y	y					
9	1	y	n	y					
10	2	y	y	y					
11	2	y	y	y					
12	1	n	n	y					
13	2	y	y	y					
14	2	n	n	n					
15	2	y	y	y					
16	2	y	y	y					
	30	out of		32	211	222	95.05	127	8
Loudn'ss 1		2	2						
Form 2		2	2						
3		2	2						
4		2	1						
5		2	2						
6		2	2						
7		2	2						
8		1	2						
	0				128	144	88.89	56	7
Length 1		1	1						
Form 2		1	1						
3		1	1						
4		1	1						
5		1	1						
6		1	1						
7		1	1						
8		0	1						

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	86	86	86	Agreem't	Maximum	%	No. of	No. of
Judge:	score	S	B	A	score	agreem't	Agreem't	items	subjects
Loudn'ss 1	6	f	f	f					
Function 2	4	f	p	p					
3	4	p	f	f					
4	6	f	f	f					
5	6	p	p	p					
6	6	p	p	p					
7	6	f	f	f					
8	6	p	p	p					
	44	out of		48	373	384	97.14	72	9
Length 1	4	b	r	r					
Function 2	6	b	b	b					
3	4	r	r	b					
4	4	b	r	b					
5	6	b	b	b					
6	6	r	r	r					
7	6	r	r	r					
8	4	r	b	r					
	40	out of		48	349	384	90.89	72	9
Range 1	6	u	u	u					
Function 2	6	s	s	s					
3	6	u	u	u					
4	6	u	u	u					
5	6	s	s	s					
6	6	s	s	s					
7	6	s	s	s					
8	6	u	u	u					
	48	out of		48	346	384	90.10	72	9
Glide 1	6	q	q	q					
Function 2	6	a	a	a					
3	6	a	a	a					
4	6	q	q	q					
5	4	a	a	q					
6	6	q	q	q					
7	4	q	q	a					
8	6	a	a	a					
	44	out of		48	308	330	93.33	62	8
Silence 1	6	u	u	u					
Function 2	6	c	c	c					
3	6	c	c	c					
4	6	u	u	u					
5	6	c	c	c					
6	6	u	u	u					
7	6	u	u	u					
8	6	c	c	c					
	48	out of		48	378	384	98.44	72	9

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	15	15	15	matc	18	18	18	matc	70	70	70	matc	85	85	85
Judge:	score	S	B	A	score	S	B	A	score	S	B	H	score	S	B	A
Rhythm 1	2	2	2	1	2	1	2	1	2	2	2	1	2	2	1	2
Form 2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
3	2	2	1	1	2	2	2	1	3	2	2	2	3	2	2	2
4	3	2	2	2	3	2	2	2	3	2	2	2	2	2	1	2
5	3	2	2	2	3	2	2	2	3	2	2	2	2	2	1	2
6	3	2	2	2	3	2	2	2	2	2	2	1	3	2	2	2
7	2	2	1	1	3	2	2	2	2	2	2	1	2	2	1	2
8	3	2	2	2	3	2	2	2	2	2	2	1	3	2	2	2
	21	out of		24	22	out of		24	20	out of		24	20	out of		24
Level 1	3	2	2	2	3	1	1	1	2	1	1	2	3	2	2	2
Form 2	3	2	2	2	2	2	1	1	3	2	2	2	3	2	2	2
3	3	2	2	2	2	1	2	2	2	0	1	1	3	2	2	2
4	3	1	1	1	3	2	2	2	2	1	2	2	3	2	2	2
5	3	2	2	2	3	2	2	2	2	1	1	2	3	2	2	2
6	3	2	2	2	2	2	2	1	3	2	2	2	3	2	2	2
7	3	2	2	2	3	2	2	2	2	0	0	1	2	2	2	1
8	3	1	1	1	3	2	2	2	1	0	0	2	3	2	2	2
	24	out of		24	21	out of		24	17	out of		24	23	out of		24
Accent 1	2	2	1	1	3	2	2	2	3	2	2	2	2	0	1	1
Form 2	2	2	2	1	3	2	2	2	2	1	2	1	2	2	2	1
3	3	0	0	0	3	2	2	2	3	2	2	2	3	0	0	0
4	3	0	0	0	3	2	2	2	2	2	2	1	2	1	0	0
5	3	0	0	0	3	2	2	2	3	1	1	1	2	2	1	2
6	2	2	2	1	3	2	2	2	3	2	2	2	2	0	0	1
7	3	0	0	0	3	2	2	2	3	2	2	2	2	2	2	1
8	3	0	0	0	3	2	2	2	3	2	2	2	2	1	2	1
	21	out of		24	24	out of		24	22	out of		24	17	out of		24

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	15	15	15	matc	18	18	18	matc	70	70	70	matc	85	85	85
Judge:	score	S	B	A	score	S	B	A	score	S	B	H	score	S	B	A
Part 2 1	1	1	0	1	1	1	0	1	2	1	1	1	1	1	0	0
more 2	2	1	1	1	2	1	1	1	2	1	1	1	1	1	0	1
& more' 3	2	1	1	1	2	1	1	1	2	1	1	1	1	1	0	0
4	2	1	1	1	1	1	?	1	1	1	0	0	2	0	0	0
5	1	1	0	1	2	1	1	1	1	1	1	0	2	1	1	1
6	2	1	1	1	1	1	0	1	1	1	1	0	2	1	1	1
7	2	1	1	1	2	0	0	0	2	1	1	1	1	1	0	1
8	0	1	?	0	1	1	0	1	2	1	1	1	1	1	1	0
	12	out of		16	22	out of		30	27	out of		32	11	out of		16
Pitch 1		2	2		3	2	2	2	3	2	2	2		2	1	
Form 2		2	2		3	2	2	2	2	2	1	2		2	1	
3		2	2		3	2	2	2	1	2	0	2		2	2	
4		2	2		0	1	0	2	0	2	0	1		2	2	
5		2	2		3	2	2	2	2	2	2	1		2	2	
6		0	0		3	2	2	2	2	2	2	1		2	2	
7		2	2		3	2	2	2	0	2	0	1		2	2	
8		0	0		3	2	2	2	3	0	0	0		2	1	
					21	out of		24	13	out of		24				
Range 1	3	2	2	2	2	1	2	2	1	0	0	2	3	2	2	1
Form 2	2	2	1	2	2	1	2	2	3	1	1	1	3	2	2	2
3	3	2	2	2	3	2	2	2	2	1	1	2	2	2	2	1
4	3	2	2	2	3	2	2	2	1	0	0	2	3	2	2	2
5	2	1	1	2	2	1	2	2	3	2	2	2	3	2	2	2
6	2	2	1	2	2	2	1	1	3	1	1	1	2	2	1	1
7	3	2	2	2	2	2	2	1	3	2	2	2	3	2	2	2
8	2	2	1	2	2	2	2	1	2	2	2	1	3	2	2	2
	20	out of		24	18	out of		24	18	out of		24	22	out of		24
Glide 1	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
Form 2	3	2	2	2	3	2	2	2	2	2	2	1	3	2	2	2
3	2	1	2	1	3	2	2	2	2	1	2	2	3	2	2	2
4	2	2	2	1	3	1	1	1	3	1	1	1	2	2	2	1
5	2	2	1	2	3	2	2	2	0	0	1	2	3	2	2	2
6	2	1	0	1	3	2	2	2	2	2	2	1	3	2	2	2
7	3	2	2	2	3	2	2	2	2	0	1	1	3	2	2	2
8	3	2	2	2	3	2	2	2	3	1	1	1	3	2	2	2
	20	out of		24	24	out of		24	17	out of		24	23	out of		24
Silence 1	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
Form 2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
3	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
4	3	2	2	2	2	1	2	2	2	2	2	1	3	2	2	2
5	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
6	3	2	2	2	2	2	1	2	2	0	0	1	3	2	2	2
7	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
8	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
	24	out of		24	22	out of		24	22	out of		24	24	out of		24

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	15	15	15	matc	18	18	18	matc	70	70	70	matc	85	85	85
Judge:	score	S	B	A	score	S	B	A	score	S	B	H	score	S	B	A
Rhythm 1	4	1	?	1	6	m	m	m	0	1	?	m	6	1	1	1
Function 2	6	1	1	1	6	1	1	1	4	1	?	1	6	1	1	1
3	5	1	1	?1	6	m	m	m	4	1	?	1	5	m	m	?m
4	4	1	1	?m	6	m	m	m	6	m	m	m	6	m	m	m
5	6	1	1	1	6	1	1	1	6	m	m	m	4	m	1	1
6	6	1	1	1	6	1	1	1	6	1	1	1	2	m	1	?1
7	6	1	1	1	6	m	m	m	4	m	?	m	4	m	m	1
8	3	1	?m	m	6	1	1	1	6	m	m	m	4	1	m	m
	40	out of		48	48	out of		48	36	out of		48	37	out of		48
Level 1	6	2	2	2	6	2	2	2	6	3	3	3	6	2	2	2
Function 2	6	2	2	2	6	3	3	3	6	2	2	2	6	2	2	2
3	6	2	2	2	6	3	3	3	6	3	3	3	6	3	3	3
4	4	3	?2	3	6	2	2	2	6	2	2	2	6	2	2	2
5	6	3	3	3	6	3	3	3	6	3	3	3	6	3	3	3
6	6	3	3	3	6	3	3	3	6	3	3	3	6	3	3	3
7	6	3	3	3	6	2	2	2	6	2	2	2	6	3	3	3
8	6	2	2	2	6	2	2	2	6	2	2	2	6	2	2	2
	46	out of		48	48	out of		48	48	out of		48	48	out of		48
Accent 1	2	y	y	y	2	y	y	y		n			2	y	y	y
Function 2	1	y	n	y	2	y	y	y		y			2	y	y	y
3	2	y	y	y	2	y	y	y		y			2	n	n	n
4	2	y	y	y	2	y	y	y		y			2	y	y	y
5	1	y	?y	y	1	n	y	y		y			2	y	y	y
6	2	y	y	y	2	y	y	y		y			2	y	y	y
7	2	y	y	y	2	y	y	y		y			2	y	y	y
8	2	y	y	y	2	n	n	n		n			2	y	y	y
9	2	y	y	y	2	y	y	y		y			2	y	y	y
10	2	y	y	y	2	y	y	y		y			2	y	y	y
11	2	y	y	y	2	y	y	y		y			2	y	y	y
12	1	y	?n	y	2	y	y	y		n			2	y	y	y
13	2	y	y	y	2	y	y	y		n			2	y	y	y
14	2	y	y	y	2	y	y	y		y			2	y	y	y
15	2	y	y	y	2	y	y	y		y			2	y	y	y
16	2	y	y	y	2	n	n	n		y				y	y	
	29	out of		32	31	out of		32					30	out of		30
Loudn'ss 1	3	2	2	2	3	2	2	2	3	2	2	2		2	2	
Form 2	3	2	2	2	2	1	2	2	3	2	2	2		2	2	
3	3	2	2	2	3	2	2	2	3	2	2	2		1	1	
4	3	2	2	2	2	1	2	2	2	1	2	2		1	1	
5	3	2	2	2	3	2	2	2	3	2	2	2		2	2	
6	2	1	2	2	2	1	2	2	2	2	2	1		1	2	
7	3	2	2	2	3	2	2	2	1	2	2	0		1	1	
8	3	2	2	2	2	1	2	2	2	1	2	1		1	1	
	23	out of		24	20	out of		24	19	out of		24	0			
Length 1		1	1		1	1	0	1	2	1	1	1		1	1	
Form 2		0	0		2	0	0	0	2	1	1	1		0	1	
3		1	1		2	1	1	1	2	1	1	1		1	1	
4		1	1		1	0	1	0	2	1	1	1		1	1	
5		1	1		1	1	0	1	2	1	1	1		1	1	
6		0	1		1	0	1	1	1	0	1	1		0	1	
7		1	1		2	1	1	1	2	1	1	1		1	1	
8		1	1						1	0	1	1		1	1	

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	15	15	15	matc	18	18	18	matc	70	70	70	matc	85	85	85
Judge:	score	S	B	A	score	S	B	A	score	S	B	H	score	S	B	A
Loudn'ss 1	6	f	f	f	6	f	f	f	6	p	p	p	6	f	f	f
Function 2	6	f	f	f	6	f	f	f	6	f	f	f	6	f	f	f
3	6	p	p	p	6	p	p	p	6	f	f	f	5	0	?p	?p
4	6	f	f	f	6	f	f	f	6	p	p	p	6	p	p	p
5	6	p	p	p	6	p	p	p	6	p	p	p	6	f	f	f
6	6	p	p	p	6	p	p	p	6	f	f	f	6	f	f	f
7	6	f	f	f	6	f	f	f	4	0	p	p	4	0	p	p
8	6	p	p	p	6	p	p	p	4	f	0	f	6	p	p	p
	48	out of		48	48	out of		48	44	out of		48	45	out of		48
Length 1	6	b	b	b	6	r	r	r	6	b	b	b	6	b	b	b
Function 2	6	b	b	b	6	r	r	r	6	r	r	r	4	r	b	b
3	6	r	r	r	6	b	b	b	6	r	r	r	4	r	b	b
4	6	r	r	r	6	b	b	b	6	b	b	b	4	r	b	b
5	6	b	b	b	6	b	b	b	4	b	?	b	5	b	b	?b
6	4	b	?	b	6	r	r	r	6	b	b	b	6	b	b	b
7	6	r	r	r	6	b	b	b	6	r	r	r	6	b	b	b
8	6	r	r	r	6	r	r	r	6	b	b	b	6	b	b	b
	46	out of		48	48	out of		48	46	out of		48	41	out of		48
Range 1	6	u	u	u	6	s	s	s	5	u	u	?u	6	u	u	u
Function 2	6	s	s	s	6	u	u	u	3	?s	?	?u	6	u	u	u
3	6	s	s	s	6	s	s	s	2	?s	u	?u	6	u	u	u
4	6	u	u	u	6	u	u	u	5	s	s	?s	5	s	?s	s
5	6	u	u	u	6	u	u	u	5	u	u	?u	4	s	s	?
6	6	s	s	s	6	s	s	s	5	s	s	?s	4	u	u	s
7	6	u	u	u	4	s	u	s	5	s	s	?s	1	u	?u	s
8	6	s	s	s	6	u	u	u	5	u	u	?u	5	s	s	?s
	48	out of		48	46	out of		48	35	out of		48	37	out of		48
Glide 1		q			6	q	q	q	6	q	q	q	6	q	q	q
Function 2		a			5	q	?q	q	6	q	q	q	6	a	a	a
3		q			6	a	a	a	6	q	q	q	6	a	a	a
4		a			6	a	a	a	6	a	a	a	6	a	a	a
5		q			6	a	a	a	6	a	a	a	0	?	a	q
6		q			6	q	q	q	6	a	a	a	6	q	q	q
7		a			6	a	a	a	6	a	a	a	6	q	q	q
8		a			6	q	q	q	6	q	q	q				
					47	out of		48	48	out of		48	36	out of		42
Silence 1	6	u	u	u	6	u	u	u	6	c	c	c	6	c	c	c
Function 2	6	c	c	c	6	c	c	c	6	u	u	u	6	u	u	u
3	6	c	c	c	6	c	c	c	6	c	c	c	6	u	u	u
4	6	c	c	c	6	u	u	u	6	c	c	c	6	c	c	c
5	6	u	u	u	6	c	c	c	6	u	u	u	6	c	c	c
6	6	u	u	u	6	c	c	c	6	u	u	u	6	u	u	u
7	6	u	u	u	6	u	u	c	6	c	c	c	6	c	c	c
8	6	c	c	c	6	u	u	u	6	u	u	u	6	u	u	u
	48	out of		48	48	out of		48	48	out of		48	48	out of		48

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	4	4	4	matc	11	11	11	matc	12	12	12	matc	13	13	13
Judge:	score	S	B	A	score	S	B	A	score	S	B	A	score	S	B	H
Rhythm 1	3	2	2	1	2	1	1	2	2	2	2	1	2	2	2	1
Form 2	3	2	2	2	2	1	2	1	3	2	2	2	2	2	2	1
3	3	2	2	2	2	1	2	2	3	2	2	2	2	2	1	1
4	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
5	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
6	3	2	2	2	2	1	2	2	3	2	2	2	3	2	2	2
7	3	2	2	2	2	2	1	2	3	2	2	2	2	2	2	1
8	3	2	2	2	3	2	2	2						2		
	24	out of		24	19	out of		24	20	out of		21	17	out of		21
Level 1	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
Form 2	3	2	2	2	2	2	1	2	2	2	1	2	3	2	2	2
3	2	1	1	2	2	2	1	2	3	2	2	2	3	2	2	2
4	3	2	2	2	3	1	1	1	3	2	2	2	3	2	2	2
5	3	2	2	2	3	2	2	2	3	1	1	1	2	1	2	2
6	2	1	2	1	3	2	2	2	2	2	1	1	3	1	1	1
7	3	2	2	2	3	1	1	1	3	2	2	2	3	2	2	2
8	3	2	2	2	1	2	0	2	3	2	2	2	2	2	1	2
	22	out of		24	20	out of		24	22	out of		24	22	out of		24
Accent 1	3	2	2	2	2	1	0	1	3	0	0	0	2	1	0	1
Form 2	3	2	2	2	2	1	0	0	3	0	0	0	3	1	1	1
3	3	2	2	2	3	2	2	2	2	2	2	1	2	1	0	1
4	3	2	2	2	2	0	1	0	2	2	2	1	2	1	0	1
5	3	2	2	2	3	2	2	2	2	2	2	1	2	2	1	1
6	3	2	2	2	3	0	0	0	2	2	2	1	0	2	0	1
7	3	2	2	2	2	2	2	1	2	1	2	2	2	1	2	1
8	3	2	2	2	3	0	0	0	2	2	2	1	2	1	0	1
	24	out of		24	20	out of		24	18	out of		24	15	out of		24

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	4	4	4	matc	11	11	11	matc	12	12	12	matc	13	13	13
Judge:	score	S	B	A	score	S	B	A	score	S	B	A	score	S	B	H
Part 2 1	2	1	1	1	1	1	0	1	2	1	1	1		1	1	
more 2	2	1	1	1	1	1	0	0	2	1	1	1		1	1	
& more' 3	2	1	1	1	1	1	0	1	2	1	1	1		1	1	
4	2	1	1	1	2	1	1	1	2	1	1	1		1	1	
5	2	1	1	1	1	1	0	1	2	1	1	1		1	1	
6	2	1	1	1	1	1	0	1	2	1	1	1		1	1	
7	2	1	1	1	1	1	1	0	1	1	0	1		1	1	
8	2	1	1	1	2	1	1	1	2	1	1	1		1	1	
	29	out of		32	23	out of		32	29	out of		32	13	out of		16
Pitch 1	3	2	2	2	3	2	2	2	2	1	2	2	3	2	2	2
Form 2	3	2	2	2	3	2	2	2	3	2	2	2	2	1	2	2
3	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
4	3	2	2	2	2	1	0	0	2	2	1	2	1	0	2	2
5	3	2	2	2	3	2	2	2	2	1	2	2	2	2	2	2
6	3	2	2	2	2	1	2	2	2	1	2	2	2	2	2	2
7	3	2	2	2	1	0	2	2	2	2	1	2	3	2		2
8	3	2	2	2	3	2	2	2	3	2	2	2		1		
	24	out of		24	20	out of		24	19	out of		24	16	out of		21
Range 1	1	0	2	2	2	2	1	1	3	2	2	2	3	2	2	2
Form 2	3	1	1	1	3	2	2	2	2	2	1	2	2	1	1	2
3	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
4	3	2	2	2	2	1	1	2	3	2	2	2	3	2	2	2
5	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
6	2	2	1	2	2	1	1	0	3	2	2	2	3	1	1	1
7	2	2	2	1	3	2	2	2	3	2	2	2	3	2	2	2
8	2	1	1	2	3	2	2	2	3	2	2	2	3	2	2	2
	19	out of		24	21	out of		24	23	out of		24	23	out of		24
Glide 1	2	2	2	1	2	2	1	2	2	2	2	1	3	2	2	2
Form 2	3	2	2	2	2	1	1	2	3	2	2	2	2	2	1	2
3	3	2	2	2	3	2	2	2	3	2	2	2	2	0	1	1
4	3	2	2	2	2	2	2	1	3	2	2	2	2	1	2	2
5	3	2	2	2	3	2	2	2	2	2	2	1	3	2	2	2
6	3	2	2	2	2	2	2	1	3	2	2	2	3	2	2	2
7	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
8	3	1	1	1	3	2	2	2	3	2	2	2	3	2	2	2
	23	out of		24	20	out of		24	22	out of		24	21	out of		24
Silence 1	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
Form 2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
3	3	2	2	2	3	2	2	2	2	1	2	2	3	2	2	2
4	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
5	3	2	2	2	3	0	0	0	3	2	2	2	3	2	2	2
6	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
7	2	1	1	2	3	2	2	2	2	1	2	2	3	2	2	2
8	3	2	2	2	1	2	0	2	3	2	2	2	3	2	2	2
	23	out of		24	22	out of		24	22	out of		24	24	out of		24

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	4	4	4	matc	11	11	11	matc	12	12	12	matc	13	13	13
Judge:	score	S	B	A	score	S	B	A	score	S	B	A	score	S	B	H
Rhythm 1	6	1	1	1	6	m	m	m	6	1	1	1	6	m	m	m
Function 2	6	1	1	1	6	1	1	1	6	m	m	m	6	m	m	m
3	6	m	m	m	6	m	m	m	6	1	1	1	6	1	1	1
4	6	1	1	1	6	1	1	1	6	m	m	m	6	1	1	1
5	4	m	?	?m	6	1	1	1	5	m	m	?m	6	m	m	m
6	6	1	1	1	6	1	1	1	2	m	1	?m	6	1	1	1
7	6	m	m	m	6	m	m	m	6	1	1	1	6	m	m	m
8	6	m	m	m	6	1	1	1	6	1	1	1	6	1	1	1
	46	out of		48	48	out of		48	43	out of		48	48	out of		48
Level 1	6	2	2	2	6	2	2	2	6	3	3	3	6	3	3	3
Function 2	6	3	3	3	6	2	2	2	5	?2	2	2	6	3	3	3
3	6	2	2	2	6	2	2	2	3	?3	?	2	6	2	2	2
4	6	3	3	3	6	3	3	3					6	2	2	2
5	6	3	3	3	6	2	2	2	5	?3	2	2	6	2	2	2
6	6	2	2	2	6	3	3	3	6	3	3	3	6	3	3	3
7	6	3	3	3	6	3	3	3	6	2	2	2	6	3	3	3
8	6	2	2	2	6	3	3	3	5	?3	2	2	6	2	2	2
	48	out of		48	48	out of		48	36	out of		42	48	out of		48
Accent 1	2	y	y	y	2	y	y	y	2	y	y	y	1	y	n	y
Function 2	2	y	y	y	2	y	y	y	2	n	n	n	1	y	?	y
3	2	y	y	y	2	y	y	y	2	y	y	y	1	y	n	y
4	2	y	y	y	2	y	y	y	2	y	y	y	2	y	y	y
5	2	y	y	y	2	y	y	y	2	y	y	y	2	y	y	y
6	2	y	y	y	2	y	y	y	2	y	y	y	1	y	n	y
7	2	y	y	y	2	y	y	y	2	y	y	y	1	y	n	y
8	1	y	?	y	2	y	y	y	1	y	n	y	1	y	n	y
9	1	y	?	y	2	y	y	y	2	y	y	y	2	y	y	y
10	2	y	y	y	2	y	y	y	2	n	n	n	1	y	?	y
11	2	y	y	y	2	y	y	y	2	y	y	y	1	y	?	y
12	2	y	y	y	1	n	n	y	2	y	y	y	2	y	y	y
13	2	y	y	y	2	y	y	y	2	y	y	y	2	y	y	y
14	2	y	y	y	2	y	y	y	2	y	y	y	2	y	y	y
15	2	y	y	y	2	y	y	y	1	y	?y	y	1	y	?	y
16	2	y	y	y	2	y	y	y	2	y	y	y	2	y	y	y
	30	out of		32	31	out of		32	30	out of		32	23	out of		32
Loudn'ss 1	3	2	2	2	3	2	2	2	3	2	2	2	2	1	2	2
Form 2	3	2	2	2	3	2	2	2	3	2	2	2	2	1	2	2
3	3	2	2	2	3	2	2	2	3	1	1	1	2	1	2	2
4	2	1	2	2	2	2	1	2	3	1	1	1	2	1	2	1
5	3	2	2	2	2	1	2	2	3	2	2	2	2	1	2	2
6	3	2	2	2	2	1	2	2	3	2	2	2	3	2	2	2
7	3	2	2	2	2	2	2	1	3	2	2	2	2	2	2	1
8	2	1	2	2	3	2	2	2	3	2	2	2	2	1	2	1
	22	out of		24	20	out of		24	24	out of		24	17	out of		24
Length 1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1
Form 2	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1
3	2	1	1	1	1	1	0	0	2	1	1	1	2	1	1	1
4	1	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0
5	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1
6	1	1	1	0	2	1	1	1	1	1	0	1	1	1	0	1
7	1	1	0	1	1	0	1	0	2	1	1	1	2	1	1	1
8	2	1	1	1	2	0	0	0	2	1	1	1	1	1	1	0

APPENDIX 14
Comparison of scores given by 3 judges on production items

Subject No	matc	4	4	4	matc	11	11	11	matc	12	12	12	matc	13	13	13
Judge:	score	S	B	A	score	S	B	A	score	S	B	A	score	S	B	H
Loudn'ss 1	6	f	f	f	6	f	f	f	6	f	f	f	6	f	f	f
Function 2	6	f	f	f	6	f	f	f	6	f	f	f	6	f	f	f
3	6	p	p	p	6	p	p	p	6	p	p	p	6	p	p	p
4	6	f	f	f	6	f	f	f	6	f	f	f	6	f	f	f
5	6	p	p	p	6	p	p	p	6	p	p	p	6	p	p	p
6	6	p	p	p	6	p	p	p	6	p	p	p	6	p	p	p
7	6	f	f	f	6	f	f	f	6	f	f	f	6	f	f	f
8	6	p	p	p	6	p	p	p	6	p	p	p	6	p	p	p
	48	out of		48	48	out of		48	48	out of		48	48	out of		48
Length 1	6	b	b	b	4	?r	?	r	6	r	r	r	6	r	r	r
Function 2	4	b	r	b	6	b	b	b	6	b	b	b	6	b	b	b
3	6	b	b	b	4	r	?	r	4	b	r	b	6	b	b	b
4	6	r	r	r	4	b	?	b	6	r	r	r	6	r	r	r
5	6	r	r	r	4	b	?	b	6	b	b	b	6	b	b	b
6	6	r	r	r	6	r	r	r	6	r	r	r	6	r	r	r
7	6	r	r	r	4	b	?	?b	6	r	r	r	6	r	r	r
8	6	b	b	b	4	r	?	r	6	b	b	b	6	b	b	b
	46	out of		48	36	out of		48	46	out of		48	48	out of		48
Range 1	4	u	u	s	6	u	u	u	5	?s	s	s	6	u	u	u
Function 2	6	s	s	s	6	s	s	s	6	s	s	s	6	u	u	u
3	6	u	u	u	6	s	s	s	6	s	s	s	6	u	u	u
4	4	s	u	s	5	?s	?	?s	6	u	u	u	6	s	s	s
5	6	u	u	u	6	u	u	u	6	u	u	u	6	s	s	s
6	6	s	s	s	6	u	u	u	4	?s	?u	u	6	s	s	s
7	6	u	u	u	6	s	s	s	4	?	s	s	6	u	u	u
8	6	u	u	u	6	u	u	u	4	?s	u	u	6	s	s	s
	44	out of		48	47	out of		48	41	out of		48	48	out of		48
Glide 1	6	a	a	a	6	q	q	q	6	q	q	q		q		
Function 2	4	q	a	a	5	q	q	?q	6	q	q	q	6	a	a	a
3	6	q	q	q	6	a	a	a	6	a	a	a	6	a	a	a
4	6	a	a	a	6	a	a	a	6	a	a	a	6	q	q	q
5	4	q	a	q	4	?a	?q	a	4	a	q	a	6	q	q	q
6	6	q	q	q	6	a	a	a	6	q	q	q	6	q	q	q
7	6	a	a	a	6	q	q	q	6	a	a	a	6	a	a	a
8	4	q	a	q	6	q	q	q	6	q	q	q	6	a	a	a
	42	out of		48	45	out of		48	46	out of		48	42	out of		42
Silence 1	6	c	c	c	6	u	u	u	6	c	c	c	6	c	c	c
Function 2	6	c	c	c	6	c	c	c	6	u	u	u	6	u	u	u
3	6	c	c	c	2	?c	u	c	6	u	u	u	6	c	c	c
4	6	u	u	u	6	u	u	u	6	c	c	c	6	u	u	u
5	6	c	c	c	6	c	c	c	6	u	u	u	3	c	c	?u
6	6	u	u	u	6	c	c	c	6	c	c	c	6	u	u	u
7	6	c	c	c	6	u	u	u	6	c	c	c	6	c	c	c
8	6	u	u	u	4	?	c	c	6	u	u	u	6	u	u	u
	48	out of		48	42	out of		48	48	out of		48	45	out of		48

APPENDIX 15
Use of elements in Function Production tasks

S's	Score	Loudness-task				Score	Length-task				Score	Pitch-task			
		Loudness:	Other elements:				Length:	Other elements:				Pitch:	Other elements:		
		(1)	1st	2nd	3rd		(2)	1st	2nd	3rd		(3)	1st	2nd	3rd
1	13	14	3			16	14	1	4	br	16		x	x	
2	13	13	3	2		12	13	4			16	15	4	2	5
3	16	16	3	4		16	13		4		16	15	4		
4	15	13	3	4		16	16				16	13	5	2	
5	10	11	3	4		5	8				15	15	4	2	
6	12	14	3	4		13	10						x	x	
7	15	15		3		14	12	1			16	16	syl		
8	14	14	3			13	13	3			16	9	5		
9	13	13	2	3		15	16				16	14	5	2	
10	12	14	2			16	16	1	3		15	13	2	4	
11	16	16	3			12	11	5			16	11	4		
12	14	14	3			15	14	3	1		16	16	2	1	
13	14	14	5			14	14		1		16	16	4	2	1
14	12	16	3			12	8	1			16	15	4		
15	16	16	3			14	14	5	2		15	16	5		4
16	12	13	3			12	12	1			16	16	4	2	
17	12	12				13	11	1			16	12	syl		
18	16	16				16	13		4	1	16	12			
19	13	13		3		12	9	1	4		15	9		5	4
20	10	12	3			11	8		2		16	9	2	5	
21	11	11	3	4	2	8	10	5			15	10	4		
22	16	16	4	3		15	14	1			16		x	x	
23	14	13	-1			11	14	1	4		16	16	4	2	
24	13	14						x	x		16	12	4		
25	15	14	3	2		14	10	5	1		16	15	5		
26	13	12		3	2	14	16		1		16	16	4	3	
27	14	14		2	-3	16	15		1	3	16	12	2		
28	16	15	3			14	12	1	3		16	16	4	2	syl
29	13	13	3			11	7		3	4	16	16	5		
30	8	9		3		4	8				16	8	2		
31	14	14				13	12	1		3	16	13	2	4	
32	14	15				16	14				16	16	2		
33	12	13	3	4		10	16	1			16	11	4	5	
34	13	14	3	4		15	12	5	2		16	16	4	5	
35	15	15	3			16	12	4	5	1	15	15	4		
36	16	16		4		16	12	1			16	14		4	
37	16	16		3		13	11		1	4	16	15	5	4	
38	16	16		3		13	8	1		3	16	8	4	2	
39	14	14		3		15	16		5		16	12		5	4
40	16	15	3			14	16				16	16	2		
41	16	16		3		14	11	3			16	15	4		
42	16	16		3		12	7	1	-4	3	16	12	4		
43	13	13	3			14	8	3	1		16	15	5		
44	13	12	4			15	8	1	4		16	16		5	
45	14	14	3	4		15	12	5		1	16	11	5		
46	16	16		4	3	16		1	5		16	16	syl		
47	15	15	3			16	8	1			16	16	4		
48	15	14		3		12	12	3	5		16	12	4		
49	12	12		3		16	8	1			16	12	4		
50	14	14		3		16	14	4	1		16	12	4		
51	12	15		3		15	8	1			16	12	4		
52	14	16	3			14	8	1	3		12	8			
53	15	16	3	4	2	16	16	1			16	16	5		
55	13	13	2	4		12	8	1	3		16	16	4	2	
61	15	15	3	4		16	11	1	3		16	13		2	
62	13	14			4	16	9	3	1		16	8	syl	4	
63	14	15	5	4		16	16	5	3	1	16	10	4	2	
64	15	14		3		16	8	1		4	16	12	4	2	
65	16	16	3			16	8	1	3		16	9	4		
66	16	16				16	16	1		4	16	11	4		
67	13	14				16	8	1			16	13		4	1
68	14	14				10	11				16	9	4	2	5
80	16	16	3			16	8	1			16	10	4		
81	16	16		4	2	16	16	3			16	12	4		
82	13	13				11	10	3			16	10	4		
83	13	13	3			15	8	1	3		16	13	4		
84	16	16	3			16	10	1	3		16	8	5		
85	14	14				14	8	3	4		16	8	4		

APPENDIX 15
Use of elements in Function Production tasks

S's	Score	Loudness-task				Score	Length-task				Score	Pitch-task			
		Loudness:	Other elements:				Length:	Other elements:				Pitch:	Other elements:		
		(1)	1st	2nd	3rd		(2)	1st	2nd	3rd		(3)	1st	2nd	3rd
86	16	16				16	10	3	1		16	10	5		
87	16	16				16	9	1	3	5	16	14	4		1
88	14	13	3			14	10		1		16	12	4		
89	16	16		3	2	12	12	4	5		16	14	4		
90	15	15	3			12	16	5	4	3	16	16	4	5	
Totals		1042					812					900			
Count		73					71					70			
Max		1168					1136					1120			
%use		89.21					71.48					80.36			
Mean		14.27					11.44					12.86			
Av as %		89.21					71.48					80.36			
		78.42					42.96					60.71			
Std dev		1.53					2.96					2.70			
		39.21					21.48					30.36			
Correl and	Loudness-task						Length-task					Pitch-task			
# of parti	0.8	73				0.25	71				0.18	70			
Use of	#	65					25					37			
task-ele	%	89.0					35.2					52.9			
	Loud		0	0	*0*			32	11	4			0	1	3
	Len*		3	3	5			0	3	*0*			8	14	0
	Pitch		33	17	1			10	11	5			0	1	*0*
	Range		2	15	2			4	8	4			38	6	3
	Glide		2	0	2			4	7	4			12	7	2
	Sile*		0	0	0			0	0	0			0	0	0
	Rhyt*		0	0	0			0	0	0			0	0	0
	eve*		0	0	0			0	0	0			0	0	0
	Accen		0	0	0			0	0	0			0	0	0
Rival elem	Pitch		45				Loud	45				Range	54		
	Loud														

APPENDIX 15
Use of elements in Function Production tasks

S's	Score	Range-task				Score	Glide-task								
		Range:	Other elements:				Glide:	Other elements:			?=/	a=\	?=v	a=L/	?=\
		(4)	1st	2nd	3rd		(5)	1st	2nd	3rd					
1	16	16	3	1		14	16	3			2	4	2		
2	13	16	5	3		16	16	3	4	2	4	4			
3	15	15	3	5	1	16	16	3	1		4	4			
4	15	14				15	8	3				3	1	1	
5	14	14		3		9	10	4							
6	15	16	3			16	16	3	2	1	4	4			
7	14	12	3	1		16	16	3	4			4	4		
8	14	14		3		15	14	3			1	4	2		1
9	16	16	3	2	1	16	16	3	1		3	4	1		
10	14	16	5			16	16	3	4		2	3	1	1	1
11	15	15				16	14	4			3	3	1	1	
12	13	12		3		15	14	3			3	3	1	1	
13	16	16	5	3	1	16	16	3	4		4	4			
14	16	16	-1			14	16				1	4	3		
15	16	16	1	3	2	16	16	1				4	4		
16	15	14	3	4		16	15	3	1		1	4	3		
17	12	8	3			16	16				2	3	2	1	
18	16	15		1		15	12	4	3		1	4	1		2
19	16	15	1	2		12	12				2	2	2	2	
20	16	16				16	16	3			4	4			
21	16	16				16	14	4			4	4			
22	16	15				16	16	4	3		4	4			
23	14	16	3	5		16	14	4			3	4			1
24	15	15	3			16	16	4	3		4	4			
25	16	16	3			16	16				4	4			
26	16	12	1	4		14	14				2	4	2		
27	16	16	3	1		12	8	4	3			3	1	1	3
28	16	16	1		3	15	12	4			4	2		2	
29	15	14	3	5		16	16		3	4	4	4			
30	14	14	1		3	16	8	4	5			4			4
31	13	13	1		3	15	14					4	3		1
32	16	14	3			15	16	3			4	4			
33	16	16	3			16	16	3			1	4	3		
34	16	14	3			16	16				1	4	3		
35	13	10		1	2	16	16	4	3		3	4	1		
36	14	12	3			16	15		3	4	2	4	2		
37	14	15				16	16		4		4	4			
38	16	12	5			16	16		4		4	4			
39	16	16				16	14		3		4	3		1	
40	14	14				16	16	3				4	4		
41	16	14		3		16	16	3	5	4		4	4		
42	12	11	3	1		16	16		3	4	4	4			
43	14	13	3			14	11	3		4			4	4	
44	15	13		1		14	13	4	3		3	1	3	3	
45	16	15		3		16	16	4				4	4		
46	16	8	5	4		16	16	4	3		3	4	1		
47	16	14	3	1		16	14		3		4	3		1	
48	15	15	3	1		16	12	3			4	4			
49	15	15	3			16	16	3			1	3	2	1	1
50	14	16	3			16	10	4			4	3		1	
51	16	16	3			16	16	3	4		2	4	2		
52	15	15	1	3		13	14				2	4			2
53	16	15	?4		3	16	14		3		4	2		2	
55	14	13	1			12	10				2	4	2		
61	16	16	3			15	14	4			1	4	2		1
62	14	14	3			14	13	4			4	3		1	
63	15	14	3			9	8		3		2	2		2	2
64	16	15	1	3	2	15	16	3			2	4	2		
65	15	14				16	16		3		4	4			
66	16	15	-1			16	15				3	4	1		
67	16	16	3	5		16	14	4		3	1	4	3		
68	12	10	3			16	13	4			4	1		3	
80	16	16	1	3		16	16		4		2	4	2		
81	16	15	3	br		16	16	4	3		1	4	3		
82	13	11	1	5	3	14	16	4			4	4			
83	13	13	3	1		16	12				4	2		2	
84	14	15	1	3	2	14	16				3	4	1		
85	14	10	3		2	15	14				1	4	2		1

APPENDIX 15
Use of elements in Function Production tasks

S's	Score	Range-task				Score	Glide-task								
		Range:	Other elements:				Glide:	Other elements:			?=/	a=\	?=v	a=L/	?=\
		(4)	1st	2nd	3rd		(5)	1st	2nd	3rd					
86	16	16	3	5		16	16					4	4		
87	14	16	1	5		14	10				2	2	2	2	
88	15	14				15	6	3	4		3			4	
89	12	14	1	3		16	12				4	2		2	
90	14	15	2	3		15	11	3	4		1	3	2	1	1
Totals		1040					1028				172	248	93	40	21
Count		73					73				73	73	73	73	73
Max		1168					1168				292	292	292	292	292
%use		89.04					88.01								
Mean		14.25					14.08								
Av as %		89.04					88.01			%	58.9	84.9	31.8	13.7	7.2
		78.08					76.03								
Std dev		1.93					2.54								
		39.04					38.01								
Correl and		Range-task					Glide-task								
# of parti	0.53	73				0.53	73								
Use of		61					56								
task-ele		83.6					76.7								
			14	10	3			1	1	3					
			1	2	5			0	1	1					
			32	14	5			24	16	1					
			0	*3*	*0*			21	10	5					
			5	7	0			*0*	*2*	*0*					
			0	0	0			0	0	0					
			0	0	0			0	0	0					
			0	0	0			0	0	0					
			0	0	0			0	0	0					
Rival elem		Pitch	44				Pitch	33							
							Range	29							

APPENDIX 15
Use of elements in Function Production tasks

S's	Score	Silence-task				Score	Rhythm-task				Score	Level-task			
		Silence:	Other elements:				Rhythm:	Other elements:				Level:	Other elements:		
		(6)	1st	2nd	3rd		(7)	1st	2nd	3rd		(8)	1st	2nd	3rd
1	16	15	2	3		13	12	2			16	14	6	2	
2	12	8	2	3		16	16	2	5	1	16	16	6	3	
3	14	12	2		3	16	16	2	5	6	16	15	6	2	
4	16	8	2	3		15	15	2	1	5	16	16	6	2	
5	16	14	2		7	10	8		2	1	16	16	2		
6	14					13	11	3			16	10	6	2	
7	15	13	2			13	10	2			13	10			
8	15	10		2	7	11	10	-4	3		12	12	6		2
9	16	15	2	7		16	15	2	1		12	9		6	2
10	14	12	2			15	16	2	1	-3	16	15	2	6	
11	13	12	2			14	16	2	6		15	16	2	6	
12	15	12	2			13	14	2	3		7	8		2	6
13	16	16	2		5	14	8	2	4		16	12	2	6	
14	15	12	2	7		16	14	2	5		14	12	6	2	
15	16	12	2			4	8	3	-4		16	16	2	6	
16	11	12	2	5		13	12				15	8	2		
17	16	8	2	5		14	8		5	1	14	14	2	6	
18	16	14		1		16	8	1	2		16	11	6	2	
19	16	12	2			9	8		1		15	16	2	6	
20	11	8	2	3		12	8				14	14		2	
21	15	14				10	8				15	16	2		
22	15	10	2	5		11	8		2	3	16	16	2	6	
23	13	10	3	2		16	16				15	14	2	3	
24	16	12	2	4		16	16	3	4		16	16			
25	16	16	2	7		14		?x			15		?x		
26	16	12	3	2	7	15	12	5			16	13	6	2	
27	16	8	2	7		14	9	2	3		16	12	2	3	
28	15	8	2	7		13	8		2		14	6		6	
29	11	9	2	7		16	16	2			16	12	6	2	
30	16	12	2	7		9	8				14	16		2	6
31	13	8	5	2	7	7	8				15	13		6	2
32	16	12	2			11	12		2		14	10		2	6
33	15	8	2	3		16	15	2	1		16		x	x	
34	16	12	2			16	16	5	2		16	10	6	2	
35	13	10		2	7	13	8	0	0		16	12	6		
36	14	10			2	15	8		1	6	14	14	2	6	
37	16	16	2	7		15	8	1	4		13	12		2	6
38	16	10	2		7	16	16	1		5	14	8	6		2
39	16	16		2		16	16	2			15		2	6	
40	14	14		2	4	12	13	2			16	10	6	2	
41	13	8	2		7	16	14	5			13	8	6		
42	14	10	er	2	7	15	16	2	9		12	8		6	
43	15	15	2		7	13	8	5	1	2	14	12	2	6	
44	13	8	2			14	8		2		12	10		6	2
45	16	12	2	5		16	14	1	5	6	16	15	6	2	
46	16	8	2			16	14	2	1		11	11			
47	10	12	2			12	8	2			16	11	6		2
48	11	8	er			13	8	4	9	3	14	14			
49	13	14	2			12	12	4	9	3	15	14	6	2	
50	16	12	2			16	12	3	4	2	16	15	6	syl	
51	15	13	2			14	10	2	4	9	14	14	6		
52	16	16	-4	2		15	10	4			15	15	6		
53	15	16	2			15	12	2	1		16	12	2	6	
55	16	14	2		3	12	10	1	2		16	12	1	2	7
61	14	10	2	3		16	16	2		-1	16	16	6		
62	14	6	2			15	15	2	1		13	10			
63	13	12	2			14	8	5	4	3	9	6			6
64	16	15	2			15	11		1	4	16	12	2		
65	16	12	2	7		16	12	2	4		16	16	2	6	
66	15	16	2	7		16	16	2	1		16	15	6	2	3
67	14	8	7	2	1	14	16	2			15	16	6	2	
68	16	10	2			12	8		4	6	9	8			
80	16	16	2	7		16	16	5	1		16	12	6		2
81	15	14	2			13	10	5			15	11		6	
82	15	8	2	7		14	14	2	4		16	8	2	6	
83	16	12	2	7		15	16	2	4	3	16	12	2	6	
84	16	10		2	7	9	10				16	10	2	6	
85	16	11	2		7	11	8		2		16	8	6		

APPENDIX 15

Use of elements in Function Production tasks

S's	Score	Silence-task				Score	Rhythm-task				Score	Level-task			
		Silence:	Other elements:				Rhythm:	Other elements:				Level:	Other elements:		
		(6)	1st	2nd	3rd		(7)	1st	2nd	3rd		(8)	1st	2nd	3rd
86	16	16	2	3		15	16	5	6		16	11	2	6	
87	16	12	2	7		16	16	4	2		16	16	6	2	
88	15	8	2	7		12	8	6	1		13	11		6	2
89	16	8	2	7		12	12	2	1		13	13	2	6	
90	16	16	2			16	8	5	2		16	13	6		
Totals		838					846					865	23	21	
Count		72					72					70			
Max		1152					1152					1120			
%use		72.74					73.44					77.23			
Mean		11.64					11.75					12.36			
Av as %		72.74					73.44					77.23			
		45.49					46.88					54.46			
Std dev		2.80					3.29					2.83			
		22.74					23.44					27.23			
Correl and		Silence-task					Rhythm-task					Level-task			
# of parti	0.37	72				0.61	72				0.49	70			
Use of		23					29					32			
task-ele		31.9					40.3					45.7			
			0	1	1			5	15	3			1	0	0
			57	11	1			29	11	2			23	21	8
			2	7	2			4	3	5			0	3	1
			0	1	1			4	10	1			0	0	0
			1	4	1			9	5	2			0	0	0
			0	*0*	*0*			1	2	4			28	24	5
			1	16	11			*0*	*0*	*0*			0	0	1
			0	0	0			0	0	0			*0*	*0*	*0*
			0	0	0			0	3	1			0	0	0
Rival elem		Length	79				Length	40				Lengt	32.4	%:	46
												ilenc	40		57

APPENDIX 15
Use of elements in Function Production tasks

S's	Scor	Accent-Task											Score 16/60		Element-use
		Accent:		Pitch		Dual ac	Defa	Other elements:			AutR	xRec	Rec'n		
		(Gfocal)	all	stepup	down	# per pai	# per	1st	2nd	3rd					
1	16	15	0				15				0		15	8	1234568
2	16	16	5	3	2			1	3	6	0	1	16	8	1234568
3	16	16	3	3				4	2	8	0		16		1234568
4	16	16	6	1	5	1		6	2	8	0		16		234568 1
5	10	11	0			2	4		3	6	10	19	5	3	2348 167
6											0	1	15		3456 21
7	14	14	0			3		2	6		0		16	8	1235 468
8	16	15	5	3	2	7		2	4		0	2	14		23-456 78
9	16	15	7	1	6	6		6	2		0	2	14	7	23456 178
10	16	14	3	2	1	2		6	1	2	0	5	14	8	1234568
11	15	15	9	7	2			4	6	1	0	2	14	7	123458 6
12	14	14	4	4		2	1	6	4		0	1	15	8	123 5684
13	16	15	1		1	13	1	2			0		16	8	123458 6
14	14	14	0				2	6	2		0	1	16	6	1234567 8
15	16	16	0					6	2		0	1	15	7	1234568
16	14	13	4	4		3	1	6	2	3	0		16		12345 68
17	15	13	0					4	1		0	4	15	8	1235 46
18	13	15	3	2	1				3		0	1	15	8	146 235
19	10	12	0			2	6				0		16	7	12346 5
20	16	14	4	2	2	1			1		0	4	12		2345
21	12	12	1	1		2					1	3	13	6	2345
22	7	3	0				3	3			0		16	7	12345 6
23	14	11	0			5		2	6		0	1	15		123457 6
24	16	15	0					6	2		0		16		1234567 8
25											0		16		123457
26	16	11	0			2		2	6		0		16	4	1234567 8
27	16	14	0			1		1	6		0		16	7	1234 867
28	16	12	2	1	1	5		6	2		0		16	4	1234 5678
29	16	16	1	1		1		2			0		16	8	2345678 1
30	15	14	1		1	2		2	6		0	3	13	8	1248 567 3
31	14	11	4	4		8	3	2	6	3	1	5	12	6	125 3468 7
32	14	14	0			1		2	6		1	1	15		12345 68
33	16	14	1	1		1		2	6	1	0		16	8	1234578 6
34	15	14	1	1		4		2	6	1	0		16	7	123456 8
35	13	12	3	3		6	2	2			0	4	12	4	13456 278
36	14	14	0			1	1	6	2		0		16	4	1356 824
37	16	16	1	1					6		0		16		1234568 7
38	15	13	3	2	1	3	1	2	1		0	1	15		124567 38
39	15	15	3	3				2	6		1	2	14	8	1245678 3
40	14	14	3	3		3		6	2		0	1	15		123456 78
41	15	15	1		1			1	6		0	2	16	5	12345678
42	11	10	0			1	3		1		3	4	14		123457 68
43	14	15	3	2	1			1	6		2	3	13	8	123458 67*
44	15	15	6	5	1	1		3	2		0	2	13	8	12348 56
45	14	13	0			11		2	6		0		16		12345678
46	16	16	2	1	1			2	6		0		16	8	1234578 6
47	15	15	4	4		1		1	6	2	0	8	8		1234568
48	13	13	3		3		6				3	7	9		1348 59
49	14	16	7	7		7		2	6		6	8	11	5	1234568 7
50	15	8	5	5		6	2	2	3	6	0		16	6	123456 8 7
51	10	10	0			4	5				0	1	15	8	1231456 89
52	16	16	1	1				6		2	1	6	10	7	134568 27
53	13	16	1		1	3	2		6	2	1	1	15	6	123456 8
55	12	7	4	1	3	4	6			1	3	7	9	7	12346 857
61	16	14	4	4			2		4	2	0		16	5	12345678
62	14	13	4	3	1		2	2			0	6	10		237 1458
63	16	16	0				1		6	1	0	3	13		123458 6
64	12	8	2	2		1	2				0		16	8	123456
65	16	16	4	4				6			0		16	8	1234586 7
66	16	15	6	1	5		1	-3	1		0		16	6	12-345678
67	13	13	4	4		1	2	2	3	1	1	4	12	7	12345678
68	16	14	2	2				1			0		10	5	12348 56
80	14	14	3	3					1	2	0	4	12		1234568 7
81	15	14	6		6				3		0		16	8	123458 6
82	16	16	4	2	2				1	3	0	3	13	4	1234578 6
83	15	16	3	3				6			0		16	8	1234678 5
84	16	15	5	5		1		2	1	6	0	2	14		123458 67
85	15	15	8	8		2		2			0	11	5	8	123456 87

APPENDIX 15
Use of elements in Function Production tasks

S's	Scor	Accent-Task											Score 16/60		Element-use
		Accent:		Pitch		Dual ac	Defa	Other elements:			AutR	xRec	Rec'n		
		(Gfocal)	all	stepup	down	# per pa	# per	1st	2nd	3rd					
86	14	16	12	12		4		3			3	6	10		12345678
87	16	15	6	5	1	3			3	2	0	4	12		1234678 5
88	13	16	8	8		1		3			2	10	6		23468 17
89	15	16	1		1				6		1	3	13		12348 567
90	16	14	7	4	3	2	3	2	6	3	0	5	11	5	1234568
Totals	63	979	204	149	55	140	77	23	11		40	175	67	362	
Count	71	71	71	71	71	71	71				77	77	71	54	
Max	###	1136	568	568	568	1136	1136				1232	1232	###	432	
%use	89	86.18									3.25	####			
Mean		13.79	0.36	0.26	###	0.12	0.07					0.14		6.7	
Av as %		86.18	35.9	26.2	9.7	12.3	6.78					22.9	###	83.8	
		72.36				8	6				8	10		67.6	
Std dev		2.43									80			1.54	
		36.18												12.5	
Correl and		Accent-task													
# of parti	0.7	71									-0.56	0.73		58	
Use of	80	57													
task-ele		80.28													
								6	9	6					
								23	11	7					
								4	7	4					
								3	3	0					
								0	0	0					
								14	22	4					
								0	0	0					
								0	0	2					
								0	*0*	*0*					
Rival elem		Length						32		46					
		ilence						20		28					

APPENDIX 16. ERRORS ON RECEPTION TASK ITEMS.

Hard items (those attracting errors in >1% of responses) are boxed

Item Number:		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Reception Task:		*Numbers of errors:*															
Loudness	**Function**	0	0	0	0	1	1	0	1	2	0	5	7	0	0	0	2
Loudness	**Form**	2	$\boxed{15}$	3	0	0	11	2	2	4	0	2	5	$\boxed{25}$	1	3	1
Length	**Function**	2	$\boxed{19}$	8	0	2	0	2	4	0	0	7	0	0	1	5	0
Length	**Form**	3	5	0	3	8	1	1	2	0	10	14	0	13	1	5	$\boxed{47}$
Pitch	**Form**	0	1	10	4	0	$\boxed{16}$	1	10	0	0	14	0	0	5	5	0
Range	**Function**	1	8	10	$\boxed{24}$	13	$\boxed{27}$	1	2	$\boxed{19}$	4	3	7	$\boxed{30}$	$\boxed{29}$	5	5
Range	**Form**	8	1	5	3	3	7	1	0	11	4	0	3	3	9	$\boxed{15}$	1
Glide	**Function**	6	$\boxed{15}$	$\boxed{15}$	4	9	1	10	$\boxed{42}$	4	10	14	6	8	10	8	13
Glide	**Form**	1	8	$\boxed{33}$	4	4	0	0	1	1	1	1	3	2	7	$\boxed{16}$	5
Silence	**Function**	8	3	3	1	0	4	2	2	0	7	4	2	0	6	0	3
Silence	**Form**	4	3	0	0	3	0	3	0	2	0	0	3	0	3	9	1
Rhythm	**Function**	3	8	11	7	2	3	2	0	8	2	8	$\boxed{30}$	6	11	12	$\boxed{16}$
Rhythm	**Form**	0	0	2	0	2	4	0	1	0	0	1	2	0	1	2	0
Level	**Function**	13	0	12	0	11	4	8	$\boxed{17}$	8	10	1	9	5	1	2	2
Level	**Form**	$\boxed{21}$	2	4	5	$\boxed{17}$	11	2	8	8	7	1	5	3	1	1	12
Accent	**Function**	$\boxed{23}$	10	3	8	2	$\boxed{15}$	13	$\boxed{31}$	11	10	8	7	11	7	11	13
Accent	**Form**	1	0	2	0	0	0	0	1	2	1	0	0	5	1	1	0

APPENDIX 17. Participants' errors on hard items (2 = normal cue-order, 5 = reverse)

Subtest:	Loudness form		Length function	Length form	Pitch form	Range function					Range form	Glide function			Glide form		Rhythm function		Level function	Level form		Accent function			Participant Totals
Item No:	2	13	2	16	6	4	6	9	13	14	15	2	3	8	3	15	12	16	8	1	5	1	6	8	
Participant																									1
1																								2	2
2							2		2																3
3		2		2																					5
4				2			2																		3
5		2		2	2					2			2	2	2		2			2		2	2	2	28
6		2		2	2		2	2																	10
7		2	2	2						2				2	2				2						8
8		2												2			2							2	9
9		2																				2			3
10		2		2	2			2		2	2		2								2	2		2	16
11		2		2							2				2										8
12		2																						2	4
13																									1
14				2	2					2									2					2	6
15				2			2	2		2				2											8
16	5			5		5	5																		6
17				5	5						5			5										5	11
18			5	5										5				5						5	7
19	5			5	5	5	5		5	5			5	5	5	5		5	5	5	5				22
20	5			5						5				5			5						5	5	8
21					5					5				5	5	5		5		5		5			14
22			5	5	5	5	5		5	5	5				5	5				5	5				17
23						5			5					5			5								7
24										5		5		5			5	5							12
25			5											5											4
26			5			5	5		5			5													6
27				5		5				5					5		5				5				7
28		2		2				2						2							2				7
29	5		5						5	5					5	5									7
30						5	5		5					5	5		5	5				5			11
31	5		5				5		5						5		5	5		5				5	12
32				2															2						3
33		2								2				2						2					7
34			2				2												2	2					5
35		2		2			2	2	2						2				2		2		2	2	15
36	5			5						5	5				5				5		5				13
37				2			2			2				2	2				2						7
38																								2	3
39		2		2				2					2									2		2	8
40		2		2			2	2														2			8
41				2				2														2			6
42				2					2			2	2	2								2			10
43				2				2		2			2						2	2					15
44				2				2				2	2	2						2			2	2	14
45	5		5	5		5					5	5	5	5											10
46				2	2					2					2		2				2	2			11
47		2						2					2					2		2			2		14
48			5	5	5	5	5	5	5			5	5	5			5						5	5	21
49						5			5			5		5	5		5	5		5		5	5		19
50				5		5	5		5					5	5										7
51	5			5		5				5						5	5	5							11
52			5												5	5					5			5	13
53	5			5						5				5	5	5	5	5						5	13
54	5				5	5		5	5		5	5	5		5	5	5			5	5	5	5	5	28
55			5					5	5	5	5			5			5			5		5	5	5	30
56			5						5						5										4
57				5		5	5		5	5	5						5								8
58	5					5	5		5	5					5		5								8
59				2					2																4
60		2		2	2			2		2			2	2	2										11
61			5									5		5	5	5	5								7
62		2		2	2			2					2	2					2	2	2			2	17
63						5	5		5	5				5			5		5		5	5		5	15
64	5		5				5				5	5		5						5					11
65				2	2	2		2	2	2															8
66			5						5																3
67							2								2		2					2	2		9
68		2		2						2					2					2					8
69			2	2			2																		7
70	5	5	5	5	5	5			5		5			5	5	5		5	5		5	5		5	21
71				5		5			5			5					5								7
72				5										5			5	5							5
73		2					2	2				2		2											10
74				5												5									4
75		2																	2						5
76				5							5				5	5		5					5		9
77	5			5		5	5		5								5	5				5		5	13
78															5					5	5	5			8
79						5	5		5	5				5							5			5	12
80		2			2		2		2	2		2		2	2				2						14
81									5		5			5											4
82														2			2		2					2	6
83		2											2	2						2					6
84						5			5		5	5	5	5	5	5	5	5	5	5					20
85			5			5	5		5								5								11
86												5		5	5	5	5	5					5	5	10
87								2		2							2			2				2	10
88		2												2	2	2	2			2	2		2	2	18
89		2												2					2						9
90	5			5		5					5			5	5	5	5				5	5	5	5	14
Totals	15	25	19	47	16	24	27	19	30	29	15	15	15	42	33	16	30	16	17	21	#				
Normal	0	24	3	26	9	1	12	16	6	14	2	4	10	17	11	1	7	1	12	11	6				
Reverse	15	1	16	21	7	23	15	3	24	15	13	11	5	25	22	15	23	15	5	10	#				

APPENDIX 18: Participants' Comments (a selection.)

Participant 1:

Silence function reception:	I listen to 'tone' rather than meaning)
Rhythm function reception	"There was a repeated rhythm but it sounded quite natural to me. I would have known it anyway."
Accent function production	T: Would it be natural to you to put extra emphasis on the one hadn't heard when you were repeating it? P: No. T: No. Okay. You'd repeat it in the same way. P: Yeah.

Participant 3:

Level function production	" 'Cr/ea::m - - buns and ch\eese.' That was a giveaway."

Participant 6

Pitch function production	"Can't do this. You'll have to get somebody younger."
Silence form production	(on the - door): "The break was in the wrong place. You can't speak like that"
Rhythm function production	"That is wrong." (comment on his first item.)

Participant 8:

Range function production	"You sound as though you're trying to appear surprised and interested but you're too relaxed." " 'Involved' is better than 'surprised.' "
Rhythm function reception	"[1st time] sounds fed up."

Participant 26:

Length function reception	"The brisk ones sounded more attractive."

Participant 43:

Level function reception	"The sound of it was 3 but the sense was 2."

Participant 49:

Accent function reception	*Cue*: ~2SX? *Response*: \2SX.
	Reception check: Which one was I querying?
	Resp: The S.(2.0) Actually it was the **2**, wasn't it, because you went 2SX.

Participant 51:

Glide function reception	"For me it's questioning if it goes up at the end, and these go up at the beginning."

Participant 55:

Rhythm function reception	"You've got to pick up emphasis"

Participant 66:

Range function production	"You can't say 'Ah' sounding surprised"

Participant 81:

Loudness function reception	"It's more the timbre of your voice."

Participant 90:

Rhythm function reception	"I did it purely on a formula in the end: '*if* you *soun*-ded *like. that'* - it was many; and 'if you said it like that' it was first; so it was speed."

APPENDIX 19. Transcription conventions

Since none of the existing systems fulfils all the requirements for transcribing results from the procedure, features from various systems are used: Crystal and Quirk, 1964; Jefferson, 1984; and Ball, Code, Rahilly and Hazlett, 1994. Many of their features overlap, and markings which have radically different meanings in other systems have been avoided.

In conversational fragments

Orthographic script is used where 'normal pronunciation' can be assumed, i.e. vowel qualities (reduced or unreduced), consonants and syllables (full or assimilated) and phonation-breaks that seem to the transcriber to be default options (unmarked forms). This is in accordance with Crystal and Quirk (1964). Where pronunciation is marked or departs from the norm, phonemic script is used. Where the words are in doubt, text is in double brackets (Crystal and Quirk, 1964 and Jefferson, 1984).

The start of overlap in talk between speakers is indicated as in Jefferson's system by a long square bracket, with the second speaker's word situated directly beneath the previous speaker's words. When the speaker changes, the new utterance begins at the lefthand edge, under the previous speaker's words: lack of bracket indicates no overlap. If the new speaker begins immediately after the previous speaker, with no gap, the 'latching' is indicated by = before the new speaker and after the previous one.

Loudness and length

Extra loudness on one syllable, where it is felt to be 'marked' (Crystal 1969), is indicated by underlining in the text (Jefferson); extra quietness by syllables in single brackets. Extra length on a syllable, again where 'marked', is indicated in the text by a length-mark (or more than one) after the vowel that is lengthened, e.g. agai:n (Ball, Code, Rahilly and Hazlett 1991, Jefferson); shorter (clipped) length on a syllable is indicated in the text by a hook over the (second) vowel in the syllable that is shortened, e.g. agaĭn (Ball, Code, Rahilly and Hazlett 1994).

Pitch, Glide, Level, Range

Pitch-patterns are given impressionistically as dashes in a 'stave' above the words. Functions such as nuclearity (Crystal, 1969), pitch accents and boundary tone (Pierrehumbert, 1980), are not assigned. This is in accordance with a system used by Local et al. (1992). The stave can be seen as the speaker's normal pitch-range, and primarily shows the relative pitch-height and glide (presence, direction and angle of slope) of adjacent syllables. Where the speaker exceeds the range of the stave for one syllable, an arrow indicates that the pitch of the syllable is either above the stave (↑) or below it (↓). For features (such as high pitch) which are present on more than one syllable, see Polysyllabic stretches.

Silence

The description of silence is an amalgam of two different transcription systems, Crystal and Quirk, 1964 and Jefferson,1984.
A minimal pause that is deemed to be not a mere phonation-break for articulatory purposes is indicated by a period. (Jefferson, 1984).
A pause that takes up one beat of the speaker's speech-rhythm is indicated by a hyphen with spaces either side, 2 beats by 2 (spaced) hyphens. (Crystal and Quirk, 1964).
Pauses of longer than 3 beats are noted as tenths of a second in parentheses, e.g. (0.9) (Jefferson, 1984)

Polysyllabic stretches

Where a prosodic marking is relevant for several syllables it is indicated in italics below the text in accordance with the recommendations of the extensions to the IPA recommended by Ball, Code Rahilly and Hazlett (1994) (*f*...., *alleg*..... etc.), with dots indicating how far the feature extends. To the features itemised by these authors are added some which are taken from Crystal and Quirk 1964: (*high, low, wide, narrow, rhythmical, staccato)* Rhythmicality is thus indicated by *rhythmical*. Accent is indicated by syllables in upper case. *Staccato* indicates an 'accented' stretch of speech, where all syllables which can be accented have extra prominence).

Within the text

There are places in the text where it is convenient to have some intonation-factor indications without inserting a stave.

Pitch indications are as follows:

Pitch steps (indicated at the start of the relevant syllable):

- up: ↑
- down: ↓

Glides (indicated before the vowel in the relevant syllable):

- fall: \
- rise: /
- fall-rise: ~ or v
- rise-fall: ^

Indications of loudness, length and silence are as for conversational fragments.

Indications of range are <u>W</u> (wide) and <u>N</u> (narrow)	}	in accordance with
Indications of rhythmicality are <u>rh</u> and <u>arh</u>	}	Crystal and Quirk 1964.