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DIE SUID-AFRIKAANSE TYDSKRIF VIR KOMMUNIKASIEAFWYKINGS

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DIE SUID-AFRIKAANSE TYDSKRIF VIR KOMMUNIKASIEAFWYKINGS

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Manuskripte moet voorberei word volgens INLIGTING VIR BYDRAERS wat agter in hierdie publikasie verskyn.

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Contents - Inhoud

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Kommunikasiepatologie: Onderrig vir die Toekoms*

Isabel C. Uys

Hoof: Departement Spraakheelkunde en Oudiologie
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INLEIDING

Alhoewel hierdie intreerede oor onderrig in die Departement Spraakheelkunde en Oudiologie gaan, is die onderwerp kommunikasiepatologie. Wat het spraakheelkunde en oudiologie met kommunikasie te doen?

Kommunikasie is een van daardie woorde met 'n verskeidenheid van gelykwaardig aanvaarde betekenisse. Dit is 'n woord wat deur verskillende vakgebiede toegeëien word, juis omdat daar geen beter woord is om doelgerigte, interaktiewe prosesse te beskryf nie. In breë trekke verwys dit na openbaarmaking, oordraging en mededeling. Meer spesifiek met betrekking tot menslike kommunikasie is dit die omskrywing van daardie interaktiewe proses tussen twee of meer mense waarin gemeenskaplike betekenis deur die oordrag en interpretasie van 'n boodskap verkry word.

Mense leef in sosiale groepe, leer en deel in die gedragspatrone van 'n spesifieke gemeenskap en sy kultuur. Die gedragspatrone bestaan uit die interaksie van mense met mekaar en met die omgewing. Hierdie interaksie word grotendeels tot stand gebring deur kommunikasie, die stuur en ontvangs van boodskappe, die mededeling van inligting vanaf die een na die ander. Die medium van hierdie kommunikasieproses is taal. Dit is 'n uniek menslike besit, omdat die mens die enigste lewende wese is wat sy uitinge sistematiseer in 'n stelsel van arbitrêre kommunikasiesimbole.

Die mens het die vermoë om die taal van sy gemeenskap aan te leer en om dit oor te dra aan andere en hierdie vermoë om kennis oor te dra, vorm die grondslag vir die ontwikkeling van alle gedragspatrone wat as kultuur beskryf kan word. Dit is die hoofkenmerk van menswees. Maar

Om te hoor is nie noodwendig om te luister nie;
Om te praat is nie noodwendig om te kommunikeer nie.

Moses het dit besef toe hy gesê het "Ek praat swaar, die farao sal nie na my luister nie."

HISTORIESE PERSPEKTIEWE

Dit is die besef dat ongeveer 10% van die bevolking se spraak sover verskil van díe van andere in hulle gemeenskap dat dit onverstaanbaar is, kommunikasie belemmer, ongunstige aandag trek en selfs veroorsaak dat die spreker wanaangepas is, wat mense laat besef het dat daar 'n behoefte aan hulpverlening is.

So 'n mens was die Vader van Spraakheelkunde en Oudiologie in Suid-Afrika, Pierre De Villiers Pienaar. Ten tye van sy nagraadse studie in Utrecht en Hamburg het hy reeds die toepassingsmoontlikhede van sekere fasette van die fonetiek op stemafwykings besef. Sy toekomsvisie en deursettingsvermoë was deurslaggewend in die ontstaan van die opleiding en beroep in Suid-Afrika, maar dit is te danke aan sy fundamentele waardering en evaluering van grondliggende kwessies dat spraak-, taal- en gehoorterapie vandag in eie reg as 'n wetenskaplik-gefundeerde dissipline gerespekteer word.

Reeds in 1937 is daar op 'n klein skaal begin met die opleiding by die Universiteit van die Witwatersrand. Eers is slegs 'n tweejarige diploma en daarna 'n driejarige diploma aangebied. Die besef dat so 'n beperkte opleiding nie kan voldoen aan die eise van hierdie komplekse vakgebied nie, het gekulmineer in die instelling van die vierjarige graadkursus, wat vandag nog as die minimum vereiste vir kwalifikasie en registrasie by die SA Geneeskundige en Tandheelkundige Raad beskou word.

In 1966 skryf Professor Pienaar self dat hy hom geroepe gevoel het om 'n soortgelyke kursus by die Universiteit van Pretoria te vestig. Hy het reeds in 1959 die hoof geword van die nuwe Departement Spraakwetenskap en Spraakheelkunde, waar die eerste finalejaarstudente teen die einde van 1963 afgestudeer het. Professor Pienaar was uit hoofde van sy opleiding by uitstek spraakwetenskaplike, maar sy wye belangstelling en uitgebreide kennis oor die totale vakgebied het gedurig tot vernuwing gelei. Geen wonder dat hy

* Hierdie artikel is as professorale intreerede gelewer op 27 April 1993 in die Senaatsaal, Universiteit van Pretoria.

met die kennis-ontploffing gedurende die 1960's gesorg het dat die naam van die departement verander na die Departement Spraakwetenskap, Spraakheelkunde en Oudiologie nie.

Dit is egter so dat ontwikkeling van 'n vakgebied rasionalisasie noodsaak - uitbreiding, sowel as inperking. In 1983, met die afskaffing van die vak Spraakwetenskap vir graaddoeleindes, is die naam van die Departement verander na die Departement Spraakheelkunde en Oudiologie. Vooruitgang op die gebied van taalteorie-ontwikkeling en die implikasies daarvan op taalafwykings het egter weer toevoeging noodsaaklik gemaak. Spraak-taalpatologie en oudiologie, en spraak-taal-gehoorterapie het reeds wêreldwyd algemene en aanvaarde vakterme geword. Ongelukkig is dit so dat, as gevolg van die konseptuele verskille, geen een van hierdie begrippe uitgelaat kan word sonder om afbreuk te doen aan die omvang van menslike kommunikasie en dus ook die naam van die departement nie. Dit laat ons met 'n dilemma van lompheid en fragmentasie in die benaming wat aangespreek moet word.

Deur al die jare is Prof Pienaar se filosofiese uitgangspunt weerspieël in die missie van die departement om 'n holistiese en organismiese benadering tot kommunikasiepatologie te bevorder en om beroepsbeoefening as 'n idealisties-geïnspireerde roeping te beskou. Maar, die uitbreiding van die veld en die toevoeging van kennis het noodwendig tot spesialisasie en fragmentasie gelei. Steeds is dit die enigste omskrewe beroep wat dienslewering aan kommunikasiegestremdes ten doel het - die beroep wat die diagnose, habilitasie en rehabilitasie van diegene met kommunikasieafwykings (spraak-, taal- en gehoorafwykings) omvat.

SELFEVALUASIE: DIE WEEGSKAAL VIR ONDERRIG EN BEROEP

Uit die voorafgaande blyk dit duidelik dat daar aan die een kant volgehoue vordering op die vakgebied en in die beroep voorkom, maar aan die ander kant moet die toepaslikheid en effektiwiteit van onderrig en dienslewering in andersoortige en veranderende omstandighede gedurig bevraagteken word. Nooit moet verandering gelykgestel word aan onstabiliteit nie. Die afwesigheid van verandering lei nie tot stabiliteit nie, maar tot stagnasie. Mens moet dus altyd ingestel wees op daardie tekens wat 'n behoefte aan verandering en 'n geleentheid vir vordering aandui (Feldman, 1981, p.942).

'n Behoefte aan kritiese evaluasie reflekteer dus nie noodwendig onsekerheid en ontevredenheid nie, maar eerder 'n bewustelike, sensitiewe ingesteldheid om te weeg en nooit onverhoeds te lig bevind te word nie.

In 1966 het Prof Pienaar gesê:

> "...one does feel that a substantial part of the idealistic program which was planned in 1936 has already been realized. A young country, with a comparatively small percentage of wage earners, keen on expansion in every sphere of life, with no endowments and handicapped by a lack of funds, has had to march foreward on faith, hope and charity and its youthful idealism. We are jealous of our standards of training, of research and therapeutics. We are eager to learn from those who can spare more manpower for research. We realize the vastness of the field still lying fallow; the great task still ahead of us to cater to the needs of the whole population of South Africa and through South Africa for the whole of the awakening Southern Africa." (Rieber & Brubaker, 1966, p. 600-601).

As the development of the profession was initially based on models from Europe (especially Germany with its strong physiologic orientation) and America (the founders of behaviourism in our field), the training and service delivery in this country is still geared towards the Western model.

> I am not saying "...that a foreign model modified on the basis of limited information is necessarily inadequate, but rather that it is important that we be aware that this is the situation." (Delaney & Malan, 1984, p. 75).

And where has this adherence to the Western Model led us?
I quote from the Main Report on Disability in the Republic of South Africa (1987, p. 14):

> "...it is clear that the existing services are distributed unevenly in the development regions. There are in fact development regions which completely lack certain basic services for the disabled. It is further noticed that in many respects there is an unequal distribution of services among the various population groups... The complete view that is obtained at the macrolevel is that services are mainly limited to the metropolitan areas and that a significant percentage of disabled people have little or no access to the existing services. It is, therefore, selfevident that in a programme for the upgrading of services, the horisontal distribution of services must be examined before generally vertical extension of services can be considered."

Even before the investigation into disability in South Africa, the South African Speech-Language-Hearing Association took steps based on the realisation that three issues should be addressed:

> " - the multifaceted nature of the linguistic and socio-cultural make-up of various communities in South Africa;
> - the consequences of this on the effective implementation of tasks performed by speech and hearing therapists, and
> - the extreme manpower shortage of speech and hearing therapists in the country." (Aron, 1984, p. 1).

These service delivery issues reflect on training within the Southern African context. We realise that "we can either shape our own future, or we can live with a profession someone else shapes" (Cole, 1986, p. 41).

External evaluation had already been initiated by the uninitiated in the field, and unfortunately

misconstruction of the facts can harm, not only the profession, but also the clients we serve. It was time for the profession to shape its own future.

Extensive and in-depth self-evaluation was indeed called for, taking cognizance of the stated scope of our profession, weighing it in terms of the needs of the population of disabled, the needs of the professionals, the existing resources, the infrastructure and the demands made by the system.

It was reasonably easy to identify the scope of the profession as it is internationally acknowledged that a speech-language pathologist specialises in the diagnosis and treatment of speech and language problems, and engages in the scientific study of human communication. Diagnoses are made of speech and language competencies of individuals, including the assessment of speech and language skills as related to educational, medical, social and psychological factors. Human communicative efficiency of individuals with communication problems of organic or nonorganic origin is restored through planning, directing or conducting habilitative or rehabilitative treatment programmes. Counselling and guidance to speech and language handicapped individuals, as well as consultation with educational, medical and other professionals, are provided. The scientific principles of human communication are taught. Projects investigating epidemiological and biosocial phenomena, associated with speech, voice and language are directed and research is conducted to develop, design and evaluate diagnostic and remedial techniques and apparatus.

But, as in South Africa professionals have a double qualification, the scope of the audiologist had to be included, which states that the audiologist specialises in the diagnostic evaluation of hearing, prevention of hearing problems, habilitative and rehabilitative services for individuals with auditory problems. Electroacoustic instrumentation is used to determine the range, nature and degree of hearing function related to the patient's auditory efficiency (his communication needs). Audiometric results are coordinated with other diagnostic data, such as educational, medical, social and behavioural information. Conservation, habilitative and rehabilitative programmes are planned, directed and conducted. Teaching and research in the physiology, pathology, biophysics and psychophysics of the auditory system are carried out. Consultation with educational, medical and other professional groups is provided (Flower, 1984, p. 5).

In considering these definitions of the scope of the profession, we realised that due to the complex nature of human communication and its disorders, it is essential that information of an academic, research and scientific nature is continually developed and evaluated. A university provides the optimal environment for constant academic validation of current professional training as teaching in the field of speech-language pathology and audiology is directed towards the accumulation and integration of theoretical knowledge rather than technical skills.

It was, however, more difficult to identify the demands, threats and opportunities that we are faced with in the present South African context.

During 1989-1990 our department undertook an investigation (Uys & Hugo, 1989) aimed at a situational and needs analysis. Information, based on questionnaire responses and personal interviews, gathered from a sample of nearly 1000 people throughout South Africa, was utilised in the formulation of a vision of the future - in Clem Sunter's words the story of our profession and training. As the story unfolded, we realised that our profession, and indeed our training, had reached the proverbial crossroads.

First of all we had to sell our story to all those involved in training and service delivery and, as is the case with all salesmen in economically straitened circumstances, this was, and to a certain extent still is, an unenviable and painful task. It is never easy to venture into the unknown, but as in goal-directed and purposeful selling one has to teach the buyer to take off his own shoes before he can step into another person's (Johnson & Wilson, 1987). The difficulty did not lie in the new ideas, but in the ability and willingness to escape from the old ones. In this case to renounce the often impractical and irrelevant, for models and strategies which promise to be appropriate and applicable within the Southern African context (Crossley, 1986).

We then had to develop strategies for the implementation of action plans to test the validity and viability of our new story. This I would like to share with you.

KRUISPAAIE IN ONDERRIG EN DIENSLEWERING

Opleiding is die een enkel grondslag waarop effektiewe, kwaliteit dienslewering gebaseer word. Maar omdat hierdie opleiding afstuur op sowel 'n akademiese as 'n professionele kwalifikasie is dit nodig om te voldoen aan akademies-wetenskaplike eise, navorsingseise en beroepseise.

Die tyd het aangebreek om die opleiding te weeg teen hierdie eise.

Is hierdie vakgebied noodwendig 'n wetenskaplik-gefundeerde dissipline?

Is universiteitsopleiding werklik nodig?

Is spraak-taalterapeute en oudioloë nie maar net resepopmakers, waarvoor 'n laervlak tegniese opleiding voldoende en heelwat goedkoper sal wees nie?

Wat is die minimum vereistes wat aan onderrig en dienslewering in Suid-Afrika gestel moet word?

Voldoen die bestaande opleiding aan al die gestelde eise?

Wat is die realiteit?

Die RSA is hoofsaaklik 'n Derdewêreldland, met eiesoortige probleme, beperkings, behoeftes en uitdagings, waarin die beroep oorwegend as 'n luuksheid gesien word.

In 'n ontwikkelende land word die spraak-taalterapeut en oudioloog met eiesoortige probleme gekonfronteer en dienslewering (en gevolglik ook opleiding) moet daarby aangepas word. Die relevansie van die tradisionele opleiding is dus bevraagteken.

Die RSA beleef 'n gevaarlike bevolkingsontploffing.

In 1984 was daar na raming reeds 'n tekort van 4 494 spraak-taalterapeute en oudioloë in die RSA. In 1986 het die tekort gestyg tot oor die 5 000 en volgens

projeksie sal daar in die jaar 2000 'n tekort van minstens 10 000 wees.

Die RSA het 'n unieke multikulturele, veeltalige bevolkingsamestelling.
Dit het aan die lig gekom dat bykans alle dienste uitsluitlik gerig is op bevoorregte, stedelike blankes. Dienste aan die ontwikkelende plattelandse bevolkingsgroepe is totaal ontoereikend en voorkomingsdienste is feitlik nêrens beskikbaar nie. By verreweg die meeste terapeute is slegs Afrikaans of Engels magtig, terwyl die grootste behoefte by anderstaliges gevind word. In die geval van spraak-, taal- en gehoorterapie is taal en kommunikasie so uiters belangrik, omdat dit beide die middel en die doel van intervensie is.

Die opleiding en dienslewering van spraak-taalterapeute en oudioloë geskied steeds binne die raamwerk van Eerstewêreldse, Westerse modelle.
Gesofistikeerde hoë-tegnologie word in die meeste gevalle in geïnstitusionaliseerde praktyke aangewend. Diens in die gemeenskap aan die gemeenskap bestaan omtrent nie.

Die standaard van opleiding en diens wat gelewer word, word internasionaal as uitnemend beskou.
Spraak-taalterapeute en oudioloë wat hier kwalifiseer bereik groot sukses met nagraadse studies en navorsing oorsee. Hulle voldoen aan die eise van kliniese vaardigheidsprofiele oorsee. Hulle word met ope arms in die internasionale arbeidsmag ontvang.

Namate al hierdie feite aan die lig gekom het, het daar nog 'n paar vraagtekens ontstaan. Indien die opleiding en dienslewering dan van so 'n hoë gehalte is, waarom verkies van ons beste graduandi om oorsee te gaan werk? Kan dit dalk toegeskryf word aan 'n onvermoë om beroepsbevrediging te verkry, juis omdat terapeute nie opgelei word vir die tipe praktyk wat hulle plaaslik beoefen nie? Waarom is daar steeds so 'n tekort aan beskikbare, bereikbare, gelykwaardige diens aan alle taal- en kultuurgroepe in die land? Die enigste gevolgtrekking wat gemaak kan word, is dat daar êrens 'n wanpassing is tussen die aard van die opvoeding en dienslewering aan die een kant, en die aard van die behoeftes en eise van die gestremde bevolking aan die ander kant.

Hierdie hipotese is bewys deur antwoorde op die vraelyste wat van beroepslui, die professionele vereniging, die beroepsraad, universiteitspersoneel en werkgewers ontvang is:

> Die algemene indruk is dat daar in die opleiding 'n hoë standaard gehandhaaf word. Die studie van menslike kommunikasie behels 'n sterk filosofiese en universeel-wetenskaplike onderbou - basiese wetenskaplike en universeel-teoretiese vakinhoud, omdat die hantering van die kommunikasieafwykende afhanklik is van 'n grondige kennis van al die prosesse onderliggend aan normale menslike kommunikasie. Juis as gevolg hiervan is dit die tipe opvoeding wat steeds op universiteitsvlak aangebied behoort te word.
>
> Daar is orals 'n mannekragtekort, sodat terapeute met onhanteerbare waglyste gekonfronteer word. Meer spraak-taalterapeute en oudioloë is nodig; 'n heroriëntasie in die benadering tot beroepsfunksies is nodig; andersoortige beroepsbeoefenaars is nodig.
>
> In die bestaande kurrikulums word egter 'n gefragmenteerde, afwykinggerigte benadering beklemtoon. Dit kan waarskynlik as toepaslik in 'n ryk Eerstewêreldse land beskou word, maar in die RSA-konteks sal fragmentasie en spesialisasie tot oneffektiewe dienslewering lei. 'n Holistiese, funksionele benadering moet gevolg word, waar elke afwyking as 'n verbreking in die totale menslike kommunikasieproses, in perspektief geplaas moet word. Spraak, taal en gehoor is slegs die waarneembare elemente van 'n omvattende kommunikasieafwyking, waarin die geheel belangriker as die som van die dele is.
>
> Die beroepsomstandighede waarvoor opgelei word, is geleidelik besig om te verskuif vanaf die normale skoolsituasie na spesiale onderwys, die hospitaal en veral die privaat praktyk. Deregulering in gesondheidsdienste is 'n werklikheid en ook terapeute neig al hoe meer om werkgewers te word en nie werknemers te bly nie. Opvoeding moet dus voorsiening maak vir inskerping in andersoortige en meer omvattende beroepsfunksies, wat sal aanpas by die eise wat aan 'n werkvoorsiener gestel word.
>
> Die bestaande westerse klem moet Afrikagerig word. Afrikakultuur en taal moet 'n integrale deel van die opleiding vorm.
>
> Daar is 'n groot behoefte aan voortgesette onderrig, juis om die brug te slaan tussen westerse, hoë-tegnologie- opleiding en Afrikakonteks behoeftes, maar ook om volgehoue kwaliteit dienslewering in die toekoms te verseker. Hierdie onderrig moet as gevolg van die mannekragtekort en geografiese verspreiding van beroepsbeoefenaars, deur afstandsonderrig aangebied word.
>
> Wat die eise van professionele opleiding betref, was dit duidelik dat die volgende beginsels moet geld:
>
> Die doelwitte van opvoeding moet gespesifiseer word in terme van die hele omvang van toepaslike bevoegdhede: kennis, vaardigheid en gesindheid. Die leerproses wat tot hierdie bevoegdhede lei, vereis 'n kombinasie van akademiese en praktiese opleiding (Cunnington, 1985, p. 76).
>
> Wat die standaarde betref, moet die opleiding voldoen aan die eise van die universiteitswese, sowel as die minimum vereistes wat deur die Beroepsraad vir Spraak-taalterapie en Oudiologie gestel word.

Dit was duidelik dat daar 'n nuwe, toepaslike model vir opleiding en dienslewering geskep moes word. Hierdie model (Uys & Hugo, 1990) hou 'n veelvlak dienslewerings hiërargie voor, waarin verskillende soorte insette in 'n verskeidenheid van omstandighede aan die behoeftes van die kommunikasiegestremde in sy gemeenskap kan voldoen. Kommunikasiegestremdheid moet aangespreek word vanaf die vlak van primêre gesondheidsorg, reg deur die spektrum van gesondheids- en rehabilitasiedienste, tot by die hoogste vlak van spesialisasie en tegnologiese ontwikkeling.

Uit die aard van die saak hou hierdie model dus ook implikasies vir opleiding in. Tans is die universiteite die enigste opleidingsinstansies waar kursusse in kommunikasiepatologie aangebied word. Voorgestelde

aanpassings en byvoeging van opleidingsprogramme moet dus aanvanklik die verantwoordelikheid van die universiteite se deskundiges wees.

ONDERRIG VIR DIE TOEKOMS: DIE VERANTWOORDELIKHEID VAN DIE DEPARTEMENT

Die Departement Spraakheelkunde en Oudiologie wil homself verbind tot verantwoordbare opleiding van studente vir die toekoms. Met hierdie dienslewerings-model as uitgangspunt, glo ek, is dit moontlik.

Op die makrovlak is die belangrikste faktor waaraan aandag geskenk word *die voorsiening van spraak-, taal- en gehoordienste, waarin op die regte plek, die regte diens deur en aan die regte mense gelewer sal word.*

Hierdie stelling impliseer dat

1. genoeg persone verskillende soorte opleiding moet ontvang om 'n veelvlakdiens te lewer;
2. dienste in 'n groot mate gedeïnstitusionaliseer moet word;
3. effektiewe diens op elke vlak gelewer moet word, veral met die oog op bestuur, supervisie en mede-konsultasie;
4. persone kennis moet dra van die taal en kultuur van die gemeenskap van die gestremdes;
5. personeel in staat moet wees om deur opvoeding en verryking gemeenskappe te bekragtig om self te besluit oor hulle eie behoeftes ten opsigte van gestremdheid en intervensie.

Dit is vandag algemeen bekend dat gesondheidsberoepe gekritiseer word omdat hulle te hooggekwalifiseer is. Is 'n minimum van 'n duur, vierjarige universiteitsgraad werklik nodig vir 'n persoon om basiese hulp te verleen aan duisende kommunikasiegestremdes wat tans geen hulp ontvang nie? Daarteenoor, is dit eties verdedigbaar om komplekse menslike dienslewering te onderneem, sonder dat jy daarvoor opgelei is?

Kan die onopgeleide persoon skade doen, of is 'n halwe eier beter as 'n leë dop?

Omdat daar baie bewyse is dat persone wat voorgee dat hulle opgelei is, wel meer kwaad as goed aan die kommunikasiegestremde doen, kan minderwaardige, vinnige, goedkoop opleiding, net om gou meer werkers in die veld te kry, nie toegelaat word nie. Maar 'n middeweg is tog moontlik deur werksverspreiding oor verskillende vlakke van dienslewering en samewerking.

Ek is geen voorstander van laer standaarde in opvoeding en dienslewering nie. Daarom wil ek pleit vir die behoud van die hoogste standaarde op verskillende vlakke van opvoeding en dienslewering, waar persone in verskillende beroepskategorieë die beste opleiding ontvang om uitnemende diens op spesifieke vlakke te lewer.

Spraak-taalterapie en oudiologie is in 'n groot mate gedragwetenskappe en 'n verskeidenheid van insette kan suksesvol aangewend word in die verandering van menslike gedrag.

Sertifikaatprogramme:
Op grondvlak is daar tans 'n noodoproep om direkte gemeenskapsopvoeding en -verryking vir die voorkoming van kommunikasiegestremdheid, vir sifting, verwysing en ook basiese verligting van lyding te voorsien. Die opleiding van gemeenskapsgesondheids-werkers/gemeenskapsrehabilitasiewerkers kan deur gedesentraliseerde dienslewerings-organisasies soos hospitale sonder noemenswaardige finansiële implikasies behartig word, met die aanbieding van sertifikaat-programme en indiensopleiding. Gemeenskapsleiers en gemeenskapsverpleegkundiges kan hierdie verantwoordelikheid aanvaar sonder dat daar werklik tot hulle werksbelading toegevoeg word.

Alhoewel hierdie opleiding noodwendig baie beperk sal wees, het ons Universiteit 'n verpligting om hierdie soort gemeenskapsopvoeding te steun. Dit is ons plig om vir die gemeenskappe waarby ons betrokke is die visstok in die hand te gee, om binne die raamwerk van die "doctrine of informed consent" die gemeenskap te bekragtig om self behoeftes te identifiseer en besluite te neem op grond van oorwoë kennis, wat ons vir hulle behoort te verskaf.

In ons Sentrum vir Aanvullende en Alternatiewe Kommunikasie word gemeenskapsopvoeding reeds met groot sukses aangewend tot voordeel van die erggestremde. Ons word oorval met noodoproepe om hulp, en in die kort bestaan van die Sentrum is honderde mense, selfs tot in Namibië, se lewenskwaliteit al deur die bemiddeling van persone wat in die gemeenskappe opgelei is, verbeter. Deure word oopgemaak vir moedertaalonderrig, tweedetaalonderrig en selfs geletterdheid.

Diplomaprogramme:
Die volgende vlak van dienslewering behoort egter dieper kennis te dra van kommunikasiegestremdhede, omdat habilitasie- en rehabilitasieprosedures 'n groter mate van tegniese kennis en vaardigheid vereis. Die Technikons kan, in samewerking met die Universiteit diplomakursusse daarstel om spraak- en gehoor-gemeenskapswerkers en spraak-taal-gehoorterapie-assistente op te lei om in konsultasie met, of onder die toesig van gekwalifiseerde terapeute tegnieke vir kommunikasieherstel aan te wend. Hierdie diens kan ook tyd- en geldbesparend wees en 'n verhoging in toerekenbare en doeltreffende mensekrag teweegbring.

Weer eens het ons Universiteit die verantwoordelikheid om te sorg dat die opleiding toepaslik is, sodat 'n verantwoordbare diens, wat veilig vir die publiek is, gelewer kan word. Daar is ook reeds bewyse dat hierdie samewerking suksesvol kan wees, omdat van ons personeel reeds betrokke is by die opleiding van spraak- en gehoorgemeenskapswerkers en gehoorapparaat-akoestici, wat 'n baie spesifieke diens aan die gemeenskap bied.

Universiteitsgrade:
Maar die Universiteit se primêre taak bly die opvoeding van spraak-taalterapeute en oudioloë - persone wat al die komplekse fasette van menslike kommunikasie en kommunikasiepatologie ken en kan hanteer. Hierdie persone moet 'n breë basies-wetenskaplike en 'n dieptevakwetenskaplike kennis hê om probleme te kan identifiseer en te kan oplos. Hulle moet bereid en in staat wees om die uiteindelike verantwoordelikheid vir die lewering van effektiewe diens aan alle kommunikasiegestremdes en hulppersoneel op hulle skouers te neem.

Indien ons kursus dan, soos ek beweer het, van hoogstaande gehalte was, waarom het ons oor die afgelope paar jaar so drasties geherkurrikuleer? Waarom het ons die magistergraad geherstruktureer? Kursusse is opgestel binne die raamwerk van nuutgeformuleerde modelle vir opleiding en dienslewering. Dit is proaktiewe optrede om te verseker dat hierdie kursusse voorsiening maak vir dienslewering vir die toekoms.

Baccalaureusgrade:
Alhoewel ons nie met die beskikbare fasiliteite en bestaande personeelkorps onmiddellik meer voorgraadse studente kon keur nie, word verskeie van die dilemmas reeds aangespreek:

- Sekere teoretiese kursusse word oopgestel, sodat studente uit ander verwante vakgebiede kennis kan verwerf oor menslike kommunikasie en kommunikasiepatologie. Die doel hiervan is gemeenskapsverryking en -opvoeding, waardeur die kommunikasiegestremde indirek sal baat vind.
- Studente uit al die verskillende taal- en kultuurgroepe, wat aan die vereistes vir keuring voldoen, word gewerf om die tekort aan terapeute in sekere sektore aan te vul.
- 'n Vakgerigte akademiese ontwikkelingsprogram word in die departement aangebied om studente, wie se moedertaal nie Afrikaans is nie, te ondersteun.
- Daar word van alle studente verwag om op die 200-vlak 'n Afrikataal aan te bied, sodat hulle beter voorberei kan word om in verskillende taal- en kultuurgemeenskappe met ander te kan saamwerk om'n effektiewe diens te lewer.
- Gemeenskapsdiens, wat die basis vorm vir onderrig en navorsing, vind plaas in 'n verskeidenheid van taal- en kultuuromgewings. Studente word dus reeds op voorgraadse vlak toegerus met vaardighede om gedeïnstitusionaliseerd intervensieprogramme te implementeer.
- Alhoewel die kursus besonder swaar gelaai is, word spraak-taalpatologie en oudiologie steeds gesamentlik as hoofvakke aangebied. Hierdie kombinasie word nie by alle universiteite oorsee aangebied nie, en tog pleit beroepsverenigings oorsee al vir die afgelope twee dekades dat spraak-taalterapie en oudiologie as 'n enkel-professie beoefen moet word (Feldman, 1981).
- Tesame hiermee, is weggedoen met die afwykinggerigte fragmentasie in hierdie professionele opleiding. Die menslike kommunikasieproses word deurgaans as uitgangspunt in die onderrig gesien. Spraak-, taal- en gehoorafwykings word gesien as aspekte van menslike kommunikasie en intervensie word gerig op kommunikasie-patologie. Dit is die rede waarom die lomp benaming van die departement ontoepaslik en verwarrend is en waarom 'n naamsverandering na die Departement Kommunikasiepatologie oorsee deur meeste universiteite, en plaaslik deur betrokkenes op verskillende vlakke, ook in die vakvereniging en Beroepsraad gesteun word.
- Hierdie opleiding van generaliste hou die voordeel in, dat gegradueerdes toegerus word om alle soorte kommunikasiegestremdhede onder alle verskillende omstandighede effektief te hanteer.
- Met in agneming van die uitdagings en bedreigings in die toekoms, is die beroepsfunksies van die gegradueerde ondersoek. Dit het duidelik geword dat samewerking met verwante dissiplines en betrokkenes in die gemeenskap onontbeerlik is. Daarom word daar in die opleiding nie slegs aandag gegee aan diagnose en terapie nie, maar ook aan gemeenskapsopvoeding (veral met die oog op voorkoming); beraad; konsultasie; supervisie; navorsing; onderrig; bestuur. Graduandi word dus voorberei om ook as besluitnemers, konsultante, bestuurders en werkgewers op te tree.

Maar die uitdagings van beroepsbeoefening in die toekoms, moes ook op ander vlakke aangespreek word. Daar moes voorsiening gemaak word vir spesialisdienste in die geval van baie komplekse en moeilik hanteerbare gestremdhede.

Magister- en Doktorale grade:
Die departement bied reeds die afgelope drie jaar 'n gestruktureerde magisterprogram aan met die oog op die akademiese onderrig van spesialiste in die wetenskappe van kommunikasiepatologie en navorsingsmetodologie.

Ten spyte van die feit dat dit nie 'n professionele, kliniese graad is nie, kan die sukses van die magisterprogram reeds gemeet word aan die hoogstaande gehalte studente, ook van ander taal- en kultuurgroepe wat inskryf en kwalifiseer (ook graduandi en personeel van ander universiteite); oudstudente wat op professionele vlak in uitvoerende poste bevorder word; wat hulle navorsingsvaardighede inspan om die effektiwiteit van dienslewering te verhoog; wat internasionaal aanvaarbare navorsings- en publikasie-uitsette lewer.

'n Volgende toekomsideaal is om gespesialiseerde, professionele magisterprogramme in te stel vir persone met 'n algemene, maar toepaslike baccalaureusgraad. So, byvoorbeeld, kan gegradueerde onderwysers op nagraadse vlak 'n magister verwerf, kwalifiseer as spraak-taalterapeut of oudioloog, beperkte registrasie toegelaat word en ook 'n spraak-taalterapeutiese diens aan die skoolgaande kind lewer. Die onderwyser by 'n skool vir gehoorgestremdes sal met hierdie kwalifikasie weer 'n belangrike bydrae tot die gehoorgestremde gemeenskap kan lewer.

Hierdie soort opleiding is dan ook algemene praktyk by verskeie Amerikaanse universiteite.

Een van die implikasies van uitbreiding van opleiding is fasiliteite en personeel. Deur akkreditering van dienslewerings instansies, kan die universiteit gebruik maak van daardie personeel om die universiteitspersoneel op 'n tydelik-deeltydse basis by te staan in die kliniese opleiding van studente. Die voordeel hieraan verbonde is dat die universiteit al hoe meer gebruik sal kan maak van afstandsonderrig. Nagraadse studente sal steeds hulle beroepe kan beoefen terwyl hulle deur middel van afstandsonderrig die teoretiese onderrig ontvang. Die praktiese, kliniese opleiding kan by geakkrediteerde praktyke, onder die supervisie van gekwalifiseerde spraak-taalterapeute en oudioloë plaasvind in hulle woongebiede. Inspeksie van opleiding deur die Beroepsraad en eksaminering deur die universiteit sal steeds die versekering bied dat die standaard van onderrig bevredig.

Voortgesette onderrig:
Waar die Westerse model die afgelope drie dekades vir die opleiding van spraak-taalterapeute en oudioloë aan die Universiteit van Pretoria gebruik is, is 'n heroriëntasie tot die Afrikakonteks gebiedend noodsaaklik. Ons oudstudente het, met 'n ingeskerpte etiese bewustheid, deur selfstudie en selfverryking hulle basiese opleiding aangevul om te voldoen aan die eise wat die beroep in Suid-Afrika aan hulle stel.

Maar nou, meer as ooit tevore, het die Universiteit die verantwoordelikheid teenoor hierdie oudstudente om die nuwe raamwerke bekend te stel. Voortgesette onderrig in die vorm van konferensies, werkswinkels en simposiums is, soos in die verlede noodsaaklik, maar oudstudente behoort ook aangemoedig te word om vir nie-graaddoeleindes modules van die nuwe voorgraadse kursus by te woon.

Die personeel en studente het die verdere verantwoordelikheid om opleiding en dienslewering gedurig te weeg deur navorsing, en hierdie bevindings bekend te stel ter bevordering van die wetenskap en die beroep en die verryking van die gemeenskap. Ook op hierdie gebied pleit ek vir hoë standaarde, maar bevraagteken die kriteria wat gestel word vir erkenning van publikasies oor navorsingsbevindings. Navorsingsbevindings wat geplaas word in ongesubsidieerde publikasies, kan gemeet word aan ander, ook streng wetenskaplike en kommunikasiekundige kriteria en juis as gevolg daarvan van groter waarde wees. Geen wonder dat Davies (1993, p. 14) die volgende sê nie:

> "Too often scientists publish only in highly technical journals and the message does not reach the people that count."

Die personeel in die Departement is voorberei daarop om hierdie verantwoordelikhede te aanvaar, omdat hulle **met behoud van die eiesoortige aard en met uitnemendheid kommunikasiepatologie as wetenskap deur onderrig, navorsing en gemeenskapsdiens wil beoefen en 'n studentekorps wil ontwikkel en vorm deur die oordrag van dissiplinegerigte kennis en kundigheid ten einde 'n verantwoordelike en betekenisvolle beroepsgerigte bydrae tot die samelewing te lewer.**

Is dit die moeite werd? Ek laat dit in u midde met die woorde van Beukelman en Garrett (1988, p. 104):

> "Speechlessness is not a loss of life, but a loss of access to life."

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Signs of the Times: Deaf Language and Culture in South Africa*

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Introduction

Of all human behaviours, language is probably the one which has been most studied through the ages. It has provided seemingly endless fascination to many disciplines, offering at once both the means and the focus of interdisciplinary dialogue. Language is the tool of thought, of poetry of narrative, of persuasion, history, tradition and religion. It is the means by which human relationships are started, maintained and terminated. Language portrays sentiment, love, anger, hope, belief. From whatever perspective we examine it - scientific, philosophical, neurological, anthropological even archaeological, the study of language continues to perplex and intrigue us.

Language is not a neutral topic. As a repository of cultural knowledge and a symbol of social identity, it has been and continues to be a charged and embattled area linked closely to social, political and educational issues.

"A language can serve as a cohesive defining source of pride and positive identification and simultaneously as a focus for stigma and ridicule from members of the majority culture." (Meadow, 1975:17.)

This is a situation we know all too well in our own country, in which many of the issues in politics and education have been centred both in the past and at present in linguistic and cultural issues.

The topic of sign language reflects just such debate and controversy - particularly in the South African context. I will propose that the study of sign language and the issues which surround it, provide insight into many of the broader issues of history, language identity, culture, education and language planning in this country.

I will also demonstrate that the study of sign language helps shed light on some issues of general concern to those studying language, such as the biological basis of language and the relationship between language and thought.

Sign language is the language of eyes and hands, of movement and of space. Sign language is the natural language of the Deaf community.

A few definitions seem worthwhile here.

The term "deaf" is traditionally defined in relation to the audiogram. A person with a mild to moderate degree of hearing loss is still able to hear a number of speech sounds and is capable, with some extra help, of benefiting from the amplification provided by a hearing aid, and of learning language in the way that hearing children do, that is in the oral-aural mode.

Even a person with a severe degree of hearing loss is capable, with adequate intervention, of acquiring spoken language. The term "deaf" should probably therefore be reserved for those individuals with very little residual hearing - that is those with a severe to profound degree of hearing loss who will not benefit from amplification. In fact this term again, is far from a neutral one. As a medical description measured in decibels or degree of infirmity, deafness is viewed as a pathology requiring treatment - a problem which can be fixed. The overall goal of both medicine and education has been to normalise the situation and to make the individual as normal or as hearing as possible.

Both historically and currently, however, there is overwhelming evidence to suggest that neither medical nor traditional educational interventions produce very successful goals in this direction with the profoundly deaf child.

However, an alternate perspective of Deafness exists which is emerging as an equal if not more powerful and compelling one than the traditional view .

The term Deaf has become a descriptor for a distinct group with its own cultural identity and language. Padden and Humphries, two Deaf Americans write:

> "The traditional way of writing about deafness is to focus on the fact of their condition - that they do not hear - and to interpret all other aspects of their lives as consequences of this fact..... In contrast to the long history of writings which treat them as medical cases or as people with disabilities who "compensate" for their deafness by using sign language, we want to portray the lives they live, their art and their performances, their everyday lives, their shared myths and the lessons they teach one another. We have always felt that the attention given to the physical condition of not hearing has obscured far more interesting facets of deaf peoples lives." (Padden & Humphries, 1988:1.)

* This article is an inaugural address delivered on 17th February 1993, University of the Witwatersrand.

The cultural cohesion of such a group thus overrides similarities or differences on the audiogram and reflects a far more complex and dynamic state of affairs. There is limited correlation between the audiogram and the descriptor. Those who share a common language and culture are considered Deaf with a capital D.

Such a distinction explains Nancy Reflects's (1985; p.53) account of her own deafness: "When I was born, my hearing was fine. At age 2, I became deaf. At age 16, I became Deaf".

Age of onset is a crucial factor to be considered within this definition: The cultural term "Deaf" is used primarily for those with congenital deafness or who acquire Deafness at a very early age. Those individuals who tragically become profoundly deaf later on in life but who have had an opportunity to acquire spoken language are rarely considered to be part of The Deaf culture - unless of course they become fluent signers. Similarly those who are labelled as "hard of hearing" (that is with some amount of residual hearing, who wear a hearing aid) and who have a substantial amount of oral language) are often excluded from the Deaf cultural group.

Residual hearing, far from becoming a desirable asset, thus becomes a type of handicap which excludes certain individuals from the Deaf group. This is the force which causes deaf adolescents to remove their hearing aids and to abandon attempts at oral communication.

One of the chief things which distinguishes the Deaf culture then is language.

The Nature of Sign Language

A number of myths have surrounded sign language for centuries. With the advent of the videorecorder which has enabled detailed study of this rich fleeting language, the past three decades has seen many of these myths dispelled. William Stokoe a linguist from Gallaudet University who must be considered the foremost researcher in this regard has suggested:

> "Interestingly as sign language is as a system, tantalizingly like other languages and fascinatingly different, the real value to be found in the study of sign language is a human and not abstract scientific value. All language is unique, but the study of sign language reveals that *language* is both abstract, independent of speech and of gestural expression, and biologically concrete because of its expression. Language depends on the human brain, not on the naked or electronically assisted human ear." (Stokoe, 1976,p.13.)

What are some of the misconceptions which the research of Stokoe and others have dispelled?

- Sign language is not gesture.
- It is not a primitive form of language and is not equivalent to or derived from the codes used by American Indians and aboriginal people, chimpanzees, and silent orders, or on a local level, the signs of the Bushmen.
- It is not more concrete, and it is not less grammatical than spoken language.
- It is not pantomime.
- It is not universal- a popular misconception- and one which has particular relevance in the South African context. As a result of linguistic change and because of independent creation in different parts of the world, no single sign language exists. As Figure 1 suggests,sign languages are often mutually unintelligible, even within countries that use the same spoken languages (as happens for example between British and American Sign Language).
- Signs are arbitrary and not iconic.
- The grammar of sign is not derived from the spoken language of the hearing community.
- Signing does not interfere in any way with the acquisition of spoken language - or of speech. On the contrary like any first language, it provides a cognitive framework for the learning of later second languages.
- Most important the Deaf are not dumb- a commonly used but hugely derogatory term which reflects many of the historical biases and misconceptions held about their language.

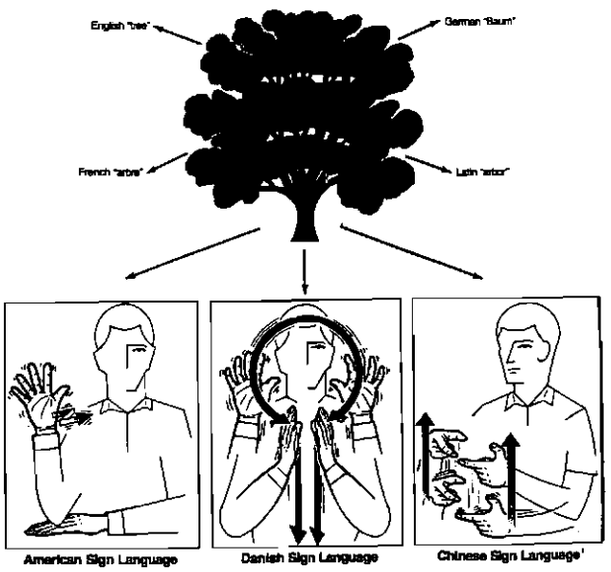


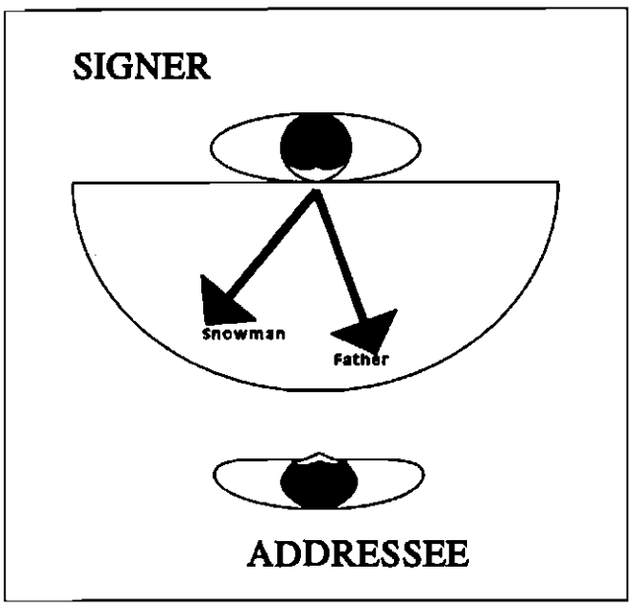
Figure 1: Seven language symbols that represent the same object.

In short sign language is a *real* language, equivalent in status to any other language - Deaf persons can sign about any topic, concrete or abstract as economically, as effectively , as rapidly and as grammatically as hearing people can. Sign language is influenced by entirely equivalent historical social and psychological factors as spoken language - there are rules for attention-getting, turn-taking, story telling, there are jokes, puns and taboo signs, there are generational effects observed in sign language, metaphors and " slips of the hand."

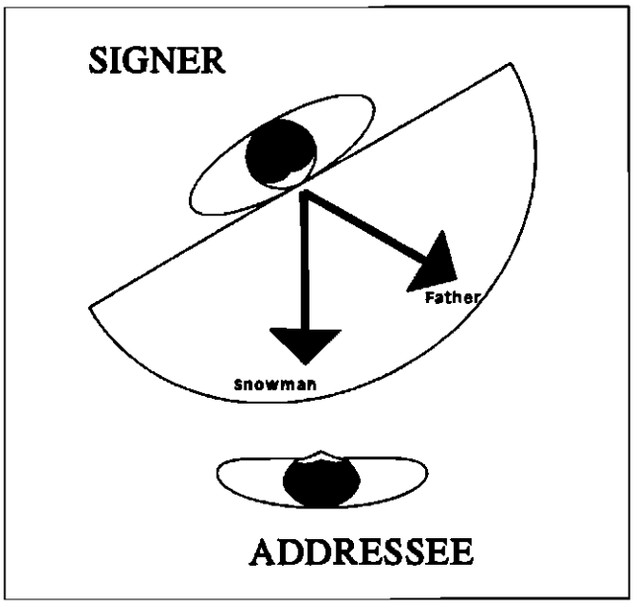
In short as Stokoe observes: "Language is not mouth stuff, it's brain stuff."

Let us examine some of the evidence accumulated with reference where possible to our own South African research base to highlight some of the properties of sign language as well as its biological basis.

Sign language has a unique spatial syntax which is complex and multilayered. What is sequential, linear and temporal in speech, additionally becomes multidimensional and simultaneous in sign- in other words "language in four dimensions."



(a) Fixed Framework



(b) Shifting Reference

FIGURE 2: Examples of fixed framework and shifting reference.

Individual signs differ from each other in terms of a system of distinctive features known as cheremes, which include hand shape, orientation, movement and location in space. In addition a complex system of non-manual features exists involving eye gaze, posture and facial expression.

Description of these features includes both the syntax , that is the way that individual signs are organised into larger units such as clauses and sentences, and also the rich morphology - that is the regular ways in which the signs can be modified to express specific grammatical functions such as number and aspect.

A few specific examples will illustrate these points:

In sign language nominals (people or other referents) are introduced into signed discourse by initially assigning spatially distinct loci. In spoken conversation, speakers may point to a specific location to indicate a person or object. For example, two speakers may be talking about (and point to) a cat who occupies a particular chair. Here a real location is used. In sign languages a combination of real as well as relative and conventionalised locations is used. In *relative* locations a signer uses points in space to produce an image of some or other location. Any subsequent reference to that locus either by pointing, gazing or shifting the body or by verb agreement refers back to the previously established nominal even when other signs have intervened.

In Figure 2 for example we see how the subjects of the conversation and the space they occupy remain established throughout the stretch of discourse.

Conventionalised locations may be illustrated in relation to the system of pronouns where indexing in relation to the speaker indicates a range of particular pronouns. (See Figure 3.)

Such conventional location may also be found in the system of verb inflections. In certain verbs the movement is mutable and marks the grammatical relationships among sentence constituents. For example, the difference between the sentences *I ask you* and *You ask me* relate to the differences in movement of the hand (and orientation) towards and away form the body, as-

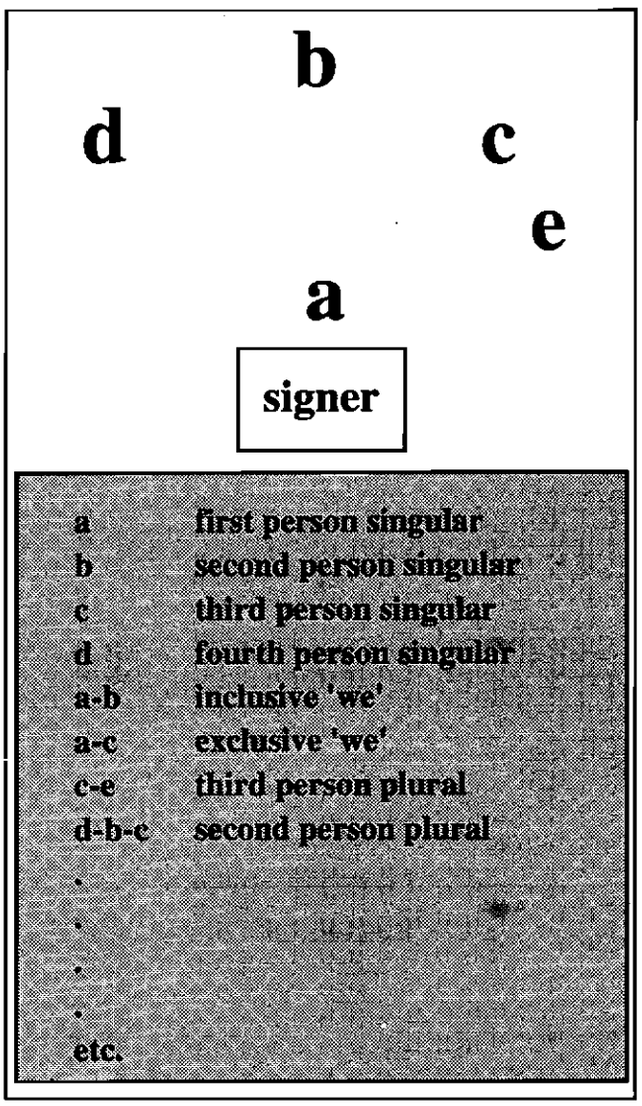


Figure 3. Example of conventionalised locations : pronouns.

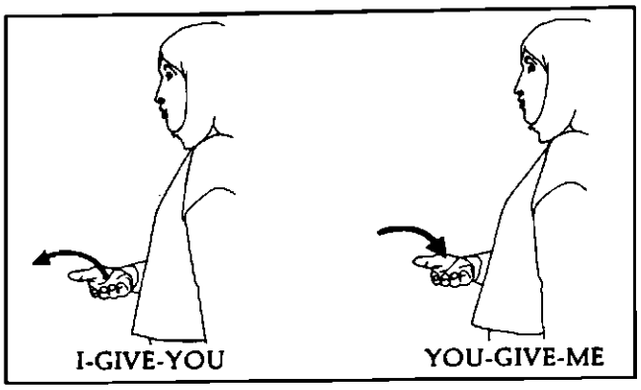


Figure 4: Example of conventionalised locations : verb inflections.

signing both the subject and the object of the sentence. (See Figure 4.)

Additional cohesion in signed discourse is achieved through the use of "performatives" equivalent to role playing in which there is modification to facial expression, body posture and style of signing as the signer adopts a particular character role in a story or everyday conversation.

The marking of the time and aspect in sign language is also of interest. Two main mechanisms may be identified.One of the ways is adverbial modification (using separate signs for concepts such as yesterday, recently, etc). Some writers make reference to the putative time line in which these adverbials as well as particular verbs are marked in a location in space to represent time illustrated in Figure 5. Thus the past is viewed as located over the right shoulder and the future in front of the body. Other ways of marking tense include the use of signs such as FINISH which imply completiveness.

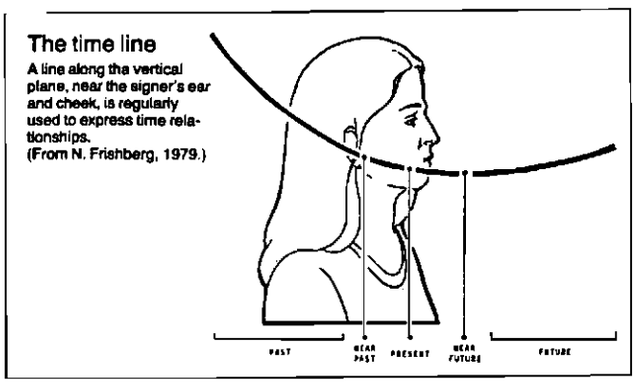


Figure 5: The Time Line.

A time line in front of the body will represent continuousness- differentiating for instance between past tense "I posted the letter" and continuous tense "I am posting the letter". In addition the verbs themselves can undergo complex modulation providing information about manner, location and direction differentiating for example between the uninflected form of the meaning "be sick" and other meanings: prone to be sick, get sick easily, sick for a long time, never stops being sick, often sick, very sick, sort of sick, became sick, through morphological changes to the basic sign in terms of reduplication, repetition and duration.

Another important area of sign language structure is nonmanual behaviour. Just as tone of voice can serve to alter meaning in spoken language, so various aspects of facial expression and posture can modify meaning in sign language. It can be used to mark sentence boundaries. It can be used to mark a grammatical function for instance in serving to mark the difference between statement and questions (illustrated in Figure 6) and state-

Figure 6a: Examples of nonmanual behaviour.

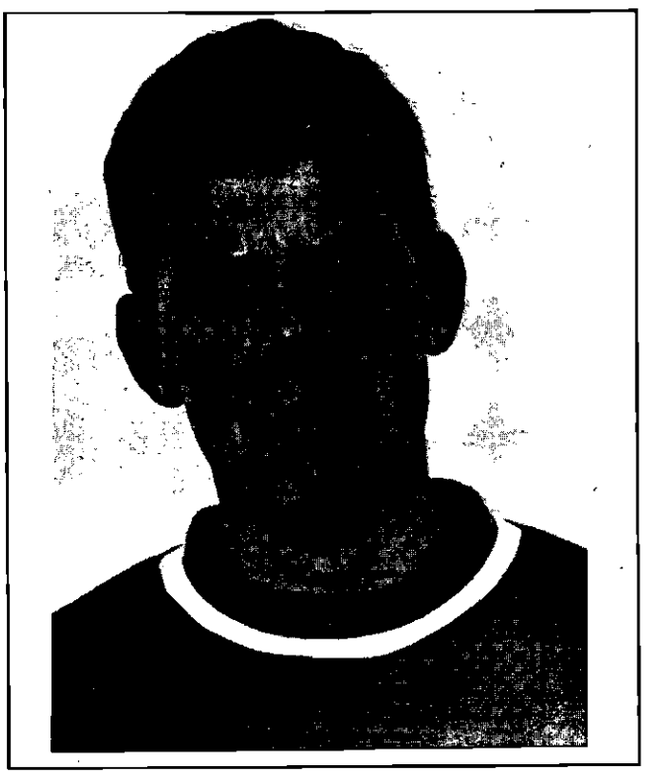


Figure 6b: Examples of nonmanual behaviour.

Figure 6c: Examples of nonmanual Behaviour.

ments and negatives. Nonmanual behaviour is also used in an adverbial way to illustrate concepts such as ease, effort, enjoyment, intensity, etc. (See Figure 6.)

What I have dealt with here is only a brief look into the some aspects of sign language linguistics. It has, however, I hope illustrated the complexity of the process as well as the rule based nature of this unique language.

Having dealt with the behavioural perspective, it seems timely to move to the biological perspective of sign language. Two areas of research shed light on this aspect and these are the areas of acquisition and dissolution:

How do deaf children acquire sign language and how does sign language become impaired after brain damage?

Are there parallels between the acquisition and dissolution of spoken and sign language and what are the implications of such parallels?

Acquisition and Dissolution of Sign Language

The best context in which to observe the acquisition of sign language is by observing the sign language development of a deaf child born to deaf parents. It has been demonstrated that such babies acquire sign language at approximately the same rate and in the same sequence as hearing children acquire spoken language. Deaf babies "babble" with their hands,in the same repetitive rhythmic patterns as hearing babies babble with their voices. The first signed word occurs at around nine months - often before the first spoken word of hearing babies - for reasons suggested to be related to motoric and neurodevelopmental aspects. Subsequent development takes place in leaps and bounds, with characteristic childhood errors (such as incorrect use of some of the more complex spatialised syntax) but within a short period of time, the deaf child achieves full signing competence .

Thus when the language learning environment is compatible with the needs of the deaf child and is presented in the visual mode, language can be acquired easily and at the same pace as language presented in the aural mode.

The question remains as to where sign language is stored in the human brain.

Cerebral asymmetries in person with normal hearing and specialisation of the left hemisphere for spoken language have long been documented. Though research in the area of deafness in this regard is more sparse, sign language is similarly located (Poizner, Klima and Bellugi, 1989). This is in spite of the fact that sign as we have seen has a large spatial component - a function widely recognised to be subserved by the right hemisphere.

One of the ways in which hemispheric specialization has been studied is by examining the effect of brain lesions on the language of an individual. In spoken aphasia, which has been documented for well over a century, characteristic patterns of language deficit emerge correlating with specific areas of brain damage. For example, in Broca's aphasia or agrammatic aphasia which is caused by a lesion in the left inferior frontal lobe, there is an impairment of expressive syntax in the presence of relatively well retained receptive abilities.

In cases of sign aphasia, that is when for example a fluent deaf signer suffers a stroke in the same area, an equivalent pattern of syntactic and morphological deficit emerges in relation to the sign. An examination of some of data supports this claim.

Figure 7 illustrates three cases of deaf adults who were previously fluent in sign language and who have as a result of a stroke shown a dissolution in their language abilities.

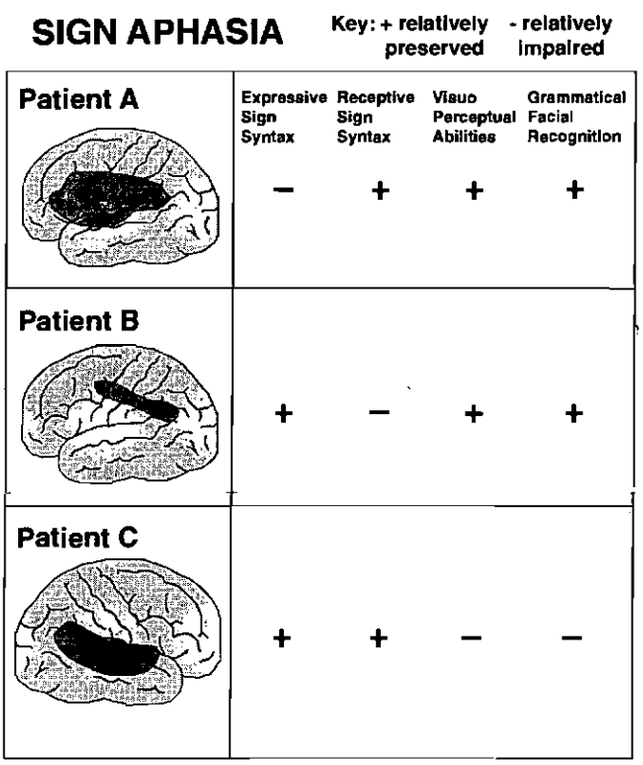


Figure 7: Performance of 3 deaf persons with brain lesions on Linguistic and Neuropsychological batteries.

The first two cases demonstrate a left hemisphere lesion and the third, a right hemisphere lesion.Their performance on a battery of neuropsychological and linguistic tests is summarised on the right hand side of the figure.

Case one demonstrates a lesion in what is traditionally known as Broca's area of the brain . Her sign language is agrammatic - consisting of uninflected and sparse nouns and verbs. She shows none of the grammatical apparatus previously described - no verb agreements or inflections and no use of spatialized syntax. In contrast, her reception of sign is relatively well retained - she is able to follow sign instructions and to understand a sign conversation. Her visuo spatial and constructional abilities, as measured on a range of adapted neuropsychological tests, remain intact, as does her ability to recognize and comprehend some of the grammatical nonmanual features (such as changes in facial expression) which have been discussed already.

This profile therefore shows some interesting parallels with the neurolinguistic profiles of a left hemisphere damaged hearing patients. Interestingly in this case (as in the only other cases of documented cases of this nature) shows damage not only to Broca's area but also to the cortical immediately above it - that dealing with the hand- and this suggests that the area above the left motor area may be an important component of sign aphasia specifically.

Case 2 with a left parietal lesion though fluent in expressive sign language has severe difficulties in the comprehension of certain grammatical forms. This receptive difficulty does not appear to parallel in severity the comprehension of a speaking aphasic patient with a lesion in this area and suggests perhaps that because of the spatial aspects to sign language, a left parietal lesion is of more impact. This patient, however, like Case I shows competence in visuospatial ability (a function served by the right hemisphere) but cannot accurately recognise the grammatical distinction between certain facial behaviours - a finding which tends to suggest a dissociation between different spatial aspects in the brain (those with and without linguistic overlay).

Finally Case 3 who has a lesion in the right capsula interna region shows poor performance as one would expect in a hearing patient with a similar lesion on a battery of visuospatial and visuoconstructional tasks such as block design. However, signing competence is spared both expressively and receptively except, interestingly, in the domain of nonmanual features . This patient appears to lack an ability to recognise some of the grammatical and adverbial marker marked by facial expression such as has been shown. The impact of a right hemisphere lesion therefore may be greater for the deaf person than for the hearing person.

This type of data while broadly confirming that sign language has an equivalent biological basis to spoken language, is thus highlighting certain interesting differences.

Such lines of evidence are also accumulating from psycholinguistic experiments with neurologically normal deaf and hearing individuals.

For example, researchers at the SALK Institute have shown that deaf children are superior to hearing children in being able to draw accurately the shape of a moving light pattern travelling in space. Similarly deaf adults seem to be better than hearing adults at generating and manipulating mental images, e.g. telling whether one object is the same as another but rotated in space. The question arises as to whether the mode of language learning thus influences the brain's ability to perform certain tasks and takes us back to the Sapir-Whorf hypothesis which suggests that how we talk determines the way we think.

Many questions still need addressing but to recap so far, I have argued that the structure and the biological basis of sign language demonstrates its full status as a language. "Sign Language is biologically and unsilenceably the voice of the deaf" (Sacks, 1989 :123). Such research has done more than anything in the past three decades to consolidate the notion of Deaf culture.

Cultural and Historical aspects of Deafness

The growing acceptance of sign language as a real language has done a great deal to strengthen the notion of Deafness as a cultural entity.

The past few years have seen the emergence of a strong and powerful Deaf culture in many countries. There is deaf art, poetry, theatre, sport, many deaf clubs, and congregations. Films such as *Children of a Lesser god* and TV series like *Reasonable Doubts* have helped to show the hearing world the pride and unique status of Deaf culture.

Additional indices of such cultural cohesion include a shared set of behavioural norms among deaf as groups and a largely endogamous marital pattern. Regardless of parental hearing status over 90 % of deaf people marry other deaf people.

A shared history is another such index of cultural strength and a glimpse into the history of the Deaf of their language and culture and the attitudes of hearing persons to Deafness provides an intriguing window on prevailing attitudes and thought about cultural minorities.

There is some reference made to the deaf and their language in Greek times. For example in Plato there is a dialogue between Socrates and Hermogenes on the relation between word and idea and Socrates asks: "If we had neither the voice nor tongue and wished to explain things to others, could we not try like the deaf to convey our meaning by using our hands, heads and other parts of our bodies?"

Hippocrates, however, suggested that deafness was due to a defect in the tongue since the deaf were not able to speak.

During the Renaissance several mentions were made of methods of teaching the deaf language and Leonardo da Vinci suggested that lip reading was a very valuable lesson for the painter.

Most modern accounts of deaf education and language, however, begin in the 18th century.

The father of modern sign language was probably the Abbe l Epee who founded the first school for Deaf children in France in about 1765. Observing closely the natural language of two deaf girls he met in a Paris slum, he decided to dedicate himself to the education of the deaf. He learnt their signs as a medium of teaching and imposed on them a formal grammar and method of instruction (based on rules of spoken French). His dis-

ciple and successor Abbe Sicard continued in his footsteps but gradually the use of methodical signing was viewed as unwieldy and cumbersome and the natural syntax of sign was adopted.

Among the foremost proponents of this was a deaf Frenchman Laurent Clerc who was invited by Rev Thomas Gallaudet to America and who with Gallaudet founded the first school for deaf children in America in 1817 . The French signs were formally integrated with some of the sign language used by local deaf groups and what became known as American Sign Language (ASL) was formally adopted in the Deaf schools in America. In 1867 there were 26 institutions for the education for the Deaf in America and ASL was the language of instruction in all. Deaf persons had moved into positions of esteem and success and were working as teachers in all the schools.

By 1907 there were 139 schools and ASL was allowed in none. A similar state of affairs had happened in France and in other European countries. What happened is that at a meeting of hearing educators in 1880 held in Milan it was agreed that oral instruction *only* could restore deaf people to society.

Thus towards the ends of the last century hearing teachers took control of schools for Deaf children and banished sign from the classrooms as well as all the deaf teachers. Despite considerable deaf protest manual language thus became oppressed. The first president of the National association of the Deaf said at the turn of the century:

> "What heinous crime have the deaf been guilty of that their language should be proscribed?"
> (quoted in Lane, 1984:xvii).

Harlan Lane, an eminent psychologist who has written two powerful books on deaf culture and history (1984,1992) has suggested that:

> Milan was the single most critical event in driving the languages of the Deaf communities beneath the surface; I believe it is the single most important cause of the limited educational achievements of modern deaf men and women (1984:25).

There is every indication according to Lane,that the Deaf were better off in the 19th century. Not until very recently have things been rectified (at least in countries such as the United States). Lane believes that attitude and treatment of the Deaf during the first part of this century can be viewed within a framework of stigma and paternalism.

For example, Alexander Graham Bell inventor of the telephone and son of a deaf mother as well as married to a deaf woman, not only suggested that sign language and deaf teachers should be banished but as committee member of the Breeders Association, wrote a great deal about eugenics, and the danger of marriage between immigrants, and also between deaf people. Presupposing that familial deafness was something to be avoided, he urged deaf students not to " hand your affliction down to your children" and to "enter into an ideal marriage with a hearing person". The unfortunate Mrs Mabel Bell not surprisingly wrote near the end of her life " I shrink from any reference to my disability... I have striven in every way to have my deafness forgotten ... I would have no friends among them."

The development of psychometrics and IQ tests also had a negative import for this model of disability. Such tests were grievously misapplied to deaf children and adults -deaf people performing up to 30 points below hearing people on such tests standardised and administered in oral language. This was taken as evidence for the "dumbness" of Deaf people and provided reason for diversion into non-academic subjects.

On the psychological track, a series of publications emerged describing the personality characteristics of the deaf. Lane (1992) likens the historical attitude towards deafness to the forces of colonization particularly in Africa. Drawing on colonial literature on the one hand, and descriptions of deafness in the past twenty years from the educational and psychological literature on the other, he demonstrates vividly the frightening parallels in description and terminology. He expands the argument by drawing parallels in attitude between the oppressors in both cases.

As an explanation Lane cites the ideas of French historian and philosopher Foucault (1977) who proposes that power in modern society is disseminated into small structures. Through a system of norms and exclusion, those members of society who are different (such as the criminal, the insane , the sick, and of course, the Deaf) are given a set of rules and restrictions which highlight their differences and disempower them further. What is also interesting is the interdependence between physicians, educators and decision makers on the one hand and the oppressed - sick (or Deaf) people slipping into roles of subservience and non-achievement.

What is probably the most important milestone in the history of deaf culture this century is the series of events which took place during a week in early March 1988 at Gallaudet University for the Deaf in Washington. This University had hearing presidents since its founding in 1864. The appointment of a new hearing president Dr Elizabeth Zinser lead to a strong accelerating protest among students and staff at Gallaudet.

During the week of protest which included a march to the White House, the shutting of the University and the barricading of campus, the activities touched the hearts and imagination of the hearing world and highlighted the power of the Deaf culture. Eventually this action resulted in the resignation of Dr Zinser and the appointment of a deaf president Dr Irving King Jordan whose words "Deaf people can do anything but hear" have become a slogan for deaf empowerment. Jesse Jackson said of this event:

> Your determination , strength and unity achieved a historic victory at Gallaudet ... your victory was a victory for all of us ... It was a victory for all people who ever felt the pain of being stereotyped, devalued and unrepresented.

After a century of oppression things had at last changed.

If such attitudes towards disability have prevailed throughout the world how much more can we expect them to be entrenched in a country like our own which has formally legislated against certain groups for so long?

Moving to a history of the South African deaf we see some uncomfortably close parallels and some similar shifts in attitudes.

HISTORY OF SOUTH AFRICAN DEAF

The main milestones in the history of the Deaf in South Africa are portrayed in Table 1.

Table 1: Milestones in the history of Signing in South Africa

1863	Irish sisters involved in training programmes for the deaf
1874	Grimley Institute for Deaf and Dumb opened in Cape Town
1877	German (Dominican) sisters started school for the deaf in King Williams Town
1881	De La Bat School started by DRC in Worcester
1920	Oralism formally adopted in deaf schools
1934	Schools divided into "European" and "Non-European" St Vincent's School for the Deaf opened in Jhb
1941	First school for the Black Deaf established Paget Gorman Coding system introduced
1980	Publication of "Talking to the Deaf" Adopted by DET
1984	Medium of education changed from vernacular to English in DET schools

There is little history formally documented and what I have had to rely on is press cuttings, records and newsletters of the South African National Council for the Deaf founded in 1929 and interviews with deaf adults. In 1863, five sisters from the Dominican Convent, Cabra, Dublin Ireland founded a school for the Deaf in Cape Town, later known as the Grimley Institute for the Deaf. At approximately the same time, the Dominican sisters started a school for the Deaf in King William's Town. In 1881 the de la Bat School for the Deaf was started by the Dutch Reformed Church in Worcester .

Official educational policy changed in South Africa changed, and in accordance with recommendations made at the Milan congress, oralism was formally adopted in deaf schools in 1920.

With pride the schools advertised themselves as "purely oral" and advocated the "The modern method of speech and lip reading." Dr van Schalkwyk, Superintendent of Social welfare and Probation in 1938 said, "a deaf mute child given the opportunity to learn lip reading will learn it as naturally and easily as a normal child learning to speak."

A deaf informant in Cape Town, born to deaf parents tells of how a Principal of a local deaf school agreed to admit her on one condition only : that the parents (both of whom had Sign Language as their first language) would never use their hands in front of her.

The belief of the time was that with amplification and early intervention , including lip reading "the deaf will hear and the dumb will speak" to quote an early Cape newspaper. Unfortunately with hindsight, such goals were hideously misdirected.

I have already discussed the complete proficiency with which deaf children acquire language from their deaf parents. The language outcome for deaf children born to hearing parents and placed in a purely oral environment is, however, considerably less effective. In most cases the deafness is not detected until the child is a few months old, and in South Africa it is quite common for this to be much later. Research suggest overwhelmingly that in the case of profound congenital hearing loss that even with concentrated and intensive early intervention, there are often considerable delays in the acquisition of spoken language and subsequently literacy. Over sixty percent of the deaf adult's speech remains unintelligible to the average listener. The average reading age of the deaf school leaver is that of an eight year old. In short, the deliberate exclusion of sign language from the learning of such children sometimes has had a disastrous effect on overall scholastic and vocational goals for the deaf in South Africa. This lack of a mutual communication system during a critical language learning phase leads to poor language development: " There is an especial peril that threatens human development, both intellectual and emotional, if the healthy acquisition of language fails to occur" (Sacks, 1989:60).

In the press cuttings I have seen, recording the history of Dominican schools for the deaf in Cape Town from 1932 to 1965 the only reference to sign language that I found was: "We don't teach it officially but they pick it up from older children and pass it on in their turn." (Sister Amata Dominican School, 1962.)

Thus Sign Language continued to be used informally in the playgrounds and in deaf clubs and congregations.

In some of our own findings surveying adult deaf in South Africa about when and from whom sign language was learned, this was confirmed, well over half our respondents learning sign from contexts other than home and formal school settings. (Figures 8.)

In 1934, the same year that St Vincent school for the deaf was founded in Johannesburg,schools were divided into European and non-European .

In the spirit of the times Dr Cawston of the Juvenile Affairs Board, writing in *The Silent Messenger* 1936 said:

> Attention would not seem to have been paid to the fact that South African natives are very seldom hard of hearing except in old age. This may be partly due to the fact that they have such spacious nostrils and air space. It is hoped that provision will shortly be made for those who are both deaf and dumb, for primitive peoples cannot be expected to look after them adequately in their own homes.

The first school for the black deaf was opened in 1941 Increasing fragmentation of educational policy was entrenched by the coming to power of the Nationalist governments in 1948. Ironically in contrast to so many other

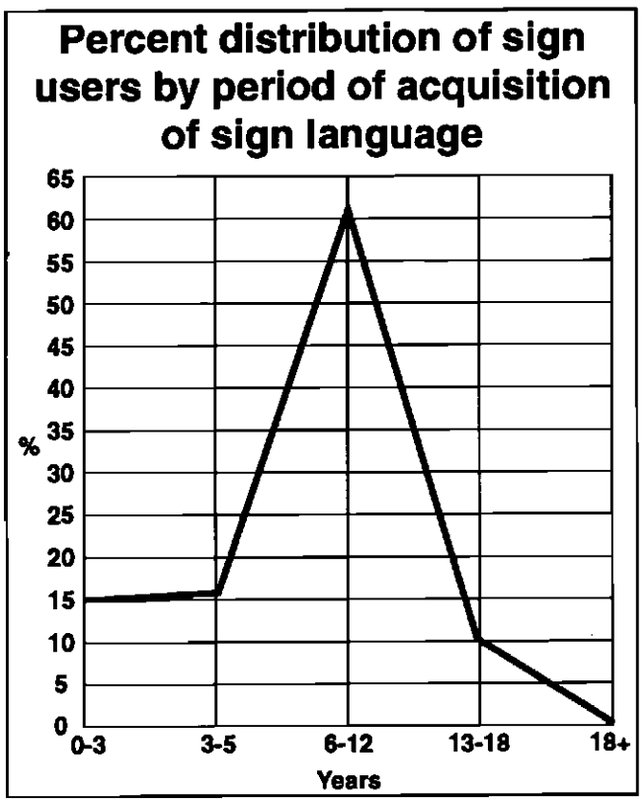


Figure 8a: Age during which sign language was learnt.

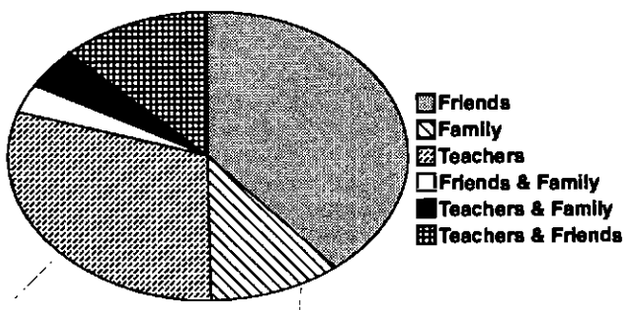


Figure 8b: Primary Educators of Sign Language.

areas of education the situation for the black deaf child with the advent of the group areas act and the separate education bill, became educationally superior to that of the white deaf child - for part of the educational policy was to introduce manual communication into the schools. The system used was not sign language per sé but a manual code known as the Paget Gorman system which enabled a facility in communication and established a very strong deaf culture among the children and graduates of the black deaf schools.

One assumes at the time that this was out of a sense of sheer desperation as hearing aids were not available to black deaf children and no effective communication system was available, but it was a happy choice, leading to the first attempt by Norman Nieder Heitmann, principal of a school for the Deaf near Rustenburg to produce a dictionary of signs for use by the deaf in South Africa. This text, called *Talking to the Deaf* (1980) was formally adopted as a teaching manual in the DET schools where medium of instruction was changed to English in 1984.

Unfortunately subsequent educational policy has denied the right of such children to achieve their potential. It is no longer possible for black deaf children to move beyond Standard six in academic subjects and the focus of their education has been limited to highly technical aspects.

Such attitudes, although not legislated in the white schools for the deaf, some of which still offer an academic matriculation, have tended nevertheless to be entrenched: For example, Rev de la Bat after whom the school for the Deaf in Worcester was named, in justifying training programmes for deaf girls (1935) said:

> My personal view is that normal intelligent educated and well trained deaf girls make excellent wives and homemakers.The general desire today of girls for social entertainment, for excitement, for economic independence and freedom from domestic trammels does not affect the deaf girl so much. This is due to her handicap of deafness..These trends in modern girls are not in themselves faults and constitute essential factors in the woman wage earner but I am old fashioned enough to hold the view that these trends are detrimental to homemaking... The married woman because of her deafness naturally finds her interests and activities curtailed and consequently confines herself more to the sphere of her home.... I would suggest therefore that training be given to deaf girls in sewing, pattern making, costume designing, dress-making, cooking,invalid cooking, dietetics, upholstery, housewifery, home nursing, household decoration, washing and ironing, rug making, woolwork, knitting, millinery,marketing, toy making, basketry, lamp shade making, eiderdown quilt making and last but not least, gardening and agriculture.

Even this vocational advice is not as misdirected as that of the misguided Dr Cawston who suggested:

> Secretarial work is difficult for those who fail to hear what is being said at committee meetings... but broadcast stations should provide a serviceable outlet of public speakers who are defective in hearing or suffer from other inefficiencies which make it difficult for them to speak from a public platform.

In 1987 a national research project jointly funded by the South African National Council for the Deaf and the Human Sciences Research Council was established which had as its aim a characterisation of the diversity of sign languages in the country as well as of the sign syntax found among deaf groups. The first volume of the *Dictionary of Southern African Signs* was published at the end of last year (Penn, 1992).

As we had predicted because of the widely diverse education systems, a number of sign variations were found to exist as illustrated in Figure 8 . No one had, however, predicted the extent of this variation with the finding of an average of six variations per word. Only two percent of the words had common signs - a reflection of the effects of the legacy of apartheid and the attempts by hearing educationalists to divide , transplant and fragment deaf people (see also Penn and Reagan, 1990; Penn, Reagan & Ogilvy, 1992). Happily, however, and a point on which to build future educational policy

Insect

GRAMMATICAL CATEGORY : Noun.
LEVEL : Preschool.
THEME : Insect - General.
TRANSLATIONS : Gogga (A)/ Intythwane (Z)/ Kokonyana (S).
EXAMPLE OF USAGE : Flies, bees, grasshoppers, and beetles are insects.
'n Insek het hom op die wang gesteek.

VARIATION 1: One-handed sign in which 5-hand (clawed), palm down, hand away moves away in wriggling motion.
Used by DET.

VARIATION 2: One-handed sign in which finger and thumb of A-hand, palm away, hand left, pinch corner of mouth.
Used by 2.

VARIATION 3: Two-handed sign in which index finger of dominant G-hand, palm down, hand away, wriggles away along palm of subordinate B-hand, palm up, hand away.
Used by 1, 3, 6.

VARIATION 4: Double-handed version of DET.
(VARIATION 1).
Used by 4.

VARIATION 6: Eenhandteken. G-hand, palm na onder, hand na links, wys na kant van mond en word vinnig na regs beweeg.
Used by 8, 9.

VARIATION 5: Two-handed sign in which dominant 5-(clawed) hand, palm down, hand left, makes crawling movement along back of subordinate B-hand, palm down, hand right.
Used by 5, 7.

Key: 1/N Tvl Tswana. 2/Soweto Sotho. 3/Zulu Natal. 4/Tvl Indian. 5/Natal English. 6/Cape English. 7/Tvl English. 8/Cape Afrik. 9/Tvl Afrik. DET/Sign taught in Dept Education and Training.

Figure 9: Excerpt: Dictionary of South African Signs (Penn, 1992).

is the finding that which lexical variety exists there is a strong common shared syntax which will surely become the basis of formal language teaching for the deaf in the future.

Before I pass on to future directions, mention should be made of two deaf South Africans whose rise to fame serve as an inspiration to all those who have struggled with an inequitable system:

The first is deaf artist Tommy Motswai born in 1963 a pupil of Kutlwanong school for the Deaf near Rustenburg, who has become a well known figure in South African art - his work has been hung in local and international galleries and has won awards including most recently the Standard Bank Young Artists award. His delightful work portrayed in Figure 10 captures the essence of South African society- its diversity, colour and its humour and reveals a sparkling wit and observation.

Figure 10: Children Play Love by Tommy Motswai (Reprinted from: Standard Bank Young Artist Award 1992. Photography: Michael Hall).

The second famous deaf South African is David Wright a poet of considerable influence having edited several anthologies and the *Penguin Book of Modern Verse*. Wright was born in Johannesburg in 1920 and became totally deaf from scarlet fever at the age of 7. He received some schooling here , then went to Northampton School for the Deaf and then to Oriel College, Oxford. He felt unsettled, lost and alienated at the Deaf school, not having learnt the sign of his peers, but at University he also felt a stranger in a hearing world (Wright 1969). In his verse he shows a cynical perception of life's paradoxes and injustices.

The last verse of his poem "Monologue of a Deaf man" is particularly poignant:

"Thus I too must praise out of a quiet ear
The great creation to which I owe I am

My grief and my love. Oh hear me if I cry
Among the din of birds deaf to their acclaim
Involved like them in the not unhearing air"

In the last lines of his own funeral oration which he wrote at the age of 30, he makes reference to his South African origins:

"Born in a dominion in which he hoped not to go back
Since predisposed to imagine white possibly black
His life, like his times, was appalling; his conduct odd
He hoped to write one good line; died believing in God"

Alas many of our talented deaf (like the hearing) are leaving South Africa like Wright because of lack of opportunities and frustration with the authorities.

Having dealt with the history of the topic, a look at the present state of affairs is relevant.

The current situation in South Africa

In South Africa, in sign language , as of course in many other things, things are in a state of transition. The ripples of the Gallaudet revolution have been felt worldwide and changes may be seen in many aspects relating to the Deaf in this country.

Sign language courses are being taught by deaf persons, the first deaf chairman has been appointed to SANCD , there is sign language interpreting in theatres and the deaf in Johannesburg organised a march through the streets two years ago to highlight their situation.

The situation in certain schools is slowly changing and although not formally legislated, the use of sign language is becoming more and more accepted - sometimes as a last resort when all else fails. Deaf teaching assistants are sometimes employed informally to assist their hearing counterparts.

Such informal change is I believe a reaction to the manifest failure of prescribed educational methods with the deaf and a frustration with the authorities:

At official levels, however, change is much less rapid. "None so deaf as those that do not hear."

There remains fragmentation and a lack of cohesive educational policy towards the deaf. As yet there are no proper courses for training teachers of the Deaf and no possibility of Deaf persons becoming registered teachers for the Deaf in this country. Some schools continue to actively punish the use of hands - even of natural gesture - and the children are reduced to "closet signing" in the playground, running the risk of developing fully neither oral nor sign language in the early years - a recipe for disastrous cognitive, social and vocational outcome.

Attitudes towards Deafness and handicap in general remain locked in a pathology/infirmity model which appears to be adhered to with vigour by far too many education and special education departments throughout the country. There is a huge lack of available resources and personnel and often some misguided decisions about even these limited resources.

Provision of expensive technology in the form of audiometers and hearing aids cannot substitute for the adequate training of specialised teachers. Until such time as there is an infrastructure throughout the country which can not only provide, but also service and use such technology, programmes which have as their very dubious goal the expensive equipping of deaf individuals and deaf schools throughout the country will have limited impact. The goal of education should surely be the development of language skills in all , not speech in the few who will benefit from amplification.

Once again one is reminded of the position put for-

ward by Lane and that is in medicalizing deafness, the majority "audist" culture stands to be considerably economically advantaged. Many deaf individuals derive little or no benefit from extremely costly hearing aids. This is a fine example of "biopower" which Foucault (1977) has referred to as being characteristic of medical advances in this century.

This argument has to be even more valid for cochlear implantation particularly in this country. Hailed as the "greatest advance in the treatment of deafness" briefly cochlear implantation involves a surgical procedure lasting about 3 and a half hours , and costing over R60 000 in which a multichannel electrode is implanted into the skull of the patient, so that acoustic energy can be converted into a type of mechanical energy which stimulates the auditory nerve. With intensive training, such individuals are able to detect and recognise distinct sounds and hopefully ultimately speech sounds. It was first approved by the Federal Drug Administration in 1985 for use with adults, and in 1989 for use with children over two years old. Several adults have been implanted with multichannel electrodes in South Africa and the first child was implanted in Johannesburg in October 1992. While the benefits of cochlear implantation in the postlingually deafened adult have been well demonstrated, cochlear implantation for the young congenitally deaf child is much more controversial. Not only is there relatively little research on their long term success but it calls to mind the whole ethical issue of child rights. There has been a very strong voice among Deaf groups internationally against such early and drastic intervention.In a sense to implant a child is to commit oneself to oralism, and hence a rejection of deaf culture and language. Further, it is a commitment to a great deal of intervention and money for relatively few individuals which is a highly questionable goal in a country like ours with scarce therapeutic resources. Cochlear implantation is for life. The adolescent or adult is not able to discard the device as he is a hearing aid. We may be creating a " culturally homeless" child who fits neither into a deaf or hearing world.

While not denying of course the need for such research we need to weigh up very carefully at the present time the distribution of relatively scarce resources.

Hopes for the Future

The issue of cochlear implantation like many others I have discussed this evening is far from resolved and presents a lively, often emotional battlefield for differing opinions on language and culture. I believe that the topic of sign language and the issues which surround it, is in a sense a microcosm of many of the issues that face South Africa today, in that it reflects a history of debate, oppression,linguistic, cultural and educational schisms.

There is a great need to be objective and to proceed with properly conducted research. Some of the questions which have up to now been ignored for reasons of cultural prejudice, are now ready for study. Under the large file I have called "Reasons for Staying in South Africa" which alas all too often is disregarded by the cream of our profession, I must include the wonderful, relevant, exciting prospects in the area of Sign language research which exist in this country.

The relationship of hearing society to the deaf community has up to now been largely paternalistic, prescriptive and medicalizing. We need to "depathologize" Deafness as Woodward (1982)suggests and begin to understand and appreciate an alternate view to Deafness. I sincerely hope that this will happen in my own Department.

In conclusion, I would like to use this platform to indulge myself in stating publicly some of my hopes for my Department and my profession and for the future of the Deaf in South Africa.

Deafness in its cultural and linguistic manifestations is an area of concern for a number of disciplines in this country. It is not only a medical problem, it is not only an educational challenge. It is a veritable banquet for practitioners and researchers, for historians, language planners, sociologists and philosophers, a reason perhaps, that I continue to regard the Arts Faculty as the happy home of our Department.

Facts about Deaf Language and culture should be taught formally at all levels and I hope that this University will continue to be a forerunner in this regard - supporting the sign language classes that have started here, the mooted development of courses for sign language interpreters within the Department of Translation, the acceptance of deaf students into academic programmes and the provision of interpreters for them within lectures. Particularly I hope that this university will move in the direction of promotion of deaf teacher training and registration. This is not a new idea. Indeed in 1803 Abbe Sicard suggested: "As a foreigner is not fit to teach a Frenchman French, so the speaking man has no business to meddle with the invention of signs, giving them abstract values." (Kyle and Woll, 1985.)

I believe that the time is ripe in the country for the Deaf to become fully involved in their own affairs. There are many positive indications that there is a groundswell among teachers of the deaf and the Deaf themselves which will hopefully affect policy in the near future.

I hope to see a name change from the current National Council *for* the Deaf to National Council *of* the Deaf. We are seeing here an increasingly empowered group who hopefully using the developing research base as justification can begin to be involved in their own future, in guiding educational policy, in informing the hearing public about Deaf culture and language, in decision making and in research.

> "What matters deafness of the ear when the mind hears... The one true deafness, the incurable deafness is that of the mind." Victor Hugo (1845)

During the course of history, health practitioners, scientists and educationalists have labelled various groups biologically inferior: these include women, blacks, gays and deaf people. South Africa I hope is at last moving away from some of its institutionalised legislation in this regard. It is my ardent hope that the future of the Deaf in this country should reflect such changes of perspective .

ACKNOWLEDGEMENTS

It remains for me to thank those who have shaped my ideas through the years and who have assisted in the conception and the production of this lecture :

Being aware of the somewhat controversial nature of my topic, I must assume full responsibility for what I have said but gratefully acknowledge the input and inspiration of many others:

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Finally and most important I would like to thank my Deaf friends and colleagues who have in the past few years allowed me some glimpses and insight into their language and culture and who have radically changed my attitudes towards disability and my visions for the profession in this country.

The fact that the large group of Deaf people who cooperated in the dictionary project and coming from widely differing geographic, racial, religious, educational and linguistic backgrounds could within a few hours - even minutes, link so successfully and communicate so well is a tribute to the power of their language and the limitless flexibility in a difficult world.

The salience of Deaf identity overshadows differences of ethnicity, age, class and gender which are so prominent in hearing society. It is my ardent hope that all South Africans will take up such a common cause and move towards better communication in the future.

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Departmental evaluation: Speech therapy and audiology, An academic department aimed at teaching a profession

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ABSTRACT

In a recently established policy guideline of the Department of National Education it was clearly indicated that programmes and departments at tertiary education institutions should institute evaluation procedures as a matter of urgency. This has become necessary to provide a basis for decision making and policy formation, to accredit programmes, to monitor expenditure of public funds and to improve educational material. It is the aim of this paper to develop an evaluation model, based on accepted education principles, for evaluating the actual performance of a Department of Speech Therapy and Audiology. A basic management model is used and specific functional indications are given of the steps that should be taken in evaluating a department. The model is a comprehensive one which can easily be adapted for use in other departments.

OPSOMMING

In 'n belangwekkende publikasie van die Departement van Nasionale Opvoeding is aangedui dat dit tans gebiedend noodsaaklik geword het dat departemente verbonde aan tersiêre opleidingsinrigtings dringend moet beplan om evalueringsprogramme te loots. Die redes hiervoor is dat evaluering basisinligting verskaf vir beleidsbesluite, akkreditering van programme moontlik maak, besteding van fondse monitor en akademiese opleidingsmateriaal en -stelsels verbeter. Dit is die doel van hierdie artikel om 'n evalueringsmodel, gegrond op erkende opvoedkundige beginsels, te ontwikkel vir gebruik in die bepaling van waarde van 'n departement vir spraakheelkunde en oudiologie. 'n Bestuursmodel is geselekteer en spesifieke aanduidings is verskaf van die strategieë, stappe en norms wat gebruik kan word in departementele evaluering. Die model is 'n omvattende een wat suksesvol aangepas kan word vir gebruik deur ander departemente.

> "Due to the complex nature of human communication and its disorders, it is essential that information of an academic, research and scientific nature is continually developed and evaluated. A university provides the optimal environment for constant academic validation of current professional training."
>
> Feldman 1981, p 942

1 INTRODUCTION

Evaluation, or the need to determine the worth and merit of whatever is being evaluated, is a well-known concept. There is ample evidence that evaluation in education was an accepted practice even prior to 1920. From the literature, it is equally clear that the debate is still raging on how evaluation should be conducted and what role it should fulfil in different spheres.

The emergence of educational evaluation in terms of student outcomes and institutional effectiveness has been a significant trend in higher education in the past few years (Nichols, 1989, p vii). In the United States of America, for example, standards are established and enforced to ensure institutional quality. To maintain accredited status, institutions must be evaluated periodically to demonstrate achievement of standards and to document ongoing efforts for institutional improvement (Middleton et al., 1989, p 15). In Europe too, there is growing emphasis on the philosophy of value for money, and funding for higher education is therefore being linked directly to performance (Goedebuure et al., 1990, p 15). Institutions for higher education throughout the world increasingly accept the fact that they are accountable to political authorities and to the communities they serve. Establishing evaluation programmes at institutional, departmental and programme levels in higher education serves the dual purpose of proving quality of performance to stakeholders, while at the same time protecting the traditional autonomy of tertiary education institutions.

In South Africa, education authorities clearly indicated in a policy statement that academic departments are expected to institute evaluation procedures aimed at internal evaluation and to plan for external evaluation according to prescribed guidelines (NASOP 02-129 87/10).

In spite of the contemporary urgency of evaluation at tertiary level, no formal and generally acceptable evalua-

tion model has been developed that could be used to provide quantitative information on the actual performance of departments in general.

Wolf (1990, p 19) reports that there are no less than fourteen different evaluation models and five different approaches. There is also little agreement or data to support the efficacy of one model or approach over another. Evidently the fundamental problem is that the various models are built on differing and often conflicting conceptions and definitions of evaluation (Worthen & Sanders 1987, p 44).

In view of the above, the following problem statement can be formulated:

What are the principles involved in structuring an evaluation model for an academic department engaged in a professional programme aimed at developing Speech Therapists and Audiologists?

2 RESEARCH OBJECTIVES AND DESIGN

The objective of the study is to develop an evaluation model, based on accepted educational principles, for evaluating the actual performance of a department of Speech Therapy and Audiology in South Africa, in order to address the specific needs of this unique and divers context.

To attain this objective, a research plan comprising of two consecutive stages was devised:

- establishing the underlying principles of evaluating programmes and departments in tertiary education institutions by means of a comprehensive literature study
- developing a proposed model for the evaluation of a department of Speech Therapy and Audiology.

3 CONCEPTUAL AND CONTEXTUAL ISSUES OF EVALUATION

3.1 Terminology and concepts

As previously indicated, various approaches and definitions of evaluation may lead to fundamental differences in educational evaluation. The term *evaluation* for example, may be interpreted to mean measurement, appraisal, assessment, professional judgment, scientific enquiry, a political activity or an act of collecting and providing information (Worthen & Sanders 1987, p 22). In this study, evaluation will be interpreted as the act of rendering judgment to determine worth or merit that is:

> ... the making of judgments about the worth and effectiveness of educational intentions, processes and outcomes; about the relationships between these; and about the resource, planning and implementation frameworks for such ventures. (Adelman & Alexander, 1982, p 5.)

Because of differences in interpretation and the divergent use of evaluation processes in various institutions and also in different countries, the meaning attached to evaluation concepts and procedures may be utterly confusing. Nisbet (1988, p 4) suggests a cognitive map to assist in establishing a common understanding of concepts and their role in evaluation. This is represented in Figure 1. Only the most important (and perhaps most controversial) concepts referred to in this figure will be dealt with here.

The controversy about the *formative* or *summative* nature of evaluation has raged for many decades. In essence, the question is whether evaluation should provide immediate feedback of information useful to programme developers who would use the information for revision during the development process (formative evaluation). Contrary to this point of view, summative evaluation is conducted at the end of the programme and is aimed at providing judgment about the value of a programme. Since the evaluation of an academic department is the subject of this study and because academic departments, like academic programmes are forever changing and in a state of development, formative evaluation is of crucial importance. However, it is equally important to provide feedback to authorities about the actual performance of an academic department at particular times (at the end of an academic or financial year or review cycle, for example). Hence evaluation in the context of this study must also perform a summative role.

Linked to the issue of formative and summative evaluation is the question of *internal* or *external* evaluation. Because of the immediateness of formative evaluation, information provided by this type of evaluation is valuable to departmental managers and often used to effect improvements. This type of evaluation is therefore frequently undertaken internally with internal evaluation objectives in mind. Summative evaluation, however, can be used for accountability and is often undertaken by external evaluators commissioned by some external audience or decision maker.

As an extension of the argument that formative as well as summative evaluation play an essential role in departmental evaluation, it is evident that in evaluating the academic department, both internal and external evaluation are essential.

The *quantitative* or *qualitative* base of evaluation is another conceptual issue referred to in the cognitive map depicted in Figure 1. Qualitative inquiry focuses on processes rather than outcomes and uses an inductive approach to data analysis while quantitative inquiry focuses on numbers by emphasizing standardization, precision, and objectivity (Worthen & Sanders, 1987, p 51).

However, in departmental evaluation quantitative and qualitative methods can be regarded as compatible and complementary approaches. Worthen and Sanders (1987, p 53) support this premise and point out that the trend in evaluation today is towards methodological pluralism.

The concepts of *accountability* and *professionalism* are of particular importance in the context of evaluation (see Figure 1). Educational accountability is the responsibility for identifying and measuring educational outcomes and using the information about these outcomes for decision making (Kogan, 1986, p 75). Accountability has three major dimensions in education. *Moral accountability* is related to the fact that academic institutions are answerable to their clients. This implies that if resources are spent on educational programmes, it is necessary to determine whether the programmes (or departments) achieve what they are designed to achieve (Lee & Sampson, 1990, p 157). Evaluation of performance outcomes provides proof of academic quality and it is important to note that funding for higher education is increasingly linked to the quality of this performance (Goedegebuure et al., 1990: 15). *Professional accountability* refers to the fact that academicians are answerable to themselves and to their colleagues in

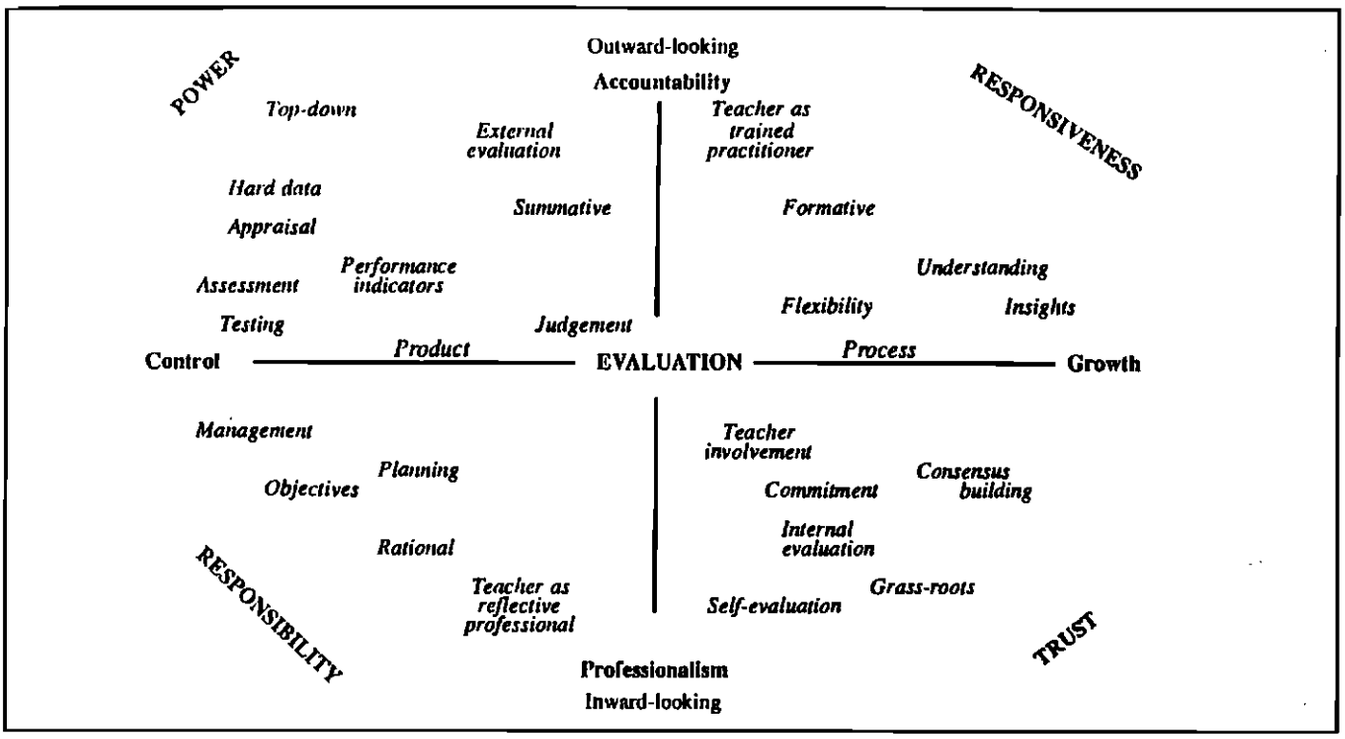

Figure 1: Evaluation - a Cognitive Map.

academy. Professional accountability is therefore fundamental to self-evaluation and peer evaluation. Peer evaluation is indeed the oldest and most fundamental of all evaluation principles in higher education (Kogan, 1989, p 118). Finally, educational accountability also encompasses *contractual accountability*. Academic departments are therefore answerable to management in higher education as well as to political authorities.

3.2 Purpose and objectives of departmental evaluation

Evidently the first step in any evaluation procedure is to determine the purpose and objectives of the evaluation process (Worthen & Sanders, 1987, p 147). This is not only dictated by logic but is vitally important because educational evaluation is always undertaken within a particular context.

Important contextual parameters can be determined by clarifying beforehand issues such as why evaluation is being undertaken, who the main audiences are, to what use evaluation findings may be put, what method of enquiry should be used and who should do the evaluation (House, 1986, p 16).

An analysis indicates that the purposes and objectives of departmental evaluation can be subdivided into three major categories.

□ ***Improvement (organisational learning)***

A major objective of departmental evaluation is to generate useful information for the improvement of departmental activities: information to management of the department for decision making and to do planning. Seldin (1988, p 24) points out that there is no better reason to evaluate than to improve performance. Evaluation data assist the faltering, motivate the tired and encourage the indecisive. Supplementary (but related) to this, is the evaluation objective of incorporating into the operation of the academic department an ongoing concern for self-study and self-improvement (Kells, 1989 p 100).

□ ***Accreditation***

In this category, the objective of evaluation is to assess the extent to which accreditation standards are being met. It also provides useful written material for the evaluation team and formal reports for the accreditation authorities.

□ ***Accountability***

As previously indicated, a major objective of evaluation is to provide proof that resources are used optimally (contractual and moral accountability). An additional objective is to ascertain the quality of higher education provided by the academic department (professional accountability). Finally, the objective of the evaluation process should be to provide a clear statement of the relationships between the goal and objectives of the academic department and the mission statement of the institution (contractual accountability).

The importance of the conceptual and contextual issues discussed in the above paragraphs gains additional perspective for departmental evaluation when viewed against the background of specific concerns relevant for academic training for professional programmes.

3.3 Specific concerns relevant to evaluating education programmes for the professions

The central feature that distinguishes a professional academic programme from general university courses can

be found in the definition of a profession. According to Hughes (1963, in Goodlad, 1985, p 7) the central feature of all professions is the motto "credat emptor" (let the buyer trust). Thus is the professional relation distinguished from markets in which the rule is "caveat emptor" (let the buyer beware). To develop an individual that embodies this code of conduct implies the incorporation of very specific academic aims, strategies and procedures in the education programme.

The one unchanging feature of professional training (and perhaps the main factor that distinguishes professional academic training from other university programmes) is unceasing movement towards new levels of performance. In this energizing process some of the following characteristics are observable:

- concern with mission / function clarification
- mastery of theoretical knowledge
- capacity to solve problems
- credentially
- public acceptance
- ethical practices (Nowlen, 1988).

This feature is usually utilized in the evaluation done by professional training bodies. These bodies play an important role in establishing minimum standards for education and training, in controlling professional ethics and even in structuring university programmes. This may, on the one hand, be negative because it can function in direct opposition to the autonomy of academic institutions. On the other hand the professional bodies can contribute to the objective determination of worth of a specific department because of their role as independent external observer of actual performance.

There are moreover specific considerations appropriate to the evaluation of an academic department concerned with programmes for Speech Therapy and Audiology.

Firstly, academic departments for Speech Therapy and Audiology in the RSA have the general characteristics of all academic departments in a developing country. Their main characteristic is the fact that up to now the departments have failed to establish sustainable capacity for monitoring and evaluation. In consequence there is a lack of information on educational outcomes and costs. In an era of constrained resources for education development this implies that the effects of investments are difficult to gauge and lessons of experience difficult to accumulate (Middleton, et al., 1989, p 1).

Secondly, on a ground roots level, evaluation of departments for Speech Therapy and Audiology must take certain practical characteristics into consideration. These include:

- a low student-lecturer ratio and in conjunction with this a low student enrolment figure attributed to the policy of individual training and practical limitations;
- high grades of students and a low failure rate because of student selection practised by most universities;
- the difficulty in evaluating practical training of students where qualitative rather than quantitative measures are employed;
- the fact that practical training is dependent on the availability and cooperation of outside agencies like hospitals, schools and clinics;
- the influence on programmes by systems independent of the academic institutions, such as the National Health Policy, the Professional Board for Speech Therapy and Audiology and the South African Medical en Dental Council.

4 A MODEL FOR THE DEPARTMENTAL EVALUATION PROCESS

4.1 Conceptual basis

A classification by Worthen and Sanders (1987, p 60) of different approaches to evaluation identifies six categories:

- objective oriented approaches
- management oriented approaches
- consumer oriented approaches
- expertise oriented approaches
- adversary oriented approaches
- naturalistic- and participant-oriented approaches

In analysing each of the above categories it became immediately obvious that the management approach would be a valuable basis for evaluation of a professional academic department for Speech Therapy and Audiology. There are three compelling reasons for this preference. The management approach to education which regards education as essentially an instrumental activity designed to bring about the achievement of specifiable and uncontroversial educational goals is becoming increasingly dominant (Mortimore & Stone, 1990, p 69). This is especially true of tertiary institutions in general and universities in particular. The choice of the management approach for departmental evaluation is therefore congruent with a general trend. The second reason is that any department of Speech Therapy and Audiology is today, with the general movement at universities towards accreditation, reduced funding and unavailability of qualified academic staff (Strydom et al., 1991), involved in a struggle for survival. A management approach towards evaluation will provide valuable information for decision making (and decision makers) in this endeavour. Lastly the management approach, if correctly understood and used in context, includes many of the characteristics and principles of the other six approaches towards evaluation in education. It is therefore a comprehensive basis for departmental evaluation.

The questions now are: what is the management approach to evaluation and how can it be utilized by a department of Speech Therapy and Audiology?

In their analysis, Worthen and Sanders (1987, p 77) state that the management approach to evaluation is meant to serve decision makers. They continue to emphasise that, by highlighting different levels of decision makers (levels of management), this approach clarifies who will use evaluation results, how they will use them and what aspects of the system they will be making decisions about.

In the normal management control procedure in an organisation information about actual performance is channelled to operational management, middle management and top management in accordance with the nature of the information and the control process. This is conceptually identical to the principal characteristics of educa-

1. Internal departmental self-study	2. External review or site visit by experts	3. Review of reports
• Audience - operational management	• Audience - middle management	• Audience - top management
• Formative evaluation	• Formative / summative evaluation	• Summative evaluation
• Aimed at improvement	• Improvement and reporting	• Review reports generated by self-study and peer group
• Departmental management	• Peer group of professionals	• Faculty / institutional management / political authorities
• Professionally accountable	• Professionally / Contractually accountable	• Contractual accountable

Figure 2: Management Approach to Departmental Evaluation.

tional evaluation referred to in paragraph 3.1.and can be illustrated in Figure 2.

Firstly, according to the improvement purpose of evaluation, information is provided to departmental management to continually effect improvement. This is clearly formative evaluation aimed at enabling departmental management to be professionally accountable. *Secondly*, in accordance with the accreditation purpose, information about the department and the actual performance of it's activities is forwarded to some higher authority (faculty management level or even institutional management level). This evaluation is clearly of a summative nature although it may contain some formative elements. Evaluation information at this level enables departmental management to be contractually accountable. *Thirdly*, in order to answer to moral accountability, evaluation information is provided to the highest management levels in tertiary education, the political authority that controls funding and also to other stakeholders such as professional boards and statutory controlling bodies. The control hierarchy typical of ordinary management control procedures is therefore also embedded in the basic principles of educational evaluation.

The implications of the preceding arguments for evaluating a department of Speech Therapy and Audiology using the management approach, are in essence that a three-tier evaluation hierarchy with the following characteristics should be constructed (adapted from Kells, 1989, p 99):

- an internal departmental self study prepared by the professionals concerned, using an evaluation model with a management approach;
- an external review or site visit by experts in Speech Therapy and Audiology (peer evaluation) using the evaluation data generated by the internal study and other suitable evaluation procedures. This can be used in conjunction with a report from the Professional Board for Speech Therapy and Audiology, but should not be based on such an evaluation alone;
- a review of the internal departmental report(s) and the reports of the external peer evaluation by a professional group in the institution (faculty management or institutional management) and by the controlling board of the profession.

4.2 Proposed model

The evaluation model proposed in this section is a conceptual model based on the general principles of educational evaluation and on guidelines for departmental evaluation discussed in previous paragraphs. The model is illustrated in Figure 3, and in broad terms follows six logical steps.

4.2.1 Preplanning for evaluation

The first step for departmental management is to identify clearly the need for evaluation why the department should be evaluated. This decision can only be finalised once the persons and organisations who are likely to be interested in the evaluation results have been identified. Information generated by evaluating the department of Speech Therapy and Audiology is aimed at a three-tier audience departmental management; an external review board of experts; and at top management, at institutional and political levels.

In general the reasons for evaluating an academic department can include any of the following (Worthen & Sanders, 1987, p 8):

- improving student development and performance
- enhancing educator qualifications and performance
- improving the departmental organisational structure
- upgrading textbooks and other curriculum materials and products
- determining whether to continue, modify, expand or terminate an existing programme
- reviewing and improving curriculum design and processes.

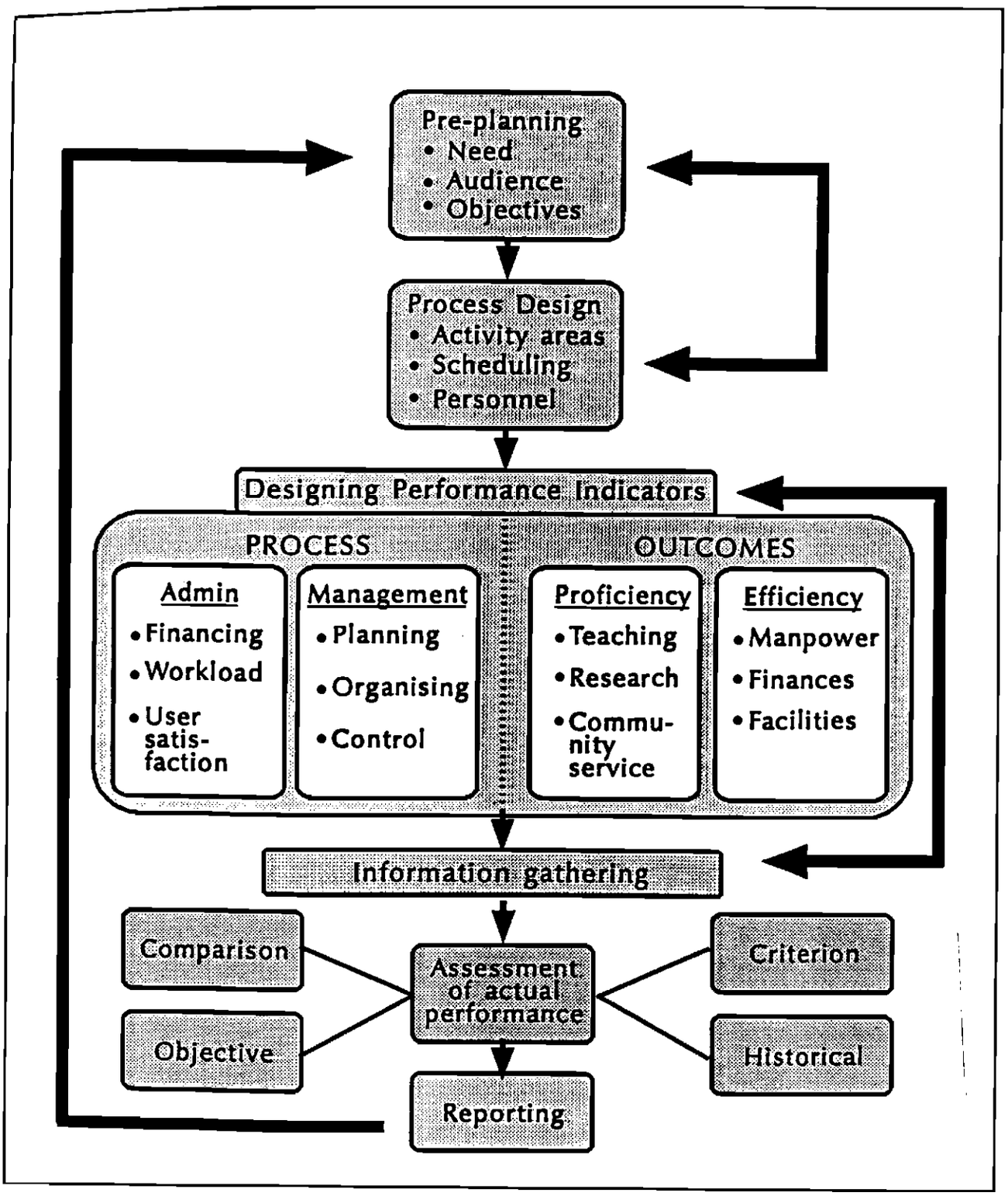

Figure 3: Evaluation Model.

This step also involves demarcating exactly what should be evaluated (for example, administration, programmes, organisational structures or research outputs) and identifying the purposes and objectives of the evaluation. Finally, the pre-planning phase should also include a survey of the resources available for evaluation.

4.2.2 ***Evaluation process design***

Drafting a plan of action for departmental evaluation is the main objective of this step. Based on the demarcation exercise in the first step and on the purpose and objectives of the evaluation, major departmental activity areas to be evaluated must be identified.

Figure 3 indicates that departmental evaluation for Speech Therapy and Audiology can be subdivided into two major but interrelated entities: *process evaluation* and *outcomes evaluation* (adapted from Worthen & Sanders, 1987, p 77 and House 1986, p 17).

On the process side, administrative evaluation is aimed at how well the administrative support activities of the

department function. In addition, the evaluation is also aimed at determining how well the department is being managed. Process evaluation provides an overview of the ability of the department to function dynamically and flexibly and of its capacity to survive.

In the outcomes section there are two major subdivisions or components. Evaluation procedures aimed at establishing how well the department is doing what it is supposed to do, i.e. success in attaining its objectives (*proficiency* also referred to as effectiveness) is one component. The second is the *efficiency* component, and it refers to how well the department is utilising the resources at its disposal.

Figure 3 also shows that the major objectives of the department that must be realised are in the activity areas of education, research and community service. The most important resources at the disposal of the department are manpower, finances and facilities.

4.2.3 ***Planning and designing performance indicators for evaluation***

Establishing performance measures and the concomitant norms, involves, in effect, designing yardsticks for the practical evaluation of departmental performance. A *performance measure* represents an integrated group or category of related departmental characteristics or activities that jointly provide a picture of a specific departmental outcome or result. *Evaluation norms* are a series of measurement techniques whereby quantitative values and/or relationships can be determined for specific departmental activities, several of which jointly depict departmental performance in terms of a performance measure (Hugo & Van Rooyen, 1990, p 295).

It is essential that a large number of measures and norms be determined for each major activity area identified in step 2. Here follow some measures and norms that may serve as examples. It is however necessary that every department should develop its own specific measures and norms based on internal characteristics and in conjunction with the aims of the department.

4.2.3.1 ***Measures and norms for process evaluation***

□ *Administration*

Measures and norms for administrative activities must be based on a comprehensive description of the administrative task. Measures and norms evaluating both proficiency and efficiency are essential. The following are examples (adapted from Wirgin & Braskamp, 1987, p 29).

1. Financial consideration:

$$\text{Total cost ratio} = \frac{\text{Annual administrative budget}}{\text{Total departmental budget}}$$

$$\text{Cost of typing} = \frac{\text{Annual cost of typing staff}}{\text{Number of pages of study material produced}}$$

2. Administrative workload:

$$\text{Spread} = \frac{\text{Number of assignments processed a month}}{\text{Average number of assignments processed per month}}$$

3. User satisfaction: administrative services:

$$\text{Lead times} = \frac{\text{Average waiting time (hours or days) for typing, photocopying any month}}{\text{Average waiting time for same tasks previous month}}$$

$$\text{Travel arrangements} = \frac{\text{Number of errors in travel arrangements}}{\text{Total number of requests for travel arrangements per time period}}$$

□ *Management*

Evaluation of management attempts to obtain a picture of how thoroughly the management elements of planning, organising, coordinating and controlling are implemented. At managerial level the management elements are therefore used as performance measures. Bearing in mind that the managerial process is an interactive process between the different elements of management, it is obviously not possible (nor desirable) to isolate the contribution to performance outputs of any particular element of management in the evaluation process. The evaluation of management performance is therefore largely conducted on a subjective basis with the aid of an evaluation sheet or questionnaire.

4.2.3.2 ***Measures and norms for outcomes***

4.2.3.2.1 ***Proficiency***

Proficiency measures and norms are aimed at determining how successful a department of Speech Therapy and Audiology is in attaining its goals. The most important of these goals are in the three areas, teaching, research and community services as indicated in Figure 3. Here follow examples of measures and norms to determine proficiency on the attainment of goals on these three areas:

□ *Teaching*

1. Staff teaching performance:

$$\text{Student feedback} = \frac{\text{Average assessment of students for a particular course}}{\text{Average assessment of students - all courses in the department}}$$

$$\text{External examiners} = \frac{\text{Number of appointments of } M + D \text{ examiners for individual staff members}}{\text{Total number of appointments of } M + D}$$

2. Staff quality:

$$\text{Qualification ratio} = \frac{\text{Number of staff members with doctorates}}{\text{Total number of academic staff in department}}$$

3. Student performance:

$$\text{Completion ratio} = \frac{\text{Students: Completion of course in four years}}{\text{Students Completion of course in more than four years}}$$

$$\text{Average pass mark} = \frac{\text{Average pass mark: students in 1st, 2nd, 3rd and 4th year in Speech Ther/Aud}}{\text{Average pass mark: students in the faculty}}$$

□ *Research*

1. Output:

$$\text{Publications} = \frac{\text{Number of accredited papers this year}}{\text{Average number of accredited papers in last 3 years}}$$

$$\text{Productivity} = \frac{\text{Total number of research publications this year}}{\text{Man-years allocated to research this year}}$$

$$\text{Student activity} = \frac{\text{Number of active doctoral students/year}}{\text{Number of registered doctoral students/year}}$$

2. Quality:

$$\text{International ratio} = \frac{\text{Number of internationally published articles this year}}{\text{Total number of articles published by the department}}$$

$$\text{Composition of research} = \frac{\text{Number of research papers: basic/applied/dissertation/monographs/accredited/proceedings/reports}}{\text{Total number of papers/publications published}}$$

3. Impact:

$$\text{Citations} = \frac{\text{Number of citations in research publications in past 3 years}}{\text{Number of citations in this field: Science Citations Index}}$$

□ *Community service*

1. Involvement:

$$\text{Representation} = \frac{\text{Number of staff on boards of associations/institutes this year}}{\text{Membership fees paid by department}}$$

2. Continued education:

$$\text{Certificate programmes} = \frac{\text{Number of students registered this year}}{\text{Number of students the previous year}}$$

4.2.3.2.2 ***Efficiency***

Evaluation of efficiency is aimed at determining how well the department is utilising the scarce resources at its disposal. The measures applied for efficiency essentially depict the ratio between the inputs (for example, man-hours) and a outputs of the department of Speech Therapy and Audiology (Hugo & Van Rooyen, 1990, p 298).

Most academic departments have only three major resources available: manpower, finances and facilities (see Figure 3).

□ *Manpower*

1. Workload:

$$\text{Input ratio} = \frac{\text{Number of postgraduate students qualified/year}}{\text{Number of professors in department/year}}$$

$$\text{Distribution} = \frac{\text{Number of assignments marked by individual lecturer}}{\text{Average number of assignments for all lecturers}}$$

2. Development:

$$\text{Conference attendance} = \frac{\text{Number of conferences attended by all staff}}{\text{Total number of academic staff}}$$

$$\text{Study leave} = \frac{\text{Number of staff on sabbatical/year}}{\text{Total number of academic staff}}$$

3. Growth of academic staff:

$$\text{Growth rate} = \frac{\text{Growth rate of academic staff/5 years}}{\text{Growth rate of students registered/5 years}}$$

$$\text{Qualification ratio} = \frac{\text{Number of staff who acquired doctoral degrees in the past 2 years}}{\text{Average number of staff in the department}}$$

□ *Finances*

1. Budget objectives:

$$\text{Conferences} = \frac{\text{Total budget allocation for conference attendance}}{\text{Number of conferences attended by staff/year}}$$

$$\text{Photocopying} = \frac{\text{Total budgeted cost for photocopying/year}}{\text{Actual budgeted cost for photocopying/year}}$$

2. Availability of finances:

$$\text{Ratio of financing} = \frac{\text{Increase in student subsidy units in past 3 years}}{\text{Increase in actual departmental budget in past 3 years}}$$

$$\text{Total budget} = \frac{\text{Total budget allocated to department/year}}{\text{Total academic staff complement/year}}$$

□ *Facilities*

1. Utilisation:

$$Computertime = \frac{\text{Actual number of hours utilised on research mainframe computer}}{\text{Budgeted number of hours on research mainframe available / year}}$$

$$Library = \frac{\text{Total number of loan requests for department / year}}{\text{Total number of academic staff in department}}$$

2. Availability:

$$Computerisation = \frac{\text{Number of PC's available in department}}{\text{Total number of academic staff in department}}$$

$$Accommodation = \frac{\text{Area of office space available to department}}{\text{Number of students registered in}}$$

4.2.4 Information gathering and quantifying deparmental outcomes (results)

In this step basic data are collected and analysed using the measures and norms identified. In step 3 it may be necessary to review some of the measures and norms during this exercise because the process of gathering information sometimes reveals relevant aspects of performance that were ignored in the planning phase, or alternatively, the data required for specific measures and norms may not be available.

4.2.5 Evaluating actual departmental performance

This step involves the actual evaluation, judgment or assessment of the evaluation data generated in step 4 in order to draw a conclusion about the worth or value of departmental performance.

Four major approaches can be used in judging or assessing actual departmental performance (adapted from Worthen & Sanders, 1987 p 302 and Hugo & Van Rooyen, 1990, p 302):

- comparison referenced assessment performance is judged against other academic departments
- criterion referenced assessment performance is compared to absolute standards
- objective-referenced assessment actual performance compared to planned performance or specified performance objectives
- historically referenced assessment actual performance is compared to own previous performance or performance trends based on historical data.

4.6 Reporting

The evaluation report aims at providing evaluation information (based on quantitative and qualitative elements of the evaluation procedure) to relevant authorities. As in the case of an academic department, these authorities may be departmental management, faculty management or political authorities. It is essential that the report should be drafted with reference to the purpose and objectives of the evaluation plan. Based on evaluation information, it should also indicate areas or activities where improvement is recommended and should reflect possible future developments.

5 CONCLUSION

The evaluation model proposed above is a conceptual model designed to be used for and by the a department of Speech Therapy and Audiology. It is essential to realise that in the implementation of the model, contextual influences unique to each department will have to be considered in structuring appropriate measures and norms. The principles on which the model is based are not new, and its only merit may perhaps be found in a logical structure for the measurement of departmental performance.

> *Measuring outcomes of educational practices is a modern phenomenon. Valuing their worth is as old as philosophy itself.* House, 1986 p 1

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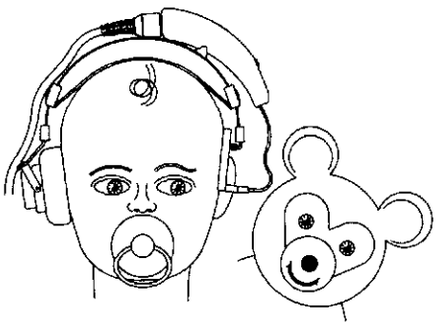

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The Mind-mapping Approach (MMA): A Culture and Language "Free" Technique

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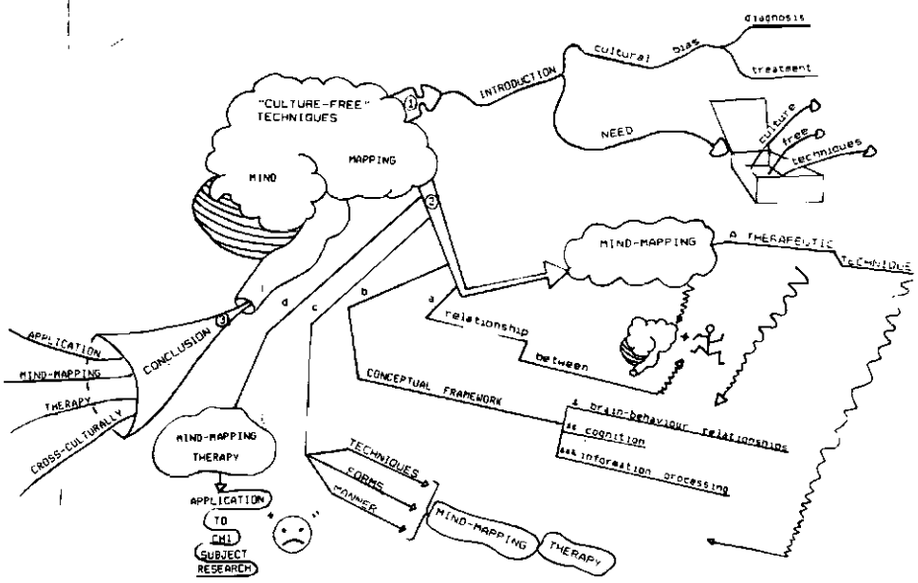
ABSTRACT

Although the roots of the Mind-Mapping approach (MMA) reach back into the depths of psychology, it is our growing understanding of the human brain, how it functions, what affects it, how we can assist it - which has become the real foundation for the model discussed in this paper. By finding ways of creating environments that are brain compatible - or rather - brain enhancing, we can begin to serve the whole person in all his dimensions. In this paper the need for language and culture "free" therapeutic techniques will be discussed. Reference is made to the author's research where the MMA was used very successfully with a closed head injured (CHI) client in order to demonstrate the effectiveness of the technique. The problem of CHI is also discussed. In addition, a brief theoretical review of the brain as it pertains to the concept of the MMA is offered. In the conclusion, it is suggested that global techniques such as the MMA, which are based on fundamental and universal principles, are the route to finding language and culture "free" techniques.

OPSOMMING

Alhoewel die oorsprong van die Breinkaartbenadering tot die grondbeginsels van die sielkunde teruggevoer kan word, is dit ons toenemende begrip van die menslike brein, die funksionering daarvan, waardeur dit beïnvloed word en hoe breinfunksionering ondersteun kan word, wat die werklike grondslag uitmaak van die model wat in hierdie artikel bespreek word. Deur wyses te vind vir die daarstelling van omgewings wat breinfunksionering versterk, kan 'n vertrekpunt gevind word vanwaar ons die kliënt as geheel in al sy dimensies kan benader.
Die behoefte aan "kultuurvrye" terapeutiese tegnieke word bespreek. Daar word verwys na die outeur se navorsing waar die Breinkaart as terapiemodel met sukses aangewend is by 'n geslotehoofbeseerde kliënt. Die problematiek van geslote hoofbeserings word ook bespreek. Daarbenewens word 'n kort teoretiese oorsig van die brein, met betrekking tot die konsep van die Breinkaartbenadering tot intervensie, verskaf.
Ten slotte word daar voorgestel dat globale tegnieke soos die Breinkaartbenadering, wat gebaseer is op fundamentele en universele beginsels, die weg is waarvolgens "kultuurvrye" tegnieke gevind sal word.



INTRODUCTION

Speech-language and hearing therapy can be defined as "the delivery of services to (all) individuals with speech-language-hearing disorders, aimed at the amelioration of communication difficulties stemming from such disorders" (Uys & Hay, 1985). Therefore, the provision of quality services to all groups and individuals is the goal of speech and language therapists worldwide. However, socio-economic, sociopolitical and demographic shifts over time have intensified "existing inequities in service delivery to specific groups" (ASHA, 1991:5).

In fact a great deal of disparity in service delivery exists in the profession (ASHA, 1991). Taylor (1986, p 3), attributes this disparity to two factors viz: Speech Therapists have a poor perception of the distinction "between a legitimate linguistic *difference* and a speech and language *disorder*". Secondly all communication norms are based on a middle-class Euro-American model (Taylor, 1986). Clearly, there is a need for greater understanding of dialect and language differences and for a clinical perspective that appropriately addresses these differences.

In South Africa it is extremely difficult to meet the needs of all individuals and to fulfil these goals as speech therapists are faced with two unique problems, namely:

- the therapist-patient ratio which is approximately 1 : 6000 annually;
- and the widely spread, multicultural, multilingual society (Uys & Hay, 1985).

Therefore, in order to be effective, a therapist needs to learn a minimum of 30 languages and as many cultures (Uys & Hay, 1985). Based on this argument, a therapist is not able to give effective accountable therapy cross-culturally. Hence, the need arises for culture and language free techniques that deal with this problem.

In this article, the Mind-Mapping Approach (MMA) developed by Leaf (1990) for Closed Head Injured (CHI) patients, will be discussed as a possible language and culture "free" technique for the multilingual and multicultural population group specifically of South Africa. The authors view language and culture as interdependent concepts, thus the language used is a reflection of the culture. The MMA is a Metacognitive technique and therefore the linguistic elements are not worked on directly. Thus, language is used as a tool in the MMA, as the MMA is a metacognitive technique (Leaf, 1990). If linguistic delays are presented by the client, these can be treated within the framework of the MMA.

MIND-MAPPING : A THERAPEUTIC TECHNIQUE FOR CHI.

CHI presents speech and language therapists with a unique diagnostic, prognostic and treatment challenge as a result of the widespread diffuse damage experienced by these patients, as well as the tendency to a lengthy recovery (Hagen, 1984). The general lack of understanding of the sequelae of CHI has inhibited the development of assessment tools, and few treatment guidelines have been proposed in literature. Thus there is a need for clinicians working with head injured patients to be able to identify and develop treatment regimes, that have functional goals involving behaviours that will make a difference in the way each person functions in his or her cultural environment (Adamovich, 1986). Due to the need for the development of accountable therapy techniques that deal with the complex problems of CHI, the strategy of Mind-Mapping therapy was developed and tested on a CHI subject (Leaf, 1990). As this research yielded exciting results, the technique will be elucidated in order to demonstrate the flexibility and effectiveness of this approach. It also provides a theoretical underpinning for the proposed concept of the MMA as a culture and language "free" technique.

The Mind-Mapping Approach (MMA) can be defined as a technique that organises and taps information in the brain by stimulating a synergistic effect between both hemispheres (Leaf, 1990). It is a way of structuring information that assists in the learning of new information (Leaf,1990). As it is a psychoneurogenic technique based on the complex functioning of the brain, a brief theoretical review on the functioning of the brain as it pertains to the concept of the MMA is necessary.

The relationship between the functioning of the brain and the Mind-Mapping Approach (MMA).

It is an often quoted statistic that humans use only 10% of their potential brain power. However, the more researchers have learnt in the last 10 years, the less likely they are to attempt to quantify brain potential. The only apparent consistent conclusion is that the proportion of our potential brain power that is used is probably nearer 0.1% than 10% (Russell, 1986). In order to more fully utilize the brain's capacity one needs to consider each of the elements that comprise the way the brain functions. Once one begins to understand how the brain operates the way is opened to tap that vast unused potential. In this regard Sperry (1982), the pioneer of the first 'split-brain' experiments, that is cerebral localization studies on the functions of the two hemispheres, indicates that the integration of the left (more analytical) hemisphere and right (more creative) hemisphere, leads to enhanced functioning whilst thinking and learning.

The general opinion in the available literature is that the two hemispheres process information differently (dual brain theory). The intensity of the involvement of each depends upon the specific task (Sperry, 1982). For example, the hemispheres do not recall in sentences but in key concepts and images (Ornstein, 1975). Of the words heard, spoken or seen, only 1% to 10% are essential key words (Buzan, 1991). Every word is multi-ordinate, i.e. it has a large number of links to other words (Buzan, 1991). In addition to this multi-ordinate nature of words, each brain is unique in the way it perceives images and is by nature both creative and organising (Zaidel, 1985). Finally, because recall is in images and words as opposed to sentences, thought processes are multi-dimensional and non-linear (Buzan, 1991).

Ornstein indicates that by cultivating both hemispheres, the brain returns to a natural holistic way of functioning which in turn unlocks potential. Thus, stimulating a synergy between the two hemispheres is critical to effective accelerated learning. Hagin (in Van Kraayenberg, 1992), has pioneered research using techniques that stimulate brain hemisphere synergy on severely learning disabled children with remarkable success. Some of the tech-

niques he has researched are ambidextrous writing and numerical techniques.

An additional example of this important research is research in the field of cerebral functioning, that has been conducted over the last 15 - 20 years, namely the attempt to ascertain the biological processes involved in learning and memory (Rosenzweig & Bennet, 1976). It is well documented that the brain is adaptable and that the brain appears to compensate for the damaged nerve fibres by:

- rerouting to alternative areas,
- the development of innate potentials in other areas of the brain, and
- gradual recovery from shock caused by injury (Luria, 1982).

A fact that has also emerged from this research - and that is very useful in terms of an evolving philosophy of remediation - is that these experiments have seemingly confirmed the susceptibility of the brain to actual physical and clinical changes resulting from training or enrichment of the environment (Rosenzweig & Bennet, 1976). The possibility therefore exists that, under the right conditions, neurons may regenerate themselves, and be capable of growing new fibres indicating that they do have the genetic potential for reproduction. It has not yet been ascertained whether or not such a regeneration can occur in a normal nervous system, but the brain appears to make the maximum use of the possibilities open to it, and one of the most likely places to find such changes in nerve cell tissues would be in damaged tissue (Russell, 1986).

Rosenzweig and Bennet (1976) indicate that much of the research done in this area will undoubtedly lead to applications such as the alleviation of learning disability caused by neural malfunctions in perception, the prevention of senile decline in memory and learning, and better means of packaging information to aid learning and retrieval. This is the principle on which Mind-Mapping therapy (Leaf, 1990) is based.

Of particular interest to the above concepts is the research by Scott (1976), concerning neuron regeneration. Scott (1976) found that neurons can be induced to reproduce themselves if placed in a medium enriched in potassium ions - which are very important to axonal electrical conduction - this is called the K-mitotic effect. Scott (1976) argued that human adult neurons have the genetic potential to reproduce themselves. Unfortunately, however, the intriguing question is still left open as to why these neurons cannot exploit this reaction so as to produce true regeneration. Scott's findings, do however, make some inroads into the traditional idea that the neurons of the central nervous system are incapable of regeneration.

In evaluating the results of applying the Mind-Mapping strategy to a CHI patient (Leaf, 1990), spontaneous recovery cannot be overlooked as it is a controversial issue in terms of its interaction with treatment. It is estimated, that spontaneous recovery in a CHI subject extends up to 18 months post-accident (Adamovich, 1986). An additional complicating factor is that uncertainty exists about how treatment interacts with spontaneous recovery (Adamovich, 1986).

Based on the foregoing discussion on brain functioning, it is possible that Mind-Mapping therapy encourages spontaneous recovery to extend beyond the spontaneous capacity of the brain for physiological and structural change. Therefore, the MMA is a neuropsychological metacognitive-communication intervention technique that attempts to utilise to the fullest possible extent, the functional plasticity of neural tissue (Leaf, 1990). The concept is based on the idea that if the brain is given suitable and varied stimulation, it will continue developing and growing through life (Rosenzweig & Bennet, 1976).

It is hypothesized that when Mind-Mapping therapy is initiated, Luria's (1982), process of intersystematic and intrasystematic reorganisation occurs. As the environment becomes enriched and progressively more organised as a result of this stimulation, new unused areas (previously not stimulated) take over function. As a result of this, an increase in potassium and sodium at the synapses probably occurs. These are important neurochemicals that can encourage collateral sprouting and regeneration of damaged neurons (Scott, 1976; Russell, 1986). The latter point has only been proved in the Central Nervous System (CNS) of animals (Scott, 1976) and, as most of our neuropsychological knowledge is based on application of animal research to humans, the above is a plausible deduction (Leaf, 1990).

Therefore, it is hypothesized that humans have a preset template of cognitive functioning that is moulded by the environment and mediators (significant people in the environment). In the brain's functional systems, however, there are other stores, i.e. potential connections that if stimulated, can carry out the cognitive activity lost or disrupted. The rationale for this is the unlimited potential of the brain and our underuse of it, that is we limit our brain by only using certain functional systems, whilst others lie dormant. If disruption due to brain damage occurs, the brain tries to restore equilibrium via compensatory strategies, for example, the patient elaborates, circumlocutes and perseverates (Penn and Cleary, 1988). In the MMA, the therapist acts as a mediator, and through a process of stimulating both the right and left hemispheres, the patient is assisted in searching the subconscious, unused stores to unlock this dormant potential and/or stimulate the regeneration of neurons (known as the K-mitotic effect). Ylvisaker and Szekeres (1986) also feel that increased spontaneous recovery can be effected by providing an enriched environment.

According to Leaf (1990), this concept advocates a plasticity of the brain with a reorganisation emphasis, as opposed to plasticity of the brain with a change in localisation of function emphasis. Therefore, with the MMA it is advocated that a new area of the brain is stimulated to learn to perform the function and, in doing this, the possibility that an enriched environment enabling regeneration and therefore restoration of the damaged functional system occurs.

This new concept stimulating brain hemisphere synergy, implies learning as opposed to equipotentiality and substitution, which implies a pre-existing spread of any function over the area - this underestimates the potential of the brain (Powell, 1981). There are many uncharted areas in the brain, and we are only beginning to understand our abilities. For instance Anokhin (1985 in Russell, 1986) calculated that the brain is capable of making 1 followed by 10 million kilometres of typewritten 0's of connections. Furthermore, he estimated that an area the size of a pea in the human brain could control the entire world's telephone network system.

Development of a conceptual framework as a rationale for developing the Mind-Mapping approach (MMA).

The concepts of brain-behaviour relationships, cognition and information processing will be discussed in the following section, in order to elucidate the rationale of the Mind-Mapping approach (MMA) developed by the first author and used with a CHI subject (Leaf, 1990).

Brain-behaviour relationships

Luria's emphasis on understanding brain functions as interlocking functional subsystems has been a particularly important concept in the Mind-Mapping approach (Luria, 1982). While the diffuse and complex neuropsychological deficits that seem to accompany severe traumatic head injury make it difficult to apply Lurian assessment and remediation techniques, his general approach to appreciating the interconnectedness of many cognitive functions has been vital.

According to Luria (1982), the destruction of cortical tissue has an effect on the entire functional system to which it contributes because a link within the functional chain has been weakened or damaged. Two situations can occur, namely:- intersystematic - incorporating a new link from a different functional system ; intrasystematic - vertical shift within a functional system (Luria, 1982).

In the MMA it is hypothesized that, initially both intersystemic and intrasystemic reorganisation occur (Leaf, 1990). This could lead to the areas around the neurons becoming enriched because of this stimulation resulting in two possible occurrences, namely:- new unused areas take over function; and collateral sprouting and regeneration (Scott, 1976) occur resulting in restoration of function. Restoration to original and possibly higher levels of original functioning may occur.

To conclude: by applying Lurian concepts Mind-Mapping therapy can be better understood. In the next section Mind-Mapping therapy will be viewed from the cognitive perspective in order to further elucidate this concept. The authors feel that a paradigm shift as to how we view our mental capacities, and those of our clients, is essential if we are to be more effective in our changing South Africa.

Cognition.

From the perspective of the information processing model, cognition involves a complex process with which an individual processes information for particular purposes, within certain mental structures and environmental constraints (Ylvisaker & Szekeres, 1986).

Cognition is viewed by Feuerstein (1980) as mental acts that enable a person to think and therefore act intelligently. He adds another dimension to his definition by stating that well developed cognitive functions are the product of mediated learning experiences, i.e. the way in which stimuli emitted by the environment are transformed by a "mediating" agent, usually a parent, sibling or other caregiver. Through this process of mediation the cognitive structure of the child is affected. The child acquires behaviour patterns and learning sets, which in turn become important ingredients of his capacity to become modified through direct exposure to stimuli, hence cultural differences.

Since direct exposure to stimuli quantitatively constitutes the greatest source of the organism's exposure, the existence of sets of strategies and repertoires that permit the organism to efficiently use this exposure has considerable bearing upon cognitive development. Feuerstein's objective therefore, is "to change the cognitive structure of the retarded performer and to transform him into an autonomous independent thinker capable of initiating and elaborating ideas" (Hobbs in Feuerstein, 1980:viii).

This concept of modifiable cognition is what the first author's research aimed to investigate, thus Feuerstein's orientation is considered a further critical aspect of MMA theory (Leaf, 1990). Feuerstein (1980) is interested in how the organism learns and solves problems. In MMA therapy, the thought processes of the brain are being stimulated as information is being structured according to the way the brain functions. Thus, deficient thought processes and learning skills can be identified as the Mind-Maps are being constructed because the clients' thought processes are being evaluated. At the same time, correct patterns can be set up, which would be therapy.

Feuerstein's (1980) interest in the formal structure of thought as opposed to the content of the mind, has relevance in that, with the MMA which, aims at improving information processing, and cognitive processes, the formal structure of thought is also being improved.

To summarise, the MMA, like the Feuerstein approach, becomes a TEACH-TEST-TEACH paradigm and the therapist tries to promote the best possible learning and motivational conditions. The MMA programme progresses through simple to complex reasoning tasks. It is dynamic because the person's learning style is assessed in the act of learning which highlights the metacognitive strategies and styles that the person is using. The technique also encourages the individual to take charge thus ensuring carryover. This in turn, guides specific therapeutic intervention (Leaf, 1990). In the following section the MMA is further evaluated in terms of information processing.

Information processing.

Information processing refers to the analysis and synthesis of information in sequential steps (Neisser, 1976 in Ylvisaker, 1986). Information processing abilities can be divided into three stages, namely:-

- regulation of input
- encoding - storage - retrieval
- regulation of response (Ylvisaker & Szekeres, 1986).

These stages become the goals of developing information processing skills. In information processing terms, humans are seen as highly sophisticated computers with elaborate programmes. Viewed from this perspective, the MMA can be seen as the operating system - somewhat comparable to MS DOS (the operating system of a computer) - of the brain allowing the programmes to work and, the more efficiently the operating system is being used, the greater the functioning of the programme.

The techniques, forms and manner of the MMA.

The term 'MMA rehabilitation' is used in a very broad sense to indicate the treatment of the cognitive communicative deficits identified in patients, namely: cognitively

based communicative, behavioural and psychosocial deficits, as well as the narrowly defined deficits in component systems and processes (Ylvisaker & Szekeres, 1986). Since the scope of the MMA is broad, an attempt is made to make it more manageable by distinguishing the general principles, forms and manner of the approach that guides treatment decisions.

The general principles provide the environment with therapy: the form of intervention provides the philosophy: and finally, the manner of intervention provides the way information in therapy is analysed. The Mind-Mapping technique described in this article was evolved into a specific treatment approach for CHI by the first author based on a literature review, and research. Thus the Mind-Mapping protocol is original research and is supported by a strong theoretical base (Leaf, 1990).

The techniques of the MMA rehabilitation.

The overall objective of the MMA is to achieve the effective functioning of patients in normal situations comparable to premorbid functioning.

The general techniques of the MMA are comparable to those of any treatment regime. There are a few specfic techniques, however, that are unique to the Mind-Mapping programme. These include techniques that are not uncommon in the realm of therapy such as relaxation, breathing and music. It is the combination of techniques that the researcher has put together as part of the standard procedure of Mind-mapping, that is unique.

The first of these techniques is relaxation. Relaxation means, "a realistic response to the environment with a minimum of needless energy expended" (Boone, 1977, p 151). Therefore, by using relaxation techniques, unnecessary tension is reduced. On a physiological level, relaxation results in an increase in secretion of the brain's natural opiates - endorphin and enkephalin - which are generated when one feels good or relaxed (Hand, 1986). This in turn relaxes the limbic system's negative potential, enabling the neurochemicals necessary for learning and remembering to be generated (Hand, 1986). Thus intellectual pursuit is allowed to progress more readily than when negative feelings prevail, and the patient is guided towards comfort management rather than stress management. According to Wolpe (1958) "As we inhibit the anxiety through relaxation, the stuttering problem recedes" (Boone, 1977).

The second technique of the MMA is the use of controlled breathing. Boone (1977) suggests the use of breathing techniques for voice patients with poor breathing patterns. Russell (1986), indicates that breathing exercises aid concentration by focusing attention on the energy interplay involved in breathing. According to Hand (1986), even though our brain is only approximately 3.5 pounds, it requires 25% of the body's oxygen intake to function optimally. For these reasons, breathing exercises are incorporated within the MMA approach.

The third technique incorporated into the MMA is the use of suggestion and visualisation. According to Van Riper (in Boone, 1977), suggestion and visualisation permeate all forms of therapy, including those practised in medicine. No patient seeks help without some expectation that his/her problem will be alleviated. Therefore, directly or indirectly, deliberately or unconsciously, some kind of suggestion and visualisation seems to be inherent in any therapeutic relationship. According to Lozanov & Gateva (1989), using suggestion and visualisation enables people to make more effective use of their brain potential, because suggestion has a similar effect to relaxation physiologically (discussed under the principle of relaxation), and visualisation is essential to the process of activating memory (Russell, 1986).

Fourthly, the use of music - specifically Baroque music is advocated by the MMA to be used throughout therapy. Music is used due to the documented effect it has on the alpha and beta wave forms of the brain (Lozanov & Gateva, 1989). Music activates neurons for purposes of relaxing muscle tension, changing pulse and producing long-range memories which are directly related to the number of neurons activated in the experience (Hand, 1986). Music relaxes major portions of the brain so that those which are active encounter little interference from other portions. Furthermore, there are different types of music for different types of activities, that is learning, relaxation and visualisation (Lozanov, & Gateva, 1989). Baroque music specifically is important as this type of music is characterized as being generally relaxing, with a 4/4 rhythm and 60 beats per minute. The relaxation is induced due to psychological entrainment of body rhythms (Hand, 1986).

Therefore, the techniques of relaxation, breathing, suggestion and visualisation, and music create the environment of the MMA procedure, the main objective being to create an optimal learning situation.

Finally, there are various other techniques derived from brain-behaviour relationships that are applied to the MMA intervention. These principles are adapted from Hand (1986) and Luria (1982), and include the following:

- Words are read aloud - this activates Broca's area, Wernicke's area, left hemisphere sensory and motor cortex and the angular gyrus.
- Words are read with emotion and inflection - this activates right hemisphere areas for prosodic functions, right motor and sensory cortex, and the limbic system.
- Pictorial images are developed and mind-maps are used throughout - thus the patient is being stimulated to think in a visual and organised way. This involves a major portion of the primary visual cortex, left and right motor sensory cortices, central and peripheral nervous system from the brain stem through the arms, hands and fingers.
- Key words on Mind-Maps allow for discrimination in the right visual cortex.
- Testing after review - this reinforces neuronal connections established during initial learning, leading to hypertrophy and/or branching of neuron dendrites, and making recall easier.
- The more vivid and active the impression of what is being learned, the stronger the memory trace. The spike of electrical activity in the brain increases markedly with novel, surprising or vivid stimuli. This activity signals the hippocampus and hypothalamus to produce increased levels of neurochemicals related to memory formation.

The forms of the MMA.

Rehabilitation efforts in general may take the form of facilitating spontaneous recovery, direct retraining of cognitive components, retraining functional-integrative per-

formance and compensation training. The Ylvisaker & Szekeres (1986) approach indicates each of these forms of intervention as separate approaches in rehabilitation through which the patient in general progresses through, terminating in compensation training to overcome deficits not remediated directly.

The Mind-Mapping approach is more eclectic than the traditional therapy discussed above, and holistic in that the process of therapy is seen to work on components and functional-integrative performance concurrently. Therefore, there is no distinction between component and functional-integrative performance (Ylvisaker & Szekeres, 1986). Furthermore, it is felt that the MMA encourages the brain to go beyond its capacity for spontaneous recovery, because patients are being taught a strategy that stimulates the whole brain resulting in increased efficiency (Leaf, 1990).

In conclusion - the MMA is not a form of compensation. In this approach, compensation is seen as for example, using logbooks to assist memory, or wearing glasses. Mind-Mapping therapy is more, - it is a strategy to stimulate whole-brain learning.

The manner of MMA: Textlinguistics/Metaphors and the creation of the Mind-Map.

The analysis of textlinguistics as a vehicle for examining discourse beyond the sentence level has recently received attention by various groups of researchers (Liles, 1985).

Textlinguistics provides a logical ordered way of approaching the content (story, newspaper article, schoolwork) of therapy. Therefore, the story (metaphor) or macrostructure model of analysis provides the manner in which the MMA is done, that is, the manner in which the texts - oral and written - used in therapy are approached.

Textlinguistics also provides the organized steps of the thinking process that goes into the actual creation of the mind-map. Thus, the mind map becomes the visual representation of the cognitive process. The actual creation of the mind map stimulates both the left and right hemispheres, which increases the effectiveness of functioning. Therefore, a mutually beneficial cyclic process is set up (Buzan, 1991).

Based on the conceptual framework as discussed in 2.1. and the principles, forms and manner of the MMA in 2.2., a treatment model was designed by the first author. This is outlined in the form of a schematic layout in figure 1. In the treatment model, therapy is viewed as being divided into two aspects, namely the creation of an optimal learning environment, and then the actual process/steps of therapy. In the first, the brain is being 'prepared' or 'primed' to receive information and to function optimely by ensuring the correct physiological aspects (electrical and chemical and oxygen). The process takes the client through various steps which stimulate brain hemisphere synergy.

Discussion of the application of the MMA to a single case study of CHI.

A number of questions were addressed in a study by Leaf (1990) regarding the effectiveness of Mind-Mapping as a therapeutic intervention technique on a white female subject. The results revealed a statistically significant improvement in the academic ability of the CHI subject, which was proved to be directly attributable to the intervention program. There was also a statistically significant improvement of the subject in the indirectly treated cognitive-language skills and the untreated pragmatic skills, indicating generalization effects. It is this finding that supports the postulation that the MMA is a language and culture "free" technique. The results furthermore revealed increasingly competent post-treatment performance academically.

With specific regard to cognitive language abilities, it was deduced that Mind-Mapping improved the following skills in the subject (Leaf, 1990):

- to interpret alternative meanings in ambiguous statements by evaluating multiple meanings, features at the surface structure and features at the deep structure level
- to reason analytically, synthetically and logically
- to interpret abstract concepts
- to improve retrieval so that it becomes an organised efficient memory search
- the processing of information
- to associate and identify relationships
- to select central concepts
- to identify, retrieve, sequence and produce semantic units - expression
- to identify, recall and retrieve appropriate grammatical structures - expression
- to make judgements about concepts
- to attend and perceive.

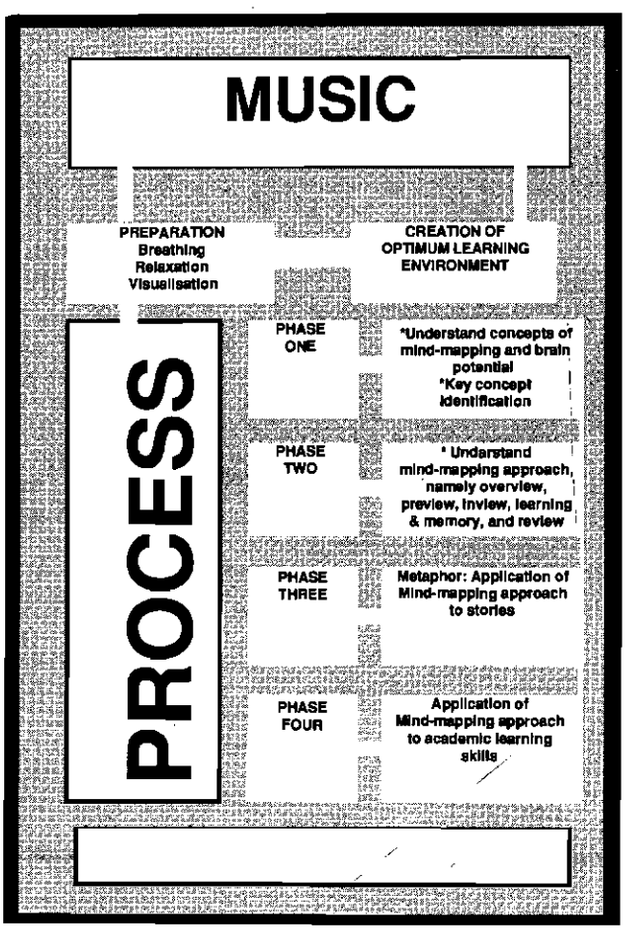


Figure 1. Schematic layout of mind-mapping intervention

As the above receptive and expressive skills in the subject of the study (Leaf, 1990) were indirectly treated, the suggestion is that a certain amount of generalization took place. This implies that the cognitive dysfunction underlies the language function - further supporting the concept of the MMA being language and culture "free".

The improved psychosocial and pragmatic functioning of the subject - which were the untreated behaviours in the study (Leaf, 1990) - proved interesting as Prigatano (1986) had the same results in his intensive neuropsychological rehabilitation programme, but he had used professional neuropsychologists and clinical psychologists to help the patients as a separate part of their treatment. In the study conducted by Leaf (1990), the only therapy received by the subject was Mind-Mapping therapy conducted by a speech and language therapist, however, the same type of effects were obtained.

CONCLUSION: APPLICATION OF THE MMA CROSS-CULTURALLY.

In order to overcome the linguistic and cultural diversity that exists the world over, the study of normal and pathological communication must be couched in cultural terms. This would avoid the risk of making judgements about the communication of a given group from an inappropriate set of assumptions and norms (Taylor, 1986). Furthermore, cultural factors also determine the definition of what is pathological, i.e. the definition of the quality and normalcy of the environment (Taylor, 1986).

Likewise, "Treatment should take into account the preferred learning style of the client and the rules of social and communicative interaction as defined by the client's indigeneous cultural or linguistic group" (Taylor, 1986, p 7). Therefore all clinical encounters are cultural events requiring an ethnological approach. This implies a need for greater understanding of dialectical and language differences.

"However, the adoption of a dialectical perspective need not imply dramatically different clinical methods for every dialect" (Taylor, 1986). That is, the universal principles of therapy would not alter, but the material would. The learner is a product of his environment, thus, the material should be selected from his specific culture. In this way the learning process is concentrated on, and not the material.

Current diagnostic and treatment procedures emphasize middle class westernized values and are therefore not "culture free" (Bogatz in Taylor, 1986). The therapist working in a multi- cultural environment needs to expand the assessment and treatment process, to determine the client's learning potential as opposed to acquired knowledge (Taylor, 1986).

Mind-Mapping, as discussed, is a way of structuring information according to the way the brain functions, stimulating both hemispheres to function in harmony (Buzan, 1984). In this way, learning potential can be assessed and improved.

The *MMA* (Leaf, 1990) is the application of this concept into the realms of therapy by providing the clients with a more efficient "operating system" allowing them to use/access their potential more efficiently. It appeals directly to the multi-dimensional cognitive level and therefore reflects the cognitive processes underlying language. Mind-Mapping therapy incorporates a unique combination of techniques that have been shown to stimulate a more efficient process of learning new information (Leaf, 1990). These include relaxation, breathing, and music which provide the environment of therapy (see Figure 1), which can be adapted to suit each individual.

By using the MMA (Leaf, 1990), the patient is not simply observing long lists of words or sentences, rather he is receiving each word in the context of the words that surround it. At the same time he is also giving the multi-ordinate nature of each word his own special interpretation as dictated by the structure of his personal information patterns - thus "culture free" - and, will be analysing, coding and criticising throughout the process.

In applying the MMA to a single CHI subject (Leaf, 1990), only multi-dimensional cognitive skills - as they pertained to academic abilities - were worked on directly, showing a statistically significant improvement. However, the indirectly treated receptive and expressive language skills, and untreated pragmatic and psychosocial functioning also improved significantly, allowing the subject to return to her premorbid level of functioning. This stresses the universality of the MMA, strengthening the possibility of the MMA being a culture and language "free" technique.

From this, one could postulate that by working via a common medium such as academic material, through using the MMA, one could circumvent the problem of language and culture bias. To this end, the MMA lends itself to being used within a consultative framework, such as suggested by Uys (1985), where a professional service is given indirectly through the use of a "consulting care person" (Uys & Hay 1985, p 4). In other words, the MMA could be used within an empowerment framework, as the MMA is easy and effective to use in group situations. In this way large sectors of the population could be reached.

If a client is not schoolgoing, illiterate or has severely depressed functioning due to a neurogenic disorder, the MMA still has applicability due to its multi- dimensional and sensory nature. It is also a highly visual technique, lending itself to images and pictures instead of words, if this is required.

The first author has applied the technique on a clinical basis cross-culturally with Blacks, Coloureds, Indians, Chinese and Japanese. The results have been encouraging in terms of linguistic, cognitive and psychosocial functioning.

Various trends were also observed where certain of the MMA techniques were more appealing to certain cultures. For example, the Black students learned material more effectively using music by Steven Halpern & Savary (adapted Baroque), whilst learning new activities. Although this music has no identifiable tune and does not have the orthodox tempo of 60 beats/minute, it has been shown to facilitate whole-brain learning (Halpern & Savary, 1985). Clynes (in Halpern, 1985) indicates that there are specific forms of emotional expression - called "essentic forms" that act like keys in a lock and activate specific learning memory processes. Research suggests that essentic forms have innate meanings that transcend cultural learning and conditioning, and are therefore neurologically coded. It is possible that these essentic forms are more activated using this adapted type of music with black clients.

Critchley and Henderson (in Halpern & Savary, 1985) found that this adapted Baroque music may be able to

activate the flow of stored memory material across the corpus callosum, so that right and left hemispheres of the brain work in harmony rather than in conflict, resulting in improved functioning.

The Asian students, on the other hand, preferred the standard combinations of classical and Baroque music to the adapted music, learning more effectively with the former. Lozanov & Gateva (1989), using Biofeedback, researched the effect of the standard classical and Baroque music, finding it to be a catalyst during the process of instruction with students.

The above clinical observations strengthen the premise that the technique of using music in Mind-Mapping therapy is a fundamental principle, and that the material - type of music - has a culture preference.

Futher corroborating the strength of the MMA as an alternative fundamental "culture-free" technique, is research conducted by Van Kraayenburg (1992). He applied a similar combination of techniques to that of Mind-Mapping therapy, within a scholastic programme to teach English to 540 Black South African schoolchildren in Sub B, Std 1 and Std 2. The result was that the programme was judged foremost by the Human Sciences Research Council, after two and a half years of evaluation against seven other suggested teaching programmes.

In conclusion, not only do we experience heterogeneity cross-culturally, but within each culture group there is diversity as well. Using more global techniques such as Mind-Mapping therapy, where the individual's perception, learning style and potential to learn and think are emphasized as opposed to a group or culture's language and thought patterns, bias can be circumvented. Thus, the aim should be to develop more global approaches to therapy focusing on creating richly varied culturally appropriate instructional environments. This should be done in a climate that fosters imagination, adventure and risk taking, all vital catalysts to learning. In this way we as speech-language therapists can try to deliver services to all individuals.

Einstein once said that imagination is more important than knowledge as knowledge is limited and imagination is not (Buzan, 1990). The authors believe that one of the ways to deal with the mammoth task of delivering services to all cultures in South Africa is to go beyond the realms of knowledge into that of imagination. Hopefully then, culture and language "free" techniques will be found.

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Indigenous Healers and Stuttering

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ABSTRACT

Traditional beliefs and attitudes of Black South Africans to stuttering were investigated. Four Indigenous Healers (IHs) from different ethnic groups were interviewed about their beliefs as to cause and management of stuttering, as well as the outcome of their treatment. The data reveals varying degrees of concern about stuttering. The traditional beliefs of cause and management of stuttering show some similarities to current beliefs held by speech pathologists. Implications in terms of direction in therapy, cooperation with IHs and future research in this field are discussed.

OPSOMMING

Die tradisionele opvattings en houdings van Swart Suid- Afrikaners ten opsigte van hakkel is ondersoek. Onderhoude is met vier Tradisionele Genesers van verskillende etniese groepe gevoer om hulle geloofsoortuiginge te bepaal ten opsigte van die oorsaak en behandeling van hakkel, sowel as die resultate wat gekry word met hulle behandeling. Die data toon wisselende grade van besorgheid oor hakkel. Die tradisionele geloof rakende die oorsaak en behandeling van hakkel stem ooreen met die huidige menings wat gehuldig word deur spraakpataloë. Die implikasies van bevindinge word bespreek met behulp van terpeutiese riglyne, samewerking met Tradisionele Genesers en verdere navorsing.

Indigenous Healers and Stuttering

An important aspect of stuttering in relation to research and therapy is the attitude of the stutterer himself and that of his associates toward his speech symptoms. (Ammons and Johnson, 1944, p.39)

Although emotions and attitudes are highly individualistic, cultural beliefs and background will invariably influence them as "... culture is the indispensable factual background in relation to which the worker adapts his contribution to the situation before him." (Fenalson, 1952, p.4). Culture implies meanings, ideas and values that constitute a way of life that pervades relationships, systems of belief and behaviour.

It may be assumed therefore that culture will influence attitudes towards stuttering as well as its development and treatment. Wendell Johnson (1944), in his studies of American Indians, was one of the first to investigate cultural influences on stuttering. He found no evidence of stuttering and no name for it was present in the languages of the groups studied. He interpreted this lack of a name as being the reason why stuttering did not exist, because it implied that stuttering was not significant in this culture. Later analysis (Wingate, 1972) identified methodological problems in Johnson's research and his results were discredited.

Subsequent studies, cited by Van Riper (1971) found stuttering among population groups as diverse as the Japanese and Eskimo, leading him to conclude that stuttering exists universally. Therefore, the cause is unlikely to be related to cultural attitudes. He does, however, cite Kluckhohn (1954) who states that "... impressive differences in the degree and incidence (of stuttering) suggests cultural influences are operative." (Van Riper, 1971, p.9.)

Wingate (1972) attributes this to the differences in the importance and expectations of a child's speech, across cultures. This sentiment is reiterated by Snidecor (1947), Leith & Mims (1975), Leith (1986) and Shames (1989) who identify cultural factors such as stress on speech performance, and child-rearing practices which are likely to influence the incidence of stuttering.

Having concluded that cultural beliefs influence the incidence of, and attitudes towards stuttering, and that these attitudes should be identified and explored in therapy, it is evident that the speech therapist needs to be familiar with the cultural beliefs of her clients. Shames (1989) states that "... therapy becomes an intercultural collision of values, attitudes, expectations and definitions". Owing to the disproportionate ratio of Black speech therapists to Blacks in South Africa, one is faced with a situation where the majority of trained therapists are unfamiliar with the cultural backgrounds of their clients. Current trends in therapy derive from America and Europe with an orientation not designed to meet the needs of cultures as diverse as that of Black South Africans. The success of therapy may therefore be hindered by the denial of, or failure to acknowledge a client's cultural beliefs through lack of knowledge, and his being forced to conform to those proposed by modern theories. Refuting beliefs about cause and treatment may serve only to alien-

ate the client (Leith & Mims, 1975). Fenalson (1952) demands that any professional worker attempting to help others in areas of personal adjustment, needs to understand an individual in terms of his culture and its effect on his responses to life experiences.

South African psychologists have become increasingly aware of the necessity to re-evaluate the therapy that they offer in terms of cultural appropriateness. Holdstock (1979, p.119) goes as far as to say that "... professionals would never be able to satisfy the emotional needs of people", while the therapy that they offer is tailored to Westernised cultures. It may be meaningless and ineffectual when applied to members of a culture so starkly different from it.

The writers have, therefore, undertaken to study an aspect of the attitudes and perceptions of a sample of Black people in South Africa to stuttering. In order to attain an understanding of traditional cultural beliefs it was decided to focus on Indigenous Healers (IHs) for this information as they have been described as "... psychologist, physician as priest ... tribal historian" (Holdstock, 1979, p.119). The IH is a highly respected member of the tribe, a reservoir of traditional beliefs and one who has the power to modify customs (Hammond-Tooke, 1989). He is that indispensable member of the society who is consulted by an estimated 70% of the black population of S.A. (Mzinyathi, undated, p.144). In 1977 the Soweto Society for Marriage and Family Life concluded that the majority of people in Soweto believe in the power of the IH (Holdstock, 1979). The World Health Organisation (WHO) estimated that IHs form the essential core of primary health workers for nine tenths of two billion rural dwellers in Third World countries (Holdstock, 1979). Once urbanised, a black person may well consult an IH as Hammond-Tooke (1974) predicts that an urban diviner's clientele consists of traditionalists, professionals, middle-class Blacks and even Whites. IHs may, therefore, be considered a valuable source of information on cultural beliefs about stuttering as well as on the traditional treatment for stuttering.

According to Hammond-Tooke (1989) there are two distinguishable types of healers, i.e. diviner and herbalist. The herbalist is one who has not been mystically called but is a master of medicines. He is one who has knowledge of plants and roots. The diviner, on the other hand has been described by Hammond-Tooke (1989, p.104) as one "... clothed with power and knowledge ... called to the profession by the prompting of the ancestors". He, therefore, likens the diviner to a doctor, and the herbalist to a pharmacist. A diviner is consulted in the case of a long-lasting illness in order to establish a cause and a remedy for the illness. The diviner was, therefore, considered to be the more suitable subject for this research report.

South Africa is moving towards a new political dispensation with revised health policies. The inclusion of the IH into these policies is now under debate. The role of the IH cannot be ignored as he is accessible to and consulted by the majority of the Black people in South Africa. It is estimated that there are between 100□000 and 200□000 IHs practising in S.A. today (Freeman, 1992). In the best interests of the clients, Krober (1990), therefore recommends fostering a spirit of co-operation between traditional healers and medical practitioners. Holdstock (1979) agrees with this recommendation and admonishes members of the helping professions that "... although indigenous healing is as old as the civilisation of Africa and at present time adhered to by countless numbers of individuals, people in the helping professions and academic community know next-to-nothing about it and acknowledge it even less" (Holdstock, 1979, p.118). There are those (Motlana, 1992) who, on the other hand, are vehemently opposed to any co-operation. They perceive IHs as dangerous due to their lack of knowledge of physiology and anatomy. Motlana (1992) criticises any attempt to co-ordinate traditional and modern practices as he feels that it traps the South African Black person in a previous era while the rest of the community moves forward into a technologically advanced and sophisticated century.

South African speech therapists cannot make an assessment about the efficacy of traditional methods until they have a knowledge of what they comprise. Effective, efficient and meaningful therapy may then only be provided once the client's attitudes and expectations have been assessed.

Methodology

Aims

The aims of this study were twofold:

1. To probe the cultural beliefs and attitudes of IHs to stuttering.
2. To investigate whether they treat stuttering clients and, if so, what this treatment would comprise.

Subjects

Because of time and other practical constraints the size of the sample had to be restricted to five subjects. An attempt was made to choose subjects reflecting the population of the IHs which is divided into the Nguni, Sotho, Venda and Tsonga groups (Hammond-Tooke, 1989). Unfortunately, no Venda subject was available. Two subjects had rural, and three urban practices to reflect possible differences in approach. All subjects were diviners, as it was considered that they would be the more likely IHs to be consulted in the event of stuttering.

All subjects were contacted through the African National Healers Association (ANHA), as Freeman (1992) cautions against consultation with IHs who may not be authentic. For a description of the individual subjects please see Table I.

Procedure

The survey was conducted through interviews because of the "richness and spontaneity of information" (Oppenheim, 1966, p.32) which is obtained through this method of data collection. Interviews yield a high response rate and decrease the number of "don't know" and "no answer" responses (Young, 1966). The flexibility of an interview was felt to be particularly appropriate in this instance as English was not the home language of any of the subjects and it was therefore sometimes necessary to rephrase, explain and probe. Interviews do not require reading or writing ability on the part of the subjects. This was an important consideration as according to the African National Healers Association (unpublished) not all IHs are literate.

An interview is prone to a number of sources of error

Table 1. Description of Subjects

Subjects	Professional Name	Years in Practice	Rural/ Urban	Calling	Training	Experience
1. Tsonga (Female)	Mungome	22	R	Fell ill. Couldn't eat. No improvement till consulted Mungome who told her it was a calling.	8 months with Mungome. Communicated with ancestors in visions.	Specialist in childhood health problems. Others - infertility, insomnia due to witchcraft. Ulcers. Trains novices.
2. S. Sotho (Female)	Ngaka	22	R	Became ill. Taken to IH.	Inaugurated via rituals - slaughtering goats. Drinking or smoking medicines.	Specialist in childhood disorders - diarrhoea, vomiting, swollen feet, sores under tongue, nail biting, failure to speak. Trains novices.
3. Xhosa (Male)	Igquira	7	U	Fell ill. Untreatable by orthodox medicine.	1 year under IH. Gained ability to communicate with ancestors and to predict events before they occur.	Treats mental disturbance, body sores, visual defects, stomach ache, female problems, birth difficulties.
4. Zulu (Male)	Inyanga	9	U	Fell ill. Called to profession by his deceased grandfather.	1 year and still consults his trainer. Throws bones to formulate diagnosis.	Ability to cure VD, nausea, vomiting and bewitching given as a few examples.

and its scientific utility is limited. It does, however, offer a means to establish contact with the subjects and to assess the appropriateness of this source of information.

Question Construction

The order and sequencing of questions was controlled (Young, 1966). Most questions were open-ended as these provide the best opportunity to obtain the maximum amount of information from each question. Guidelines outlined in the literature (Babbie, 1973) were followed in the construction of questions.

Pilot Study

Following a pilot study, conducted with a Southern Sotho IH, several changes were made to the sequence and content of the questions. At the end of the interview the respondent asked if she could ask the interviewer some questions. This proved to be valuable as her questions provided insight into her frame of reference and beliefs about stuttering. This procedure was then incorporated into the interview framework.

Interviews

It was felt that the respondents would feel more relaxed and discuss their thoughts and practices more openly in familiar surroundings. Subjects 1 and 2, who practice in a rural area, were interviewed at a private residence of their choice in the area in which they live. The other three subjects were interviewed at the offices of the ANHA. The interviewer followed the subjects' lead in terms of where to sit, i.e. at a table or on the floor.

None of the respondents could speak English well and they were, therefore, joined by a member of the African National Healers Association (not an IH himself) who acted as interpreter. Kahn and Cannel (1957) caution against the use of an interpreter as it creates a barrier in the establishment of a rapport between respondent and interviewer. In this case it was felt that the interpreter actually set the respondents at ease and facilitated more open responses. An interpreter should merely be a medium through which questions and answers are transmitted (Young, 1966). In order to ensure this, sources of error such as prompting or leading the respondent's answers were discussed with the interpreter before the first interview. He showed a knowledge and understanding of the protocol for research.

During the third interview, the interviewer became aware that the interpreter was leading the subject. When this interview was analysed by a Sotho speaking speech therapy student her suspicions were reinforced. It was, therefore, decided to exclude this subject from the study. Following this the process was rediscussed with the interpreter and he was reminded of his role before completing the remaining two interviews.

None of the subjects was present at interviews other than their own and they were asked not to discuss their interviews with the other subjects.

Analysis of the Data

The contents of the interviews were reported upon as "... precise summaries of the data" (Forcese and Richer, 1973, p.213). As this research was descriptive, results were categorised according to the questions, tabulated, and discussed qualitatively in order to compare the salient features.

Results and Discussion

The subjects' views on stuttering, i.e. name, cause, management, outcome and attitudes are presented in Table 2, and will be discussed below.

Name and Description of Stuttering

All the IHs had names for stuttering, which corresponded with those found by Aron (1966). S1 and S2 also gave alternate names. S1 (Tsonga) originally spoke of treating "lilele", which from her description may or may not have referred to stuttering. However, when asked to translate "stuttering" she used the term "konkoretsa" and demonstrated this as syllable repetitions.

It is interesting to note the similarity between this word and "korakoretsa" the term used by S2 (South Sotho) as these two languages are not related.

All the names used were onomatopoeic as are the names for stuttering in many languages, e.g. "tuhuhtuhuh" - Egyptian, "gimgeim" - Hebrew and "howdodo" - Ghana (Van Riper, 1971).

The IH's descriptions of stuttering all corresponded with the description of characteristic stuttering symptoms, i.e. syllable repetitions, complete blocks and sound prolongations given by Peters and Guitar (1991).

Cause

All 4 subjects identified stuttering as an inherited disorder, although S4 was originally undecided. Authorities in the field of speech therapy have, over the years, researched heredity as a causative factor. Theorists now seem to agree that certain constitutional factors may be inherited and predispose a child to stuttering (Van Riper, 1973; Bloodstein, 1987).

S2 and S3 gave additional causes which seem to have their roots in folklore, i.e. being left out in the first rains of spring or failure to inform the ancestors of the child's imminent birth. S2 gave witchcraft as another alternative. These have no parallel in the professional literature.

Diagnosis and Management

The subjects differed in their approaches to diagnosis and management. S1 believes there is no treatment for konkoretsa as it is hereditary. S2 treats according to the cause. Where the cause is hereditary there is usually a sore under the tongue which she treats with medication. If the stutter is caused by being left out in the rain the child must be treated outside (as this is where the affliction took place) by inhaling smoke from the ashes of medicinal products.

S3 manifests the same symptoms as the patient and through this, intuitively determines the cause and treatment. He may use prayer, ritual medication or fulfilment of the forgotten rituals. He also educates parents and siblings on ways to handle the stutterer. S4 communicates with the ancestors, then prepares medication from the dried tongues of certain animals which is rubbed into cuts in the throat.

Table 2. Summary of Data

	Name	Description	Cause	Management	Outcome	Attitude of Stutterer	Attitude of Society
S1 Tsonga	(Lilele) Konkoretsa	Syllable repetitions	- Heredity (Accumulation of coagulated milk in throat.)	- None - Medication	- None	Not a problem	Accepting Status unaffected.
S2 South Sotho	Kgakgametsa Korakoretsa	Syllable repetitions Prolongation Visible and audible tension	- Heredity - Baby left out in first spring rain	- Medication - Prayer and ritual medication. - Parental counselling.	Slow speech Easy prolongations	Problem Low self esteem	Accepting Status unaffected.
S3 Xhosa	Thintitha	Syllable repetitions Blocks	- Heredity - Failure to inform ancestors of imminent child-birth - Whitchcraft	- Prayer Medication Rituals Parental counselling - As with mental disorder	Slow speech	Big problem handicapping	Accepting Status unaffected
S4 Zulu	Amalimi	Repetitive clicks (syllable repetitions)	- Heredity	- Medication applied to cuts on throat area.	Slow speech	Big problem	Accepting Status affected

Outcome

Subjects 2, 3 and 4 were agreed that their treatment would not cure the stuttering but would lead to slower, improved speech. Therapists in many parts of the world report programs based on slow easy speech as helpful for stutterers (Peters & Guitar, 1991).

Subject 2 claimed that "there will be some noticeable change in the child". When asked to demonstrate the change, she showed easy prolongations in place of the effortful blocking she had shown as symptomatic of stuttering. Van Riper (1973) and others, advocate modifying the symptoms of stuttering to easy prolongations.

There is no objective proof that the IH's treatment of stuttering is as successful as reported. It is likely, however, that the treatment could bring relief to the patients, at least partially, through indirect suggestion. Indirect suggestion forms part of any stuttering program. A patient seeking therapy, goes with an anticipation and expectation of relief from his stuttering. This strong faith and desperate need are able to bring about a certain amount of relief (Van Riper, 1973). Van Riper attributes the success of suggestion to the intermittent, variable, fluctuating nature of stuttering, spontaneous recovery and the fact that temporary fluency is easily established.

Whether or not any known medication has proved successful in treating stuttering is queried. Van Riper (1973) cites many experiments done to assess the efficacy of certain drugs but criticizes their methodologies. He concludes that placebos may produce the same effects as drugs, because the therapeutic value of drugs often comes from the patient's faith in his physician. Van Riper (1973) gives credit for success in therapy, to the therapist's love and concern for the patient, over any other factors.

IHs provide "... warm, nurturent, total acceptance of their patients" (Hammond-Tooke, 1989, p.147). This, coupled with a belief in their powers of healing and a need to be cured, may be effective in relieving some of the symptoms, e.g. tension, associated with stuttering.

Counselling parents also plays a significant part in the therapy provided by speech therapists. The principle of guiding parents in terms of their speech and behaviour towards a stuttering child, is reported by some of the IHs. Given the warm empathetic environment that an IH can provide, parents may discuss their anxieties and become open to suggestions regarding the treatment of their children (Van Riper, 1973). It is not uncommon for parents to report a dramatic cessation in stuttering once they have removed certain pressures from speaking situations (Van Riper, 1973). Strategies, e.g. use of simple language, reducing time pressure, providing a fluency model and not calling attention to the stutter are some of the suggestions that Peters and Guitar (1991) make reference to in a summary of the parent counselling of theorists such as Van Riper, Bloodstein and Luper and Mulder. S3 makes similar suggestions, e.g. "... they shouldn't shout at the child, they shouldn't speak fast to the child", and cautions that "... imitating him to tease him creates a big problem ... this shouldn't be done".

The success of the IHs treatment may, in some cases, not be attributable to their efforts at all. Research has indicated that 50-80% of children who stutter, recover before puberty, without any treatment (Peters and Guitar, 1991). Although they commented that the methods of gathering this information were not entirely reliable, Peters and Guitar (1991) conclude that spontaneous recovery can occur.

Attitudes

S1 did not feel that konkoretsa was a problem. The other three concluded that stuttering was a problem which would handicap the individual or cause him to develop a low self esteem. However, only S4 felt that the stutterer would be prevented from attaining a position of status such as a tribe leader. This duty requires proficient, confident speech which is beyond the reach of the stutterer.

Implications

Aron (1991) estimates that only a fraction of the more than 3 000 000 people in South Africa who require speech therapy, receive it, due to the small number of speech therapists working in this country. As a solution she proposes a community based approach to speech therapy, i.e. training community workers to provide basic therapy and knowledge of when and to whom referrals should be made. IHs are already recognised and consulted by most Black South Africans. They may, therefore, provide the untapped resource needed to make services accessible to more people with communication disorders, one that includes an awareness of "linguistic and cultural forces that operate" on the individual (Shames, 1989, p.74). Co-operation between speech therapists and IHs in the treatment of stuttering appears viable, not to undermine or eradicate cultural beliefs, but to share information and establish a system of referral.

The beliefs held by IHs have proven to be a fertile and accessible area and more research is indicated in

- IH's beliefs as to cause and management of other communication disorders, e.g. hearing loss, strokes and cerebral palsy were mentioned by these subjects;
- the outcome of treatment by an IH from the patient's perspective;
- interviewing greater numbers of IHs in order to generalize common trends in their beliefs about cause, management and attitudes to stuttering;
- a comparison of the views of rural and urban IHs. Although no marked differences appeared in the views expressed by the subjects in this study, it must be noted that the two rural subjects lived relatively close to an urban area. Possibly subjects living in more remote parts of the country might offer different ideas;
- the efficacy of modern stuttering therapies for Black South Africans.

Conclusion

At a conference in Geneva in 1987, the WHO resolved to develop traditional medicine in its member states as IHs constitute the most abundant health resource in many countries. In order to utilise and maximise this existing resource, the WHO has suggested national research strategies into traditional medicine (Akerele, 1987).

South Africa too is scrutinising its National Health Policy in order to address primary health needs (Aron, 1991). These could be satisfied by community workers familiar with the particular linguistic and cultural background of the community. The IH may be considered ideal

in filling this role.

This article is limited in terms of its scope, i.e. only stuttering was investigated and only a small sample was used. However, it indicates that communication disorders are recognised and treated by IHs, and more research into this field is necessary.

Further research may strengthen the conclusion that co-operation between IHs and speech therapists is possible as "... knowledge and sympathetic understanding ... combine in ongoing dialogue, with the interests of the patient as the overriding concern" (Hammond-Tooke, 1989, p.155).

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Appendix

Interview Format

A) Biographical Information

1) Name, ethnic group.
2) How did you become an IH?
3) Did you receive training?
4) For how many years have you been practicing as an IH?

B) Stuttering

1) Tell me about the work you do.
2) Have you ever been consulted by a patient with a speech problem? Tell me about this case.
3) Do you know what stuttering is?
4) What word do you use for stuttering?
5) Have you ever treated a stutterer?
   - Cause
   - Management
   - Outcome
6) Does your treatment differ if the patient is male or female?
7) Would a stutterer's status be affected because of the stuttering, e.g. could he be a tribe leader?
8) How would you rate stuttering: As a big, small or no problem?
9) Do you have any questions that you would like to ask me?

Vokaalreëls by Dowes

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OPSOMMING

Alhoewel die bepaling van reëlmatighede in spraakproduksie belangrik vir terapiebeplanning is, is dit nie altyd identifiseerbaar in die spraak van die dowe nie. Die doel van die studie was om te bepaal of die normaalhorende luisteraar in staat is om die dowe se spraakreëls te identifiseer. Sewe dowes met 'n kongenitale, sensoriesneurale gehoorverlies het ses toetsvokale in woorde vyf keer herhaal wat deur derdejaarstudente in Oudiologie in 'n geslote-keuseformaat beoordeel is. Twee luisteraars moes saamstem in 70% van die beoordelings dat 'n spesifieke vokaal gehoor is. Uit die beoordelingsmatrikse blyk dit dat die luisteraars wel in staat was om konstanthede te identifiseer. Die interluisteraarkorrelasies wissel van r=0.49 tot 0.89, wat impliseer dat die luisteraars nie altyd saamstem in hulle beoordelings van 'n spesifieke vokaal nie. Die bevinding het implikasies vir die oudioloog in terme van spraakevalusie.

ABSTRACT

Although the establishment of patterns in speech production is important for therapy planning they are not always identifyable in the speech of the deaf. In this study the object was to ascertain whether the normal hearing person was capable of identifying rules of speech. Seven deaf speakers with a congenital, sensori-neural hearing loss repeated six test words five times which were rated by third year Audiology students in a closed set format. Two listeners were required to agree in 70 % of the cases that a specific vowel was heard. The rating matrixes showed that the listeners were able to identify consistencies. The interlistener correlations varied from r=0.49 to 0.98, implying that the listeners did not always agree in their judgements regarding a specific vowel. In terms of speech evaluation the findings pose implications for the audiologist.

Ten spyte van uitgebreide navorsing en verbetering in die spraakopleidingstegnologie word die spraak van die dowe steeds gekenmerk deur swak verstaanbaarheid (Gold, 1980). Nogtans word spraakverbetering by dowe kinders aangemoedig en ook deur hul begeer om onafhanklike funksionering in die breë samelewing te vergemaklik (Ling, 1976; Manilal, 1992). Voortgesette pogings tot beter begrip van die spraakproduksie van die dowe en dus meer effektiewe spraakevaluasie en -terapie bly 'n navorsings-prioriteit.

Afgesien van die swak spraakverstaanbaarheid, word die dowe se spraakpogings ook deur 'n hoë mate van produksie-onstabiliteit of intrapersoonsvariasie in herhaling van dieselfde uitings, gekenmerk (Harris, Rubin, Spitz & McGarr, 1985; Metz, Schiavetti, Sitler & Samar, 1990; Osberger, 1987). Desnieteenstaande is daar aanduidings dat sprekers konstante verskille tussen sekere uitings aanbring (Monsen 1976). Hierdie konstante verskille kan as spraakpatrone of spraakreëls[1] beskou word.

Spraakreëls ontwikkel waarskynlik by die gehoorgestremde (daar word hier spesifiek na die persoon met 'n binourale kongenitale ernstige tot totale sensoriesneurale gehoorverlies verwys) op dieselfde wyse as by die normaalhorende. Die omgewingsleidrade wat deur die gehoorgestremde gebruik word, sal waarskynlik van die normaalhorende verskil in die sin dat visuele en slegs gedeeltelike ouditiewe inligting (meestal lae frekwensie-inligting) beskikbaar en dus benutbaar is (Boothroyd, 1978). Daar kan verder verwag word dat die gehoorgestremde se reseptiewe leidraadsisteem uitgebrei en gemodifiseer sal word soos in die geval van die normaalhorende kind, afhangende van die gehoorgestremde se omgewing en sy vermoë om spraak uit die omgewing, te gebruik (Fry, 1978). Hy ontwikkel dus 'n sisteem wat as konstanthede of reëlmatighede in sy spraak geïdentifiseer kan word, of te wel spraakreëls. Dit is egter 'n kontensieuse hipotese want daar is navorsers wat beweer dat daar nie sprake van 'n reëlgebaseerde sisteem in die dowe se spraak is nie as gevolg van die hoë mate van variasie in produksie (Harris et al., 1985). Hierteenoor beweer ander outoriteite dat daar nie bewys kan word dat die uitings op 'n lukraak wyse en dus sonder enige plan, geskied nie (Monsen, 1974;

[1] *Spraakreëls* is die produksiereëls waarvolgens spraakklanke op dieselfde, konstante wyse uitgespreek word en op 'n konstante wyse van ander spraakklanke verskil (verwerk uit Grunwell, 1982).

Monsen, 1976).

Die verskil in mening is nog nie besleg nie veral aangesien dit vir die spraakopleier[2] so problematies is om hierdie spraakreëls te identifiseer. Die reëlmatighede in die produksie van die dowe se spraak is soms deur die normaalhorende luisteraar identifiseerbaar maar in vele gevalle nie. Selfs waar die dowe se spraakproduksie deur middel van die Internasionle Fonetiese Alfabet (IFA) getranskribeer word, is die gevaar dat die spreker se komplekse reëlsisteem vereenvoudig word deur die transkripsie (Parker & Rose, 1990). Verder is die onakkurate segmente dikwels moeilik artikulatories spesifiseerbaar en dus moeilik verteenwoordigbaar met 'n IFA-simbool (Abberton, Hazan & Fourcin, 1990). Dit is dus moontlik dat die dowe reëlmatighede in sy eie spraak gebruik wat nie deur die normaalhorende luisteraar identifiseerbaar is nie.

Die teenwoordigheid en die aard van spraakreëls is egter vir die klinikus van groot belang met die oog op die ontwikkeling van rehabilitasiestrategië. Terapie is tradisioneel nie dieselfde vir 'n persoon met 'n konstant foutiewe reël, die met variasie in produksie van dieselfde klank en die persoon met geen spraakklankreël nie. Die prognose vir terapie sal ook verskillend wees in die geval van 'n individu met geen spraakreël nie en vir die persoon waar daar alreeds 'n foutiewe reël vasgelê is (Stoel-Gammon & Dunn, 1985).

Dit is derhalwe duidelik dat die identifikasie van die dowe se spraakreëls, indien enige, belangrik is. Tot op hierdie stadium is die probleem dat daar nie 'n klinies bruikbare metode is om die spraakreëls te identifiseer nie. Die studies wat die reëlmatighede aangetoon het, het dit slegs vanuit 'n teoretiese oogpunt benader, instrumentele analises gebruik wat nie vir die klinikus beskikbaar is nie, byvoorbeeld elektromiografiese studies en nie gepoog het om die spraakreëls van 'n individu aan te toon nie (byvoorbeeld Monsen, 1976; Huntington, Harris & Sholes, 1968). Een van die redes is dat slegs enkele klanke ondersoek is en in die meeste gevalle is die studies net op die fonetiese vlak van spraakproduksie, met ander woorde in betekenislose eenhede, uitgevoer (Metz, 1980; Huntington et al., 1968). Die gebruik van die spraakreëls as 'n kommunikasiemedium, waar spraakklanke betekenisonderskeidend aangewend word (op die fonologiese vlak), word nie op die wyse ondersoek nie. 'n Tradisionele fonologiese ontleding (byvoorbeeld Grunwell, 1982) is onbevredigend aangesien die swak spraakverstaanbaarheid van die dowe spreker transkripsie van die spraak feitlik onmoontlik maak. 'n Tradisionele "artikulasietoets" het verskeie probleme (Ling, 1976) waarvan een is dat die onkonstantheid in die dowe se produksie nie in ag geneem word met die enkele ontlokking van 'n foneem in 'n spesifieke konteks nie. Om die spraakreëls dus te kan bepaal, moet die metode vir die spraakopleier uitvoerbaar wees en ook in staat wees om die konstanthede, indien teenwoordig in die spraakproduksie van die dowe, uit te lig.

Die studie het dus ten doel om te bepaal of daar reëlmatighede in geselekteerde uitinge van die Afrikaanssprekende dowe deur luisteraarsbeoordelings geïdentifiseer kan word. Deur spesifieke spraakvoorbeelde van die dowes op 'n herhaalde wyse te ontlok en luisteraars die voorbeelde te laat beoordeel, kan bepaal word of die dowes foneme konstant produseer en of luisteraars ooreenstem ten opsigte van die foneme wat hulle hoor.

METODE

Proefpersone

Die twee groepe proefpersone, naamlik dowe sprekers en normaalhorende luisteraars word afsonderlik bespreek.

Dowe sprekers

Die proefpersone moes verteenwoordigend wees van dowes waar slegs 'n gehoorverlies voorkom het dat die omgewing se spraakreëls spontaan aangeleer kon word. Hulle moet dus geen ander probleme as slegs 'n ernstige (71-91dB) en uitermatige (>91 dB) kongenitale sensories-neurale gehoorverlies openbaar nie en verby die aktiewe periode van spraak- en taalaanleer wees (Bess & McConnell, 1981). Seuns in standerd agt, nege en tien met ernstige en uitermatige kongenitale sensories-neurale gehoorverliese is in 'n Afrikaanse skool vir dowes geïdentifiseer. Die seuns met 'n normale intellektuele vermoë volgens hul skoolprestasie en vorige IK-toetsing en met horende Afrikaanssprekende ouers wat sedert kleutertyd 'n skool vir dowes bygewoon het, is vervolgens geselekteer. Sewe proefpersone het aan die vereistes voldoen. Hulle het 'n gemiddelde spraakverstaanbaarheidskaaltelling van tussen 1.5 en 3.8 op 'n vyf-punt-skaal (Meyer, 1984) behaal met een as onverstaanbaar en vyf as volkome verstaanbaar gestel. Die skaaltelling is bereken deur die gemiddeld van ses beoordelaars.

Normaalhorende luisteraars

Vrywillige studente in hul derde jaar van die B.Log.-graad aan die Universiteit van Pretoria is as beoordelaars van die spraakuitings gebruik. Hulle is reeds opgelei om breë transkripsies van abnormale spraak te doen. Die studente (ouderdom wissel van 20 tot 22 jaar), beskik oor normale gehoor en het slegs beperkte indien enige blootstelling aan die spraak van dowes gehad. Dertien van die studente het Afrikaans as moedertaal, terwyl een haarself as tweetalig beskou.

Apparaat

'n Sony Stereo Cassette Corder TC-158 SD Bandopnemer met twee Sher-O-Dyne Model 533SA mikrofone is vir die opname van die spraakvoorbeelde in 'n stil vertrek by die skool gebruik. Die perseptuele beoordelings is in die Taallaboratorium van die Universiteit van Pretoria gedoen. Die Taallaboratorium is toegerus met 'n Tandberg model IS-10 apparaat. Elke luisteraar het vir die ouditief- perseptuele beoordelings 'n TDK D 60 band ontvang wat deur middel van 'n individuele kopstuk (Tandberg TLH 12) en na gelang van persoonlike luidheidsvoorkeur beoordeel moes word. 'n Enkele luisteraar het 'n Phillips D-6280 bandspeler vir die beoordelings gebruik.

[2] *Spraakopleier* verwys na die persoon wat die spraakopleiding van die dowe doen. Dit kan die oudioloog of die onderwyseres indie skool vir dowes wees.

Tabel 1: Gehoorgestremde sprekers en eienskappe vir seleksie

Spreker	Ouderdom	Graad van verlies	Oorsaak van verlies	Aanvang	Ouderdom: diagnose	Ander probleme	IK	Spraakverstaanbaarheid
EEN	17 jr 6 mnde	uitermatig	onbekend	kongenitaal	11 mnde	geen	123	1.5
TWEE	17 jr 3 mnde	uitermatig	onbekend	kongenitaal	17 mnde	geen	105	1.8
DRIE	16 jr 11 mnde	ernstig	onbekend	kongenitaal	30 mnde	geen	93	2.7
VIER	19 jr	uitermatig	Waardenburg	kongenitaal	32 mnde	geen	101	2.5
VYF	19 jr 9 mnde	uitermatig	onbekend	kongenitaal	24 mnde	geen	122	1.8
SES	18 jr 6 mnde	uitermatig	onbekend	kongenitaal	18 mnde	geen	100	3.8
SEWE	20 jr 1 mnd	uitermatig	onbekend	kongenitaal	24 mnde	geen	114	1.5

Materiaal vir die ontlokking van die spraakvoorbeelde

In 'n poging om die spraakreëls van die dowe op 'n klinies toepasbare wyse te bepaal, is daar verskeie vereistes gestel, naamlik:

- Die eksperimentele taak en die materiaal wat gebruik word, moet geskik vir die dowe spreker wees.
- Verskeie herhalings van die spraakvoorbeelde moet versamel word sodat reëlmatighede of produksie-stabiliteit, bepaal kan word.
- Die woordstruktuur moes eenvoudig wees sodat dit met gemak deur 'n dowe gelees en uitgespreek kan word. Daar is besluit om KVK-woorde te gebruik. Die KVK-woorde wat geselekteer is, is minimale pare om op 'n gekontroleerde analitiese wyse te bepaal of geselekteerde kontraste inderdaad afwesig of teenwoordig is. Slegs die toetsvokaal is gevarieer en die konsonante is as /b-t/ konstant gehou. Die konstante klankomgewing is belangrik in die perseptuele beoordelings sodat die beoordelaars nie enige addisionele inligting kry wat die beoordeling van die toetsklank beïnvloed nie. Elke woord is vyf keer herhaal sodat daar van elke vokaal in 'n spesifieke kontekstuele omgewing vyf produksies is.
- Dit is nie moontlik om alle spraakreëls te bestudeer nie en daarom is slegs vokale geselekteer.

  Vokale is geselekteer na aanleiding van die volgende kriteria:

  Slegs enkelvokale is oorweeg, aangesien die dowe duurverskille in vokaalproduksie, selfs al is die produksie abnormaal, behou en duurverskille in Afrikaans kontrasterend gebruik word, byvoorbeeld *man* teenoor *maan* (Meyer, 1984) . Die abnormale hoë voorvokaal [y] is ook uitgelaat aangesien die vokaal dikwels as ongerond uitgespreek word en dus as [i] of [ə] realiseer (Meyer, 1984). Slegs vokale wat in die [b-t] klankomgewing voorkom is verder ingesluit en om die rede is [ae] weggelaat. Vokale moes ook verteenwoordigend wees van die Afrikaanse vokale en is dus geselekteer om hoë, neutrale en lae, sowel as voor-, middel- en agter-vokale in te sluit, naamlik /a, i, u, ɛ, ə, ɔ/ (Wissing, 1982; De Villiers & Ponelis, 1987). Die woorde vir die vokaalontleding is: *boet, bot, bad, bed, bied en bid.*

- Aangesien verskeie faktore 'n effek op die duur van klanke het, byvoorbeeld die spraakspoed, die posisie van die woord in 'n sin, die betekenis van die woord, klem van die woord in die sin (Nickerson, Stevens, Boothroyd & Rollins, 1974, Lehiste, 1970), is alle toetswoorde in dieselfde sin geplaas, naamlik "Ek het.....gesê".
- Die toetssinne is individueel op wit 10 X 20 cm kaarte aangebring waarop die toetswoord in donker en onderstreepte font verskyn. 'n Swart en wit lyntekening wat die woordbetekenis illustreer, is telkens op die kaart aangebring om sodoende die betekenisvolheid van die woord te verseker.

Optekening van data

Die beoordelaars het 'n geslotekeuseantwoordblad ontvang waarop hul response aangeteken moet word. Die responsmetode is geselekteer aangesien die sprekers as gevolg van hul swak verstaanbaarheid besonder swak sou vaar op 'n onbeperkte-keuse-responswyse (Osberger, 1992). Die alternatiewe is geselekteer om die korrektheid van die volgende fonetiese kontraste te evalueer, naamlik vertikale tongposisie of tonghoogte (bied/bad; boet/ bad), horisontale tongposisie (bied/boet; bed/bot), lipvorming (bied/ buut; bid/ bot; bed/bot) en duur (bat/ baat; bed/beet; bot/boot). Daar was met ander woorde 10 moontlikhede waaruit die luisteraar 'n keuse moes maak sowel as 'n vraagtekenkategorie. Die vraagteken-kategorie is ook ingesluit om inligting te verkry wanneer die spreker se distorsie nie 'n bekende identifiseerbare vorm aanneem nie (Owens, Talbott & Schubert, 1968).

Prosedure

Prosedure vir dataversameling

1) 'n Stil vertrek is geselekteer sodat die agtergrondgeraas op die opnames so laag moontlik vir die versekering van akkurate analises is.
2) Die doel van die eksperiment is kortliks aan elke proefpersoon verduidelik en die eksperimentele taak is uiteengesit.
3) Die kaarte met toetsstimuli is omgekeerd op die tafel voor die spreker geplaas en die mikrofone is ongeveer 20 sentimeter regs, voor die spreker se mond op 'n tafel geplaas om die effek van die kamerakoestiek sover moontlik te beperk.
4) Daar is dan oorgegaan om die voorbeelde van die toetssinne aan die spreker voor te hou om te verseker dat hy begryp wat van hom verwag word.
5) Die sprekers is daarna gevra om die woorde op die kaarte op 'n natuurlike wyse te lees. Wanneer die ondersoeker seker was dat die spreker weet wat van hom verwag word en dat hy die opdrag kan uitvoer, is tot die oudio-opnames van die eksperimentele sinne oorgegaan.

Prosedure vir die perseptuele ontleding

6) Al die beoordelaars is opgelei vir die luistertaak deurdat die navorser twee sprekers se spraak saam met die groep beoordeel het.
7) Die beoordelaars het elk hul eie oudioband ontvang waarop die toetssinne van 'n spesifieke spreker gekopieer is met 'n vel papier waarop 'n beperkte keuse van elke toetsitem aangebring is. 'n Voorbeeld van die toetsitems is : "Ek het **bad, baat, boet, bot, boot, biet, beet, bid, bed, buut ?**.....gesê."
8) Elke spreker se sinne is deur twee luisteraars beoordeel. Elke luisteraar is slegs vir die ontleding van een spreker se uitinge gebruik om te voorkom dat daar 'n orde-effek voorkom deurdat die beoordelaars die daaropvolgende sprekers beter beoordeel as gevolg van hul blootstelling aan die navorsingstaak (McGarr, 1983).

Analise van data

9) 'n Punt is aan elke korrekte foneembeoordeling toegeken. 'n Vervangingstelling word ook bereken deur die aard van die beoordelaars se "foutiewe" response (die beoordelings wat nie die mikpuntfoneem bevat nie) te ondersoek. Indien dieselfde foneem vir 70 of meer persent waargeneem is, is dit as die vervangingsfoneem beskou.
10) Die beoordelaarsresponse is ook nagegaan om 'n kontrastelling op te teken (Boothroyd, 1985). Die kontraste naamlik tonghoogte of vertikale tongposisie (hoog, middel, laag), horisontale tongposisie (voor, sentraal, agter) , duur (kort, lank) en lipstand (de Villiers & Ponelis, 1987; Wissing, 1982) is ondersoek. Die kontraste lewer 'n totaal van 40 (vier kontraste, vyf herhalings, twee luisteraars) moontlike korrekte response per proefpersoon per foneem.
11) Die response is verder in die vorm van 'n beoordelingsmatriks vir elke spreker opgestel met die doel om patroonmatigheid in die luisteraarsresponse visueel voor te stel.
12) Die interluisteraar-korrelasiekoëffisiënt is .93 wat dui op betroubare luisteraarsbeoordelings (Downie & Heath, 1971).

RESULTATE

Resultate van die luisteraarsbeoordelings van die dowes se vokaalproduksie as 'n groep.

In tabel 2 word die vokaal wat deur die luisteraars waargeneem is horisontaal en die teikenvokaal vertikaal in die beoordelingsmatriks se selle ingevul. Die getal in die selle is die frekwensie waarmee elke teiken-/waargenome vokaalpaar voorgekom het. Die persentasie korrekte produksie sowel as die persentasie waarmee 'n spesifieke vokaal as vervanger gebruik word, word ook verskaf. Elke vokaal is deur 14 luisteraars beoordeel.

Beskrywing van die resultate van die vokaalbeoordelings van die dowes as 'n groep.

Uit tabel 2 is dit duidelik dat die ses toetsvokale met 'n verskeidenheid vokale vervang word. Die sprekers behaal 'n persentasie korrekte produksie van slegs 46.6%. Die

Tabel 2. Beoordelingsmatriks van die gehoorgestremdes se vyf herhalings van die vokale.

Teikenfoneem	Waargenome foneem											
	a	ɑ:	i	y	e:	ɛ	ə	ɔ	o:	u	Totaal	% korrek
a	51	2	0	1	0	7	9	0	0	0	70	72.9
i	14	3	11	1	1	30	9	0	1	0	70	15.7
ɛ	14		9	4	2	34	7	0	0	0	70	48.6
ə	16	1	0	0	0	5	41	0	1	6	70	58.5
ɔ	13	6	2	2	0	1	1	19	1	25	70	27.1
u	8	8	1	4	0	0	2	6	1	40	70	57.1
Totaal	116	20	23	12	3	77	69	25	4	71	420	46.6
% vervang	15.5	4.8	2.9	2.9	.7	10.2	6.7	1.4	.95	7.4	53.4	

vokale wat die meeste korrek[3] geproduseer word is /a/ (73%), /ə/ (59%) en /u/ (57%). Hierdie foneme, sowel as die /ə/, word ook algemeen as vervangingsvokale gebruik.

Dit is verder opvallend dat selfs die beste geproduseerde vokale (/a/ teen 73%) 'n relatief lae persentasie korrekte produksie behaal het. Die vokaal wat die meeste probleme opgelewer het, is die /i/ waar die sprekers slegs 16 % behaal.

Bespreking van die resultate van die vokaalbeoordelings van die dowes as 'n groep.

Die beoordelingsmatriks (kyk tabel 2) illustreer die swak produksie van vokale duidelik. Vokale word deur ten minste drie ander vokale vervang. Die swak vokaalproduksie van die dowe spreker is alreeds deeglik in verskeie tale gedokumenteer (Angelocci, Kopp & Holbrook, 1964; Meyer, 1984; Odendaal, 1981; Suonpää & Aaltonen, 1981). Die huidige studie bevestig dan ook die resultate waar 'n maksimun persentasie korrekte vokaalproduksie van slegs 47% verkry is.

Die prestasie is egter beter as in ander studies wat ook op Afrikaanssprekende proefpersone uitgevoer is. Meyer (1984) verkry byvoorbeeld 33% en Odendaal (1981) 21%. Die verskil is egter waarskynlik aan die aard van die beoordelingstaak toe te skryf. In hierdie studie is van 'n geslote-keusetaak gebruik gemaak terwyl die ander studies die luisteraars 'n vrye keuse in die beoordelings gegee het. Dit is bekend dat die prestasie in 'n geslote-keusetaak beter as in 'n vrye keuse is (Osberger, 1992).

Oor die algemeen blyk dit dat die lae en die sentrale vokale meer dikwels korrek uitgespreek word en dat die voorvokale meer dikwels probleme oplewer (Gold, 1980) soos ook in die huidige studie die geval is. Die verklaring wat hiervoor voorgehou word, is dat dowes geneig is om hul tonge laag en na agter in die mondholte te hou. Daar word gemeen dat dowes die tongstand verkies omdat dit taktiele leidrade verskaf (Boone, 1966). Die tongplasing het uiteraard 'n negatiewe effek op die voorvokale se resonansiepatrone.

Wanneer die *hoorbaarheid* van die vokaalformantfrekwensies in gedagte gehou word, kan die beter produksie van /a/ en /u/ verklaar word. Beide die vokale se eerste en tweede formante is in 'n relatief lae frekwensiegebied geleë (Meyer, 1984).

Die sentrale /ə/ vokaal se relatief geslaagde produksie is ook in ooreenstemming met vorige studies. Daar word algemeen gemeen dat die ontspanne natuurlike tongposisie /ə/ 'n maklik produseerbare vokaal maak.

Die relatief ongeslaagde produksie van /ɔ/ (slegs 27% korrekte produksie is behaal) is nie duidelik nie. Dit is 'n vokaal waar beide die eerste en die tweede formante in die frekwensiegebied onder 1000 Hz geleë is (Peterson & Barney, 1952) en dus *hoorbare leidrade* vir die produksie behoort te bied. Nogtans berig Owens et al. (1968) dat dowes die vokaal dikwels foutief waarneem. Daarbenewens is dit ook 'n vokaal wat *sigbare leidrade* in die vorm van lipronding bied, wat ook korrekte produksie kan bevorder. Daar is egter verskeie ander studies wat die dowes se probleme met die vokaal aantoon (Meyer, 1984; Odendaal, 1981).

Die swak produksie van /i/ is egter nie onverwags nie, en is ook al in vorige studies en in ander tale bevind (Geffner, 1980; Meyer, 1984; Odendaal, 1981). Die hoë voortongposisie verskaf min taktiele leidrade (Boone, 1966) en die hoë tweede formantfrekwensie maak die vokaal moeilik hoorbaar (Meyer, 1984; Peterson & Barney, 1952). Die spreker het met ander woorde min inligting tot sy beskikking om sy produksie van die vokaal te rig, wat tot die swak produksie aanleiding gee.

Alhoewel duurversteurings dikwels in die vokaalproduksie van die dowe se spraak voorkom (Parkhurst & Levitt, 1978), was dit nie 'n opvallende kenmerk van die huidige studie nie. Daar is spesifiek net kort vokale vir die navorsingstaak geselekteer, en die luisteraars het slegs met uitsondering 'n lang /ɑ:/ (4.7%), /e:/ (.7%), en /o:/ (.95%) in plaas van kort vokale gehoor. Dit is steeds moontlik dat die sprekers hul toetsvokale verleng, maar dat dit nie as lang vokaal relatief tot die res van die sin gehoor word nie, aangesien die totale uiting se duur verleng is. Dit is dan ook reeds opgeteken dat die dowe spreker, ten spyte van algemene verlenging van vokale, die relatiewe duur van sy vokale behou (Meyer, 1984).

Die laaste opvallende bevinding is dat alle vokale nie ewe veel as vervangingsvokale gebruik word nie. Die /ɛ/ en die /a/ word algemeen as vervangingsvokale gebruik. Die /ɛ/ word hoofsaaklik as die vervangingsvokaal van die /i/ gebruik. Beide vokale is voorvokale en het 'n relatief lae eerste formant. Die tweede formant van die /ɛ/ is egter laer as die van die /i/ (Meyer, 1984) wat dit waarskynlik makliker hoorbaar maak. Die /a/ daarenteen, word vir 'n wye verskeidenheid vokale as vervanging gebruik sodat daar nie so 'n duidelike patroon voorgekom het nie. Wat egter opvallend is, is dat /a/ eerder as die neutrale vokaal /ə/ as "algemene" vervangingsvokaal gebruik word. Afgesien van die /a/ se hoorbaarheid soos reeds genoem, bied die middellae tongposisie moontlik taktiele terugvoeringsleidrade wat produksie vergemaklik. Die vervangingspatroon het veroorsaak dat die tradisionele vokaalneutraliserings (Levitt, Stromberg, Smith, & Gold, 1980) nie in die groep sprekers se spraak opgeval het nie.

Die bestudering van die data van die groep as geheel, het interessante patrone na vore gebring met die uitstaande indruk dat die dowe spreker oor swak vokaalproduksie beskik. Die samevoeging van die groepsdata verskuil egter die moontlikheid van enige hoorbare patroonmatigheid in die vokaalproduksie van die individuele dowe spreker. In 'n poging om die individuele patroonmatigheid na te gaan, sal die beoordelingsmatrikse van die sprekers afsonderlik bestudeer word.

Resultate van die luisteraarsbeoordelings van individuele dowe sprekers

In tabel 3 word die vokaalbeoordelingsmatriks vir Spreker Een aangetoon. Die vokaal wat deur die luisteraars waargeneem is, is horisontaal en die vokaal wat die spreker geproduseer het of die teikenvokaal, vertikaal in die beoordelingsmatriksselle ingevul. Die getal in die selle is die frekwensie waarmee elke teiken-/waargenome vokaalpaar voorgekom het. Elke vokaal is deur twee luisteraars beoordeel en die persentasie korrekte beoordeling vir elke vokaal asook die persentasie korrekte beoordeling vir al die vokale gesamentlik word aangetoon. Die asterisk by 'n selinskrywing toon aan dat 'n luisteraar in al vyf beoordelings dieselfde vokaal gehoor het. Die persentasie waarmee 'n spesifieke vokaal as vervangingsvokaal gebruik is, word ook aangegee.

[3] *Korrek* moet gelees word as "korrek identifiseerbaar" aangesien die spraak van al die sprekers die kenmerkende afwykings van die dowe vertoon.

Tabel 3. Vokaalbeoordeling van Spreker Een

Teikenfoneem \ Waargenome foneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a					3	6				10
i					7	3				0
ɛ					10*					100
ə	1					9*				90
ɔ							2		8*	20
u									10*	100
% vervang	1.7	0	0	0	16.7	15	0	0	13.3	

% korrekte vokaalproduksie: 53.3%

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Een

Uit tabel 3 blyk dit dat die die spreker 'n persentasie korrekte vokaalproduksie van 53 % behaal het en dat die luisteraars /ɛ/, /ə/ en /u/ korrek kon hoor. Hulle het egter met goeie eenstemmigheid 'n foutiewe maar reëlmatige produksie van /i/ as /ɛ/ en /ɔ/ as /u/ gehoor. Die spreker het met ander woorde slegs drie in plaas van die ses vokale in sy foneemskat. Die vokale wat hy korrek produseer, word ook as vervangingsvokale vir die ander gebruik.

In tabel 4 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Twee.

Uit tabel 4 blyk dit duidelik dat die luisteraars nie enige ander vokaal as /a/ konstant kon hoor nie. Die spreker maak met ander woorde nie enige verskil in die produksies van /a/, /i/, /ə/ en /ɔ/ soos deur die luisteraars waargeneem nie. Dit is ook interessant dat /ɛ/ en /u/ vir 'n geringe aantal herhalings as korrek waargeneem is maar dat 'n groot

Tabel 4. Vokaalbeoordelings van Spreker Twee

Teikenfoneem \ Waargenome foneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	10*									100
i	9*							1		0
ɛ	6				3	1				30
ə	8*							1	1	0
ɔ	9*							1		0
u	6							1	3	30
% vervang	63.3	0	0	0	0	1.6	0	6.6	1.6	

% korrekte vokaalproduksie: 27%

Tabel 5. Vokaalbeoordeling van Spreker Drie

Teikenfoneem \ Waargenome foneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	10*									100
i		1	1		5*	3				10
ɛ			3		5*	2				50
ə						10*				100
ɔ							2		8*	20
u									10*	100
% vervang	0	0	6.6	0	8.3	8.3	0	0	13.3	

% korrekte vokaalproduksie: 63%

aantal van die produksies ook as /a/ gehoor is. In plaas van ses foneme gebruik die spreker slegs een foneem. Dit is dus nie onverwags dat hy slegs 23% korrekte vokaalproduksie behaal nie.

In tabel 5 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Drie.

Uit tabel 5 blyk dit die luisteraars /a/, /u/ en /ə/ konstant korrek kon hoor. Die enigste ander vokaal wat 'n konstant hoorbare patroon gegee het, is /ɔ/ wat as /u/ gehoor is. Die ander vokale is as verskillend gehoor, en die spreker behaal 'n relatief hoë persentasie korrekte produksie, naamlik 62%.

Dit was egter interessant dat die luisteraars nie dieselfde inligting uit die uitings verkry het nie. Die vokaal /ɛ/ is konstant korrek gehoor deur die een luisteraar en ook as die konstante vervangingsklank vir die /i/ gehoor (aangedui met *). Die ander luisteraar het egter nie

Tabel 6. Vokaalbeoordelings van Spreker Vier

Teikenfoneem \ Waargenome foneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	7*					3				70
i		1	1		5	3				10
ɛ			1		5*	4				50
ə						10*				100
ɔ			2		1		5*		2	50
u			2			2	5*		1	10
% vervang	0	0	10	0	10	15	8.3	0	3.3	

% korrekte vokaalproduksie: 48%

dieselfde konstante inligting uit die /i/ en /ɛ/ uitings verkry nie, want sy het die vokale, hoofsaaklik /y/ of /ə/ gehoor.

In tabel 6 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Vier.

Uit tabel 6 blyk dit duidelik dat die luisteraars slegs in die geval van /a/ en /ə/ die vokale as korrek kon hoor. Die ander vokale is egter nie as patroonmatig waargeneem nie. Verskeie vokale is met /ə/ vervang, terwyl /ɛ/ en /ɔ/ ook dikwels in plaas van ander foneme gehoor is. Van die ses toetsvokale wil dit voorkom asof die spreker /a/

Tabel 7. Vokaalbeoordelings van Spreker Vyf
Waargenome foneem

Teikenfoneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	8*	2								80
i	5	3			2					0
ɛ	8				2					20
ə	7*	1				2				20
ɔ	4	6								0
u	2	8								0
% ver-vang	43.3	33.3	0	0	3.3	0	0	0	0	

% korrekte vokaalproduksie: 20%

kontrasteer met voorvokale wat deur /ɛ/ verteenwoordig word en agtervokale wat deur /ɔ/ verteenwoordig word. Die /ə/ word as algemene vervangingsfoneem aangewend. Ten spyte van die beperkte foneemskat behaal die spreker 47% korrekte produksie.

In tabel 7 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Vyf.

Uit tabel 7 blyk dit dat die luisteraars net een vokaal, naamlik die /a/, korrek kan identifiseer. Die /a/ word dan ook as algemene vervangingsfoneem gehoor. Die spreker kontrasteer /a/ en /u/ skynbaar deur middel van 'n duurverskil, waar die /u/ met 'n langer duur uitgespreek word. Daar is egter geen ander duidelike patroon wat uit die data na vore kom nie en hy behaal slegs 20% korrekte produksie.

In tabel 8 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Ses.

Uit tabel 8 blyk dit dat die luisteraars eenstemmig was ten opsigte van die korrektheid van die produksies van vier van die vokale. Daar is ook nie onduidelikheid ten

Tabel 8. Vokaalbeoordelings van Spreker Ses
Waargenome foneem

Teikenfoneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	10*									100
i		10*								100
ɛ		8			2					20
ə						5*			5*	50
ɔ							10*			100
u							1		9*	90
% ver-vang	0	13.3	0	0	0	0	1.6	0	8.3	

% korrekte vokaalproduksie: 76.6%

opsigte van die /ɛ/ wat met redelike goeie konstantheid met die /i/ vervang is nie.

Daar was egter 'n verskil in opinie tussen die luisteraars oor die korrektheid van die /ə/. Die een het gemeen dat die vokaal korrek uitgespreek is terwyl die ander dit as 'n konstante vervanging met /u/ gehoor het.

Die spreker gebruik vier in plaas van die ses toetsvokale. Hy tref geen onderskeiding tussen /i/ en /ɛ/ nie en sy produksie van /ə/ is nie duidelik nie. Hy behaal 62% korrekte vokaalproduksie.

In tabel 9 word die vokaalbeoordelingsmatriks vir Spreker Twee afsonderlik aangetoon. Die uiteensetting is soos in tabel 3.

Beskrywing van die resultate van die vokaalbeoordelings van Spreker Sewe.

Uit tabel 9 blyk dit dat die luisteraars slegs die /ɛ/ en die /u/ as korrek beoordeel het. Hulle was ook eenstemmig dat die spreker nie enige onderskeid tref tussen /i/ en /ɛ/ nie en ook nie tussen /ɔ/ en /u/ nie. Die ander beoordelings vertoon nie 'n duidelike patroon nie. Hy behaal dan ook slegs 40% korrekte produksie.

Tabel 9. Vokaalbeoordelings van Spreker Sewe
Waargenome foneem

Teikenfoneem	a	i	y	e:	ɛ	ə	ɔ	o:	u	%-korrek
a	5		1		4					50
i				1	8*	1				0
ɛ		1		2	7*					70
ə					5	5				50
ɔ		2				1			7	0
u		1	2						7*	70
% ver-vang	0	6.7	5	5	28.3	3.3	0	0	11.7	

% korrekte vokaalproduksie: 40%

Bespreking van die resultate van die vokaalbeoordelings van individuele dowe sprekers.

Die individuele beoordelingsmatrikse van die sprekers toon dat daar groot individuele verskille ten opsigte van die persentasie korrekte vokaalproduksie, wat wissel van 20 tot 62 persent, bestaan. Alhoewel die luisteraars nie in staat was om al ses vokale in enige van die sprekers se spraakmonsters te identifiseer nie, kon hulle vier by Spreker Ses teenoor slegs een by Spreker Twee hoor.

Nog 'n interessante verskil tussen die verskillende sprekers was die vokale wat die luisteraars as korrek kon identifiseer. Die /ɑ:/ is deur 5 sprekers (Sprekers Twee, Drie, Vier, Vyf en Ses) die /u/ deur vier (Sprekers Twee, Drie, Vier en Ses) en /ə/ deur drie (Sprekers Een, Drie, en Vier) korrek gebruik. Die ander vokale was korrek deur een (/i/, /ɔ/) of twee (/ɛ/) sprekers (Sprekers Een en Sewe) gebruik. Dit dui ook net weer op die individuele patrone in die vokaalproduksie by die sprekers.

Die verskil in die vervangingsvokale wat die luisteraars kon hoor, was ook opvallend tussen die sprekers. Die vokale wat as vervangingsvokale gebruik is, was in die meeste gevalle die vokale wat die spesifieke spreker ook korrek kan produseer. Dit gee dan outomaties aanleiding tot individuele verskille soos in die vorige paragraaf verduidelik is.

Alhoewel daar aanvaar word dat dowes nie dieselfde foute vertoon nie, lewer die studie 'n bydrae ten opsigte van die klem wat op individuele foutpatrone geplaas word. Groepsdata soos in verskeie studies (Gold, 1980; Odendaal, 1981) en soos in tabel 2 verskaf, verbloem die individuele foutpatrone wat in die dowes se spraak na vore kom wanneer die individuele data bestudeer word. Dit lei tot die foutiewe aannames dat "dowe spraak" nie ook individuele patrone vertoon nie.

Die individualiteit van 'n spreker se fonologiese stelsel is van groot belang in terapie. Öster (1991) noem dat 'n afwykende produksie sistematies en stabiel oor tyd kan wees en dat dit die realisering van 'n afwykende reël kan wees. Indien terapie gegee word sonder bewustheid van bestaande kontraste in die kind se spraak en dus bestaande verbindings tussen die fonetiese realisering en die abstrakte linguistiese vlak, kan dit tot die verval van die kind se sisteem en tot 'n afname in verstaanbaarheid lei.

Dit is verder belangrik om daarvan bewus te wees dat dit nie raadsaam is om op slegs 'n enkele uiting staat te maak om die dowe se produksiekennis te evalueer nie. Die variasie in die beoordelings van die sprekers het duidelik uit die beoordelingsmatrikse geblyk. Dit is duidelik dat sommige vokale op 'n lukraak wyse geproduseer word, soos blyk uit die /a/ van Spreker Sewe. Die variasie in produksie sou nie uit 'n enkele spraakvoorbeeld duidelik geword het nie.

'n Laaste opmerking ten opsigte van die luisteraarsbeoordelings is dat dit wil voorkom asof luisteraars nie dieselfde "perseptuele strategieë" gebruik in die beoordeling van die spraak van die sprekers nie. (Wanneer 'n luisteraar telkens in elk van die lyste dieselfde vokaal gehoor het wanneer die spreker 'n spesifieke toetswoord geproduseer het, is dit met 'n asterisk in die matrikse aangetoon.) Daar is uiteraard niks vreemd omtrent die beoordelings waar 'n spreker 10 in die selinskrywing ontvang het nie. Dit impliseer slegs dat beide luisteraars die geproduseerde vokale as korrek beoordeel het. Wanneer een luisteraar egter konstant 'n spesifieke vokaal hoor, terwyl die ander luisteraar konstant 'n ander vokaal hoor (kyk Spreker 6, vokaal /ə/) of verskeie ander vokale hoor (kyk byvoorbeeld Spreker 4, vokaal /ɛ/) kan daar moontlik van verskillende luisterstrategieë gepraat word. Om die aspek verder te ondersoek is die interluisteraarsbetroubaarheidskoëffisiënt van die kontrastellings van die twee luisteraars wat elke spreker beoordeel het, ondersoek.

Resultate van die interluisteraarsbetroubaarheidskoëffisiënt van die kontrastellings van die luisteraars

In tabel 10 is die interluisteraarsbetroubaarheidskorrelasiekoëffisiënt vir die twee luisteraars bereken deur die kontrastellings vir die vyf herhalings van elke van die ses toetsvokale teenoor mekaar te stel.

Beskrywing van die interluisteraarsbetroubaarheidskoëffisiënt van die kontrastellings van die luisteraars

Uit tabel 10 blyk dit dat die korrelasiekoëffisiënte wissel vanaf 0.49 tot 0.98. Die rede waarom daar so 'n goeie korrelasie in sommige en so 'n swak korrelasie in ander gevalle bestaan, kan net oor gespekuleer word, veral gesien in die lig van die interluisteraarkorrelasie van 0.93.

Luisteraarsbeoordelings is tradisioneel die metode van keuse vir die evaluasie van afwykende spraak (Kearns & Simmons, 1988). Dat dit moeilik vir selfs 'n hoogs opgeleide luisteraar is om die spraak van die dowe te beoordeel, is algemeen bekend (Monsen, 1978). Dit is problematies om die oorsaak van die fout te onttrek omdat spraak nie 'n eenvoudige liniêre string simbole is nie, maar 'n ingewikkelde gekoartikuleerde kode. Die feit dat die twee luisteraars egter nie dieselfde kontrastellings behaal nie, dui op verskillende luisterstrategieë. Dit is moontlik dat sekere luisteraars van die kontraste wat in die spreker se spraak voorkom, suksesvol kan benut, terwyl dit nie vir 'n ander luisteraar duidelik genoeg is om te benut nie. Die abnormaliteit in die spraak van die spreker verbloem moontlik die kontras vir so 'n luisteraar.

Dit is immers bekend dat die luisteraar, selfs 'n opgeleide fonetikus, nie 'n spraakanalise kan doen sonder om deur konvensionele terminologie en linguistiese ondervinding beïnvloed te word nie (Clark & Yallop, 1990). In die geval van hierdie luisteraars, slegs opgelei om breë fonetiese transkripsies te doen, sou bogenoemde invloed

Tabel 10. Korrelasie-koëffisiënt vir vokaalbeoordelings van elke spreker se twee luisteraars

Luisteraars van	Korrelasie-koëffisiënt
Spreker 1	.93
Spreker 2	.74
Spreker 3	.49
Spreker 4	.56
Spreker 5	.98
Spreker 6	.76
Spreker 7	.71

moontlik nog sterker kon wees. Die luisteraars wat vir die studie geselekteer is, is waarskynlik tiperend van die persone wat vir die dowe se spraakopleiding verantwoordelik sal wees en die bevindings is dus van belang vir die spraakopleier.

In teenstelling met die hipotese van individuele luisterstrategieë, is Harris et al. (1985) van mening dat luisteraars, hetsy gesofistikeerd of ongesofistikeerd, nie oor 'n spesiale strategie beskik om dowes se vokale te dekodeer nie. Die studie spreek egter nie spesifiek die resultate van individuele luisteraars aan soos die huidige navorsing nie. Die feit dat luisteraars in hierdie studie in die beoordeling van dieselfde spreker se uitings verskil, bevestig die hipotese dat daar moontlik van verskillende luisterstrategieë sprake is. Wanneer die uitings waaroor hulle saamstem bestudeer word, kom interessante inligting na vore en dit word vervolgens verskaf.

Resultate van die ooreenstemming in die luisteraarsbeoordelings van die dowe sprekers se segmentele produksie

In tabel 11 word die resultate van die twee luisteraars se beoordelings van elke spreker weergegee. Wanneer sewe van die tien beoordelings ooreengestem het, word die resultaat as 'n duidelike patroon in die produksie van die uiting beskou. Wanneer al die beoordelings egter tussen slegs twee segmente gewissel het met ongeveer ewe veel beoordelings in elk is dit ook aangetoon soos byvoorbeeld in die geval van die ə/u-inskrywings. Indien die luisteraars se beoordelings oor 'n aantal selle verspreid was, is daar nie 'n hoorbare konstantheid in die produksie van die spesifieke foneem nie.

Beskrywing en verklaring van die ooreen-stemming in die luisteraarsbeoordelings van die dowe sprekers se segmentele produksie

Uit tabel 11 blyk dit duidelik dat daar sekere foneme is wat meer dikwels deur die luisteraars korrek waargeneem kon word as ander. Die /a/ is 'n mikpuntfoneem wat deur vyf of ses van die sewe sprekers gebruik is. Die vokale /i/ en /ɔ/ lewer opvallend dikwels probleme. Die luisteraars kon selde hoor dat 'n spreker die mikpuntfoneme konstant korrek gebruik.

Dit val verder op dat die sprekers nie een dieselfde vervangingspatroon vertoon nie. Alhoewel daar ooreenkomste tussen die sprekers is, is daar nie by enige twee sprekers presies dieselfde mikpuntfoneme wat korrek gebruik word of wat met dieselfde foneem vervang word nie.

Dit is ook duidelik uit tabel 11 dat die sprekers sommige van die kontraste van die korrekte mikpuntfoneem behou het, byvoorbeeld in die geval van /i/ is die vervangingsfoneem /ɛ/. Beide die teiken- en die vervangingsvokaal is voorvokale alhoewel die plek van vorming nie korrek is nie.

Die individualiteit van die sprekers se segmentproduksie blyk duidelik uit die bespreking. Die sprekers het patroonmatigheid getoon en mikpuntfoneme op 'n konstante wyse gerealiseer sodat beide beoordelaars oor ten minste 70% van dieselfde foneem se realiserings saamgestem het. Dit dui op die gebruik van kontraste op 'n sistematiese wyse. Die individualiteit van die sprekers se foutpatrone is waarskynlik te wyte aan hul individuele sensoriese en omgewingsomstandighede.

GEVOLGTREKKING

Die resultate van die studie toon aan dat dit wel moontlik is om *spraakreëls in geselekteerde uitinge van die Afrikaanssprekende dowe deur middel van luisteraarsbeoordelings te bepaal.*

Uit hierdie studie het daar belangrike feite na vore gekom. Eerstens het dit geblyk dat die luisteraars se segmentbeoordelings aangetoon het dat die groep dowe sprekers se produksie in 'n groot mate ooreenstem met wat reeds in die literatuur berig is. Die lae voorkoms van korrek geïdentifiseerde foneme is reeds in verskeie studies aangetoon en is weer in die studie bevestig.

Tweedens was dit duidelik dat sekere mikpuntfoneme met konstantheid gerealiseer word terwyl dit nie by ander die geval is nie. Dit was ook opvallend dat die dowes individuele verskille getoon het ten opsigte van die vokale wat hulle korrek kon produseer en die vokale wat hulle as vervangingsvokale gebruik.

Derdens is daar bevind dat daar verskille tussen luisteraars na vore getree het. Die verskille toon aan dat die luisteraars, indien hulle dieselfde produksie moet beoordeel, nie noodwendig dieselfde foneem identifiseer nie.

Die metode wat hier gebruik is, het beperkinge aangesien die monsters nie spontane spraak is nie en die linguistiese vaardigheid van die spreker nie bepaal word nie. Die verstaanbaarheid van die uitings sal beïnvloed word deur die sintaktiese en leksikale probleme wat nie op die wyse geïdentifiseer word nie (Boothroyd, 1985). Deur egter die uitings te beperk, te laat herhaal en op 'n

Tabel 11. Konstanthede identifiseerbaar in elke gehoorgestremde spreker se vokaalproduksie deur twee luisteraars.

Toets-foneem	Spreker 1	Spreker 2	Spreker 3	Spreker 4	Spreker 5	Spreker 6	Spreker 7	Aantal korrek
a	geen	a	a	a	a	a	geen	5
i	ɛ	a	geen	geen	a/ɑ:	i	ɛ	1
ɛ	ɛ	geen	geen	ɛ	a	i	ɛ	3
ə	ə	a	ə	ə	a	ə/u	ə/ɛ	3
ɔ	u	a	u	geen	a/ɑ:	ɔ	u	1
u	u	geen	u	geen	ɑ:	u	u	4

geslotekeusebasis te beoordeel, kan die spraakopleier 'n idee vorm of 'n segment op 'n konstante wyse uitgespreek word en die spreker dus oor 'n reël vir die produksie beskik. Die kennis kan tot meer effektiewe terapiebeplanning bydra.

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A New Look at Cochlear Mechanics

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ABSTRACT

The spectacular discovery of otoacoustic emissions has led to a plethora of cochlear mechanic models, all attempting to explain the active, nonlinear processing of the cochlea suggested by these recordable responses. These hypothetical proposals have been largely based on animal experimentations, mathematically-based theorems, and observations in simulated environments. None have been irrevocably validated although there is much circumstantial evidence expounding their feasibility. Advances in electron microscopy, mechanical engineering, histological examination techniques together with the technology enabling us to measure these emissions, have radically altered the current views on the assumptions of auditory mechanics. This paper briefly contrasts the previously established cochlear theories proposed by doyens such as Helmholtz (1857) and von Békésy (1936) with current perspectives advanced by cell biologists and biophysicists. However, the exact nature of cochlear processing still remains a mystery. As numerous chasms of knowledge about audition are being filled, so even more questions are posed in a seemingly eternal quest for the answer!

OPSOMMING

Hierdie indrukwekkende ontdekking van otoakoustiese emissies het gelei tot 'n oormaat kogleêre-werkingmodelle wat almal gepoog het om die aktiewe nie-lineêre prosessering van die koglea wat deur optekenswaardige response voorgestel word, te verklaar. Hierdie hipotetiese voorstelle is grotendeels op diere-eksperimente, wiskundig gefundeerde stellings en waarnemings in gesimuleerde omgewings gebaseer. Nie een hiervan is onweerlegbaar bekragtig nie, alhoewel daar heelwat omstandigheidsgetuienis bestaan wat die uitvoerbaarheid daarvan verklaar. Vooruitgang op die gebied van elektromikroskopie, meganiese ingenieurswese, histologiese ondersoektegnieke, tesame met die tegnologie wat die meting van hierdie emissies moontlik maak, het die algemene opvattings oor die aannames van ouditiewe funksionering radikaal verander. Hierdie artikel vergelyk die voorheen opgestelde kogleêre teorieë wat voorgestel is deur doyens soos Helmholtz (1957) en von Békésy (1936) kortliks met die huidige perspektiewe wat deur bioloë en biofisici daargestel is. Die presiese aard van prosessering bly egter nog steeds 'n geheim. Namate talryke leemtes in die kennis van gehoor nog aangevul word, word selfs meer vrae gestel in 'n oënskynlik nimmereindigende soeke na die antwoord!

ABBREVIATIONS USED IN TEXT

OAE	Otoacoustic emissions
EOAE	Evoked otoacoustic emissions
DPOAE	Distortion product otoacoustic emissions
BM	Basilar membrane
IHC	Inner hair cell
OHC	Outer hair cell
RL	Reticular lamina
OCN	Oliviocochlear nucleus
ATP	Adenosine triphosphate

INTRODUCTION

"Few areas of audiology have advanced as rapidly as cochlear physiology and biophysics have over the past decade. The advance began with the shock realisation that existing knowledge and accepted concepts could not explain the response of the cochlea to sound and in particular otoacoustic emisssions. Our very understanding of both the physical basis of hearing and the nature of hearing impairment was challenged".
(Grandori, Cianfrone and Kemp, 1990, VIII)

As early as 1948, Gold (cited in Rossi, 1990) inarguably stated that the inner ear itself was a vibratory body and could therefore produce sound since it did not exist in a vacuum. However, instrumentation to measure this response had been slow to develop and his statements were largely ignored in favour of an exclusively sound-receiving cochlear, until the discov-

ery of otoacoustic emissions (OAE) by David Kemp (1978).

Prior to this breakthrough, the ear was viewed as a passive transducer of sound and the idea that it could produce its own energy was inconceivable. Kemp (1978) changed this perspective radically when he presented his discovery of a response measurable within the closed external acoustic meatus, more than 5 milliseconds after excitation. He termed these responses "cochlear echoes" (Kemp, 1978, p.1386) also referred to as "Kemp echoes" (Johnstone, Patuzzi & Yates, 1986, p.147) and currently called "otoacoustic emissions" (Probst, Antonellia & Pieren, 1990, p.117; Glattke & Kujawa, 1991, p.29; and numerous others). Upon his discovery, Kemp (1978) hypothesized that there could be an augmentation of energy from the cochlea which would result in a secondary disturbance of the middle ear and eardrum. By doing so, he implied that some active processing was occurring in the cochlea causing a major upheaval in the last decade of audiology.

Since then, the traditional model proposed by von Békésy (1936 cited by Zemlin, 1982) more than fifty years ago, has been expanded, manipulated, modified and at times rendered obsolete in the attempt to explain these OAE. Contemporary theories all aim to decipher the active, nonlinear, frequency selective processing of the cochlea. Each model has its own unique orientation often based on examination of isolated aspects of cochlear physiology. Unfortunately, none have been undeniably verified from research nor have these specialised viewpoints been amalgamated to form a cohesive model yet. Indeed, it would seem that the process of audition is one of the most poorly understood physiological systems in medicine today.

OTOACOUSTIC EMISSIONS

Using a signal averaging technique, a specially constructed acoustic probe and a broadband click stimulus, Kemp (1978) recorded the well-documented, large initial middle ear response (0 - 5ms post stimulus) due to reflection of acoustical energy from the ear canal and tympanic membrane, as well as a much smaller response (5 - 62ms post stimulus) the hypothetical cochlear echo. Responses of a 1.5 cc coupler with similar impedance characteristics to the human ear was compared to the human ear response as illustrated in Figure 1. He found that both showed rapid deterioration of response to almost zero approximately 6ms post stimulus. However, the reappearance of a significant but much smaller response at about 10ms post stimulus was unique to the human ear and found consistently amongst normal hearing subjects, and subsequently known as ***Evoked Otoacoustic Emissions*** (EOAE) (Kemp, 1978). Such evidence led to speculations about the active function of the cochlea.

Distortion Product Otoacoustic Emissions (DPOAE) were subsequently discovered a year later (Kemp, 1979). Distortion products are usually generated by systems which are nonlinear (Probst et al., 1990). Stimulation of the acoustic system by two primary frequencies f_1 and f_2 will undergo intermodulation distortion and a response is generated at frequencies other than the primary ones but at specific mathematically-predictable frequencies ie. $f_1 + f_2$, $f_1 - f_2$ and the most robust at $2f_1 - f_2$ (Probst et al., 1990; Glattke & Kujawa, 1991). Nonlinearity of the cochlea is strongly suggested by this distortion of the signal.

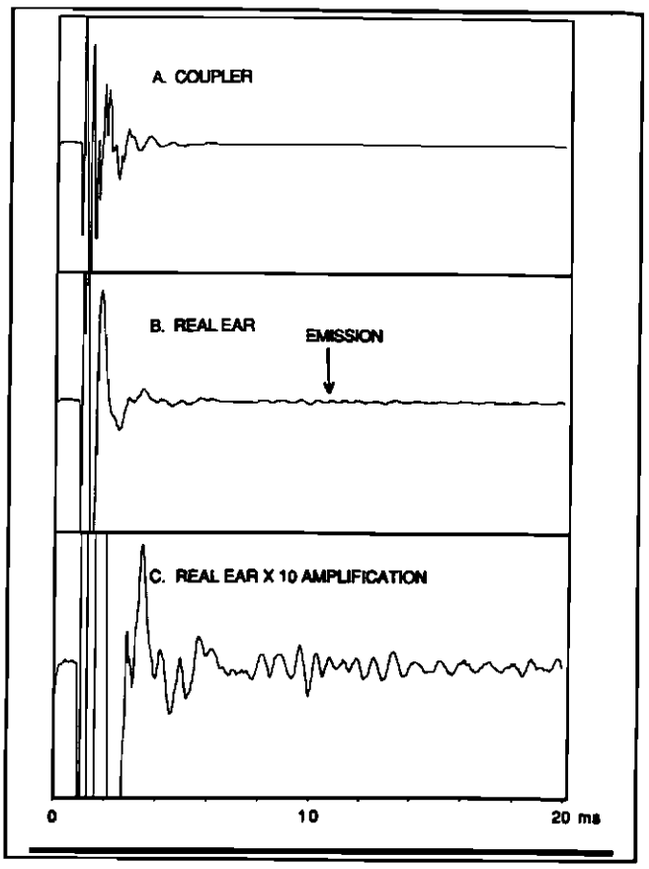

Figure 1. Comparison between responses recorded in a coupler (A) and an adult human ear (B) showing the much smaller response at about 6ms post-stimulus amplified in (C) (after Glattke & Kujawa, 1991, p. 31).

The third type of OAE differs from the previous two in that it is generated in the absence of any evoking stimuli and known as ***Spontaneous Otoacoustic Emissions*** (SOAE). They are measurable in approximately 40% of normal hearing people (Bright & Glattke, 1986 cited in Glattke & Kujawa, 1991) and are also thought to be representative of the active processes occurring in the cochlea.

The growth in technology together with the discovery of OAE has thus led the way towards a more objective, *in situ* measurement of the non-linear, active role of the cochlea and refocussed the attention of biologists, physiologists and audiologists.

COCHLEA AS SOURCE OF EMISSIONS

There was initial speculation that this response could be due to protracted reflections within the middle ear structures (kemp, 1978) but Glattke & Kujawa (1991, p.29) refuted this concept because (a) the time delay of more than 6ms is sufficient time for a sound wave to travel more than 6 feet; (b) the duration of the response is much longer than either the duration of the stimulus of the time for the middle ear response to decay; and finally (c) the stimulating clicks produced well-defined,

frequency specific waveforms.

Johnson and Elbering (1982) in examining the clinical utility of OAE verified the cochlea as the source of these emissions by selecting two pathologies of known cochlear origin, that of aspirin toxicity and mumps. A moderate reversible salicylate-induced cochlear hearing loss was traced from pre-ingestion to two days following completion of the drug course. The initial bilateral emissions were reduced during the hearing loss but recovered fully after the drug was excreted suggesting to the researchers that the cochlea had recovered sufficiently. To ensure that these emissions were not an artifact of middle ear mechanisms, they tested a subject with complete anacusis in the right ear due to mumps. Emissions could not be measured in the right ear, even in the presence of normal recordings in the left. These experiments led the authors to believe that the OAE was of cochlear origin.

This paper aims to briefly outline the basic anatomy of the cochlea and the classic theory of cochlear mechanics, before examining current models focusing on the macro-functioning of wave propagation, the cochlear cellular responses, and finally the biochemical activity within the OHC.

HISTORICAL PERSPECTIVE

As early as 1857, Helmholtz (cited in Zemlin, 1982) proposed his resonance theory of hearing where he described the transverse fibres of the BM as being a bank of resonators. Then von Békésy (1960 cited in Clopton, 1986) was the first to formalise the one-dimensional travelling wave of the cochlea after extensive observations and experimentations spanning over half a decade (Kim 1986), for which he was awarded the Nobel Prize in Medicine and Physiology in 1961 (Zemlin, 1982). He postulated that spatial analysis of frequency information occurred as a result of the differential masses and stiffnesses along the length of the BM, each locus acting as a bank of resonators in a sense, but longitudinally coupled together by soft tissue (Clopton, 1986). Hydrodynamic forces within the fluids of the inner ear lead to displacement of the BM, and a shearing force between the RL and the tectorial membrane resulted in bending of the stereocilia and electromechanical transduction (Lim, 1986; Nuttall, 1986).

This view was supported by Zwislocki (1946 cited in Dancer 1992) and subsequent scrutinies and analyses have verified this very acceptable theory. Yet, with the improvements in observation and model construction techniques, it appears that this macromodel of cochlear mechanics is now insufficient. The discrepancy between the broadly tuned data of the BM and the sharply sensitive auditory nerve was still confusing (Johnstone et al., 1986). Subsequently Evans and Wilson (1975 cited in Clopton, 1986) suggested that there was a "second filter" to sharpen the frequency selectivity of the cochlea. The nature of this second filter has been open to much conjecture, with ideas ranging from microresonance of the BM to the gradient differences of the BM displacements (Pickles, 1982). However, this concept of a second filter has generally been dismissed as being unnecesarry especially with the currently available experimental data (Kim, 1986).

Indeed, Lechner (1993) cautions against the use of passé models of BM motion because many models were based upon eclusively visual and often faulty observations. An example of such an occurrence is von Békésy's examination of longitudinal and radial fibres in the BM wherein he described that the incision of the BM resulted in openings in the shape of a cone (Zemlin, 1982; Lechner, 1993). One needs to bear in mind that several hours had elapsed between his observations and death of the tissue. Voldrich (1978) repeating these experiments soon after cell death, found that the shape was in fact more radial, only becoming conical 24 hours following death - the shape having far-reaching consequences in mathematical calculations. Furthermore, Nuttall (1986) highlights the poor instrumentation sensitivity used by von Békésy requiring intensity of at least 140dBSPL (Johnstone et al., 1986). Therefore, a plethora of models was based on incorrect observations of a cadaver basilar membrane (von Békésy, 1960 cited in Lechner, 1993) or following drainage of the scala tympani during preparation of an animal cochlea (Dancer, 1992).

ACTIVE MACROMECHANICS IN THE COCHLEA

The fundamentals of the travelling wave theory are generally still felt to hold true, that the cochlear is able to perform broad frequency analysis via differential displacement of the basilar membrane (Neely & Kim, 1986). Nevertheless, the prevailing travelling wave theory has many limitations. It implies a cochlea which is a passive transducer to sound but if this was the case, it would be too highly damped to permit the sharp frequency selectivity to occur (Clopton, 1986). The linear system model also implies that one could predict the response to a click from a previously measured frequency response to tone stimulation (Eggermont, 1993, p.177), but this does not hold true and indeed, Geisler and Sinex (1983 cited in Eggermont, 1993) found that one could not even predict the response of a high intensity stimulus from that of a low intensity one. Such inexplicable evidence, together with the discovery of OAE and the ability of the cochlea to give rise to harmonic and intermodulation distortion and generate the DPOAE, suggests that: **the previously accepted anatomical and physiological processes were wholly inadequate to explain nonlinearity of the cochlea (Eggermont, 1993) and that the inner ear was not as simple as first proposed by von Békésy in 1960 (Kim, 1986, p.105).**

Kemp tentatively suggested that at very low levels of stimulation, there may be hyperexcitation at certain frequencies resulting in a recoil of the BM at "localised impedance discontinuities" (1978, p.1386) and the generation of the cochlea echo (1978). This postulation highlighted the possibility of the cochlea producing its own energy, sufficient to be transmitted retrograde through the middle ear and be generated within the ear canal. By constructing various cochlear models, several researchers have acknowledged the presence of 'some active element' to explain its fine tuning characteristics (Neely and Kim, 1986). Contemporary theories expounding the *mechanically active cochlea* tend to agree with this axiom and imply that the travelling wave is amplified by initiating or supplementing existing motion in the BM.

Subsequent experimentation culminated in Davis (1983) presenting a revolutionary new model of cochlear mechanics in which - "an active process increases the vibration of the basilar membrane by energy provided somehow in the Organ of Corti" (p.79). He termed this active process "the cochlear amplifier: (p.80) but subsequent researchers have referred to it as "negative impedance" and "negative damping" (Neely & Kim, 1986. p.1479), or "positive feedback" (de Boer, 1983, p.571).

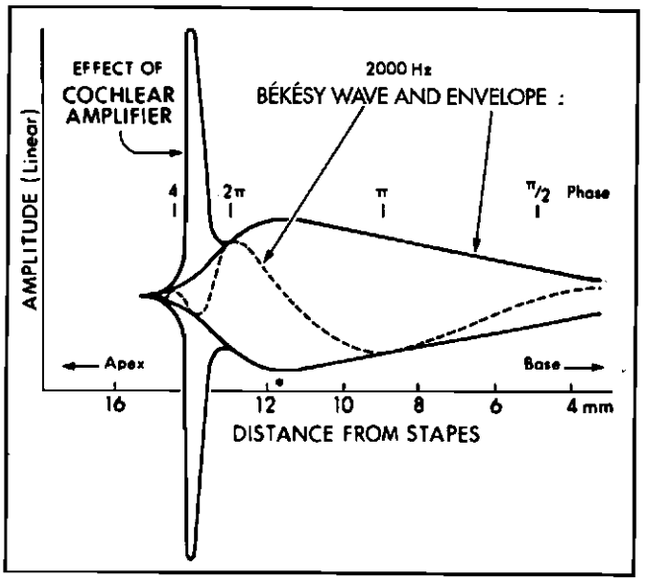

Figure 2. The classic travelling wave and its envelope is presented together with the cochlear amplifier. Note the frequency difference in amplitude peaks between the two (after Davis, 1983, p. 82).

The cochlear amplifier acts as a high-Q (good frequency resolution) acoustic resonator according to Davis (1983), such that it increases the sensitivity to low-threshold stimuli, and sharp-tuning curves of a narrow segment of the BM. Figure 2 illustrates a travelling wave with its envelope to which is added the effect of this cochlear amplifier. It is interesting to note that the tip of the cochlear amplifier does not correspond with the maximum displacement of the travelling wave. This theorem has since been corroborated by Johnstone, Patuzzi & Yates (1986) who generated travelling wave envelopes with increasing intensity and found that at high intensities, the maximum displacement shifted half an octave lower than the stimulating frequency citing this as another example of the nonlinear property of the cochlea. The well-documented frequency differences between the noise exposure and its resultant temporary threshold shifts (about one-half octave) may be used as further substantiating evidence (Davis, 1983, p.81).

From a hydrodynamic perspective, Kim,Siegel & Molnar (1979) on the other hand, proposed that the sharply tuned curves could occur as a result of negative damping along the crest of the travelling wave. By constructing a passive model of the cochlea, they observed a diffuse spread of energy through the fluid and assumed the total amount of energy entering the oval window was absorbed by the partition. In a contrasting active model, they constructed a negative damping partition just basal to the characteristic frequency, and hence energy in the form of eddy currents (according to Neely & Kim, 1986) is released from this point of the partition, resulting in an increase in energy equivalent to 40dB which was sharply focussed. Excessive gain at this point on the cochlear partition causes spontaneous oscillations of the hair cells thought to be the source of SOAE (Neely & Kim, 1986).

Neely & Kim (1986) in an attempt to combine the mechanical and hydrodynamic properties of the cochlea into a single cohesive model, suggested that the cochlear amplifier not only occurs as a result of BM displacement but that the loci of maximum displacement coincides with the greatest pressure difference between the two fluid-filled compartments. They imply that this pressure differential acted as a selective tuner. Von Békésy (1960 cited in Zemlin, 1982) also reported observing an eddy current at the locus of maximum displacement during his experiments.

ACTIVE CELLULAR RESPONSES

Although the mechanics of nonlinearity differ, there appears to be a consensus amongst researchers that "the BM vibration is very sharply tuned ... and is the predominant determinant in the major responses of the eighth nerve e.g., sensitivity, sharpness of tuning and many nonlinear functions" (Johnstone et al., 1986, 148).

Despite these different theories, researchers believed that the OHC were responsible for this active process in the cochlea (Clopton, 1986), and Davis (1983) and Bronwell (1990) postulated that it may be the energy source for the OAE measurable in the external ear canal. Noise, drugs (Glattke & Kujawa, 1991, p.30), anoxia and mechanical insults (Davis, 1983, p.81) result in damage to OHC which then compromises the sensitivity (Harrison and Evans, 1979) and selectivity (Sellick et al., 1982 cited in Bronwell, 1990) of the cochlea, and can therefore be assumed to diminish or obliterate OAE recordings - a fact which has been verified through subsequent clinical trials.

Davis (1983) acknowledges that the active mocromechanism of the cochlea is very poorly understood and this has been the source of much debate. The motile properties of OHC are well accepted and it is popular to suggest that the lengthening or shortening of OHC could either move the RL and BM further apart or closer together in order to deform the Organ of Corti and thereby produce the nonlinear response of the cochlea. Caution against such simplistic explanations is voiced by de Boer (1990). Through a series of mathematical computations based upon the 'sandwich model' (refer Figure 3), he proved that the motility of OHC would be unable to provide sufficient pressures to overcome the BM impedance and initiate motion.

Through observations and experimentations on the cat cochlea, Khanna, Ulfendahl & Flock (1990) assumed that the sharply tuned curves of the BM were sourced by the OHC. In subsequent research, Khanna et al. (1990) were able to observe that the vibration amplitude and tuning characteristics for the OHC and the BM were different and concluded that they were independently controlled. The large vibration amplitude of the OHC suggested that the OHC-induced movement in the BM and bony shell of the cochlear and not *vice versa* previously supposed. Such observations give

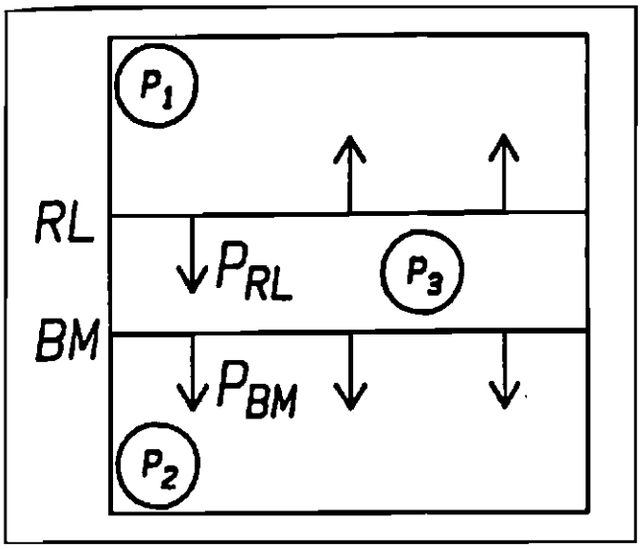

Figure 3. The "Sandwich Model" showing a filling of scala media (P3) with the organ of Corti, and two wedges on either side, the scala vestibuli (P2) and tympani (P1) (after de Boer, 1990, p.4).

credibility to what was previously a revolutionary statement, even in this information era. Moreover, they found that the vibration amplitudes at the level of the RL were maximal in the Hensen cells, decreasing towards the IHC. The steepness of the slope, i.e. the tuning curve was sharpest in the third row of OHC, and shallowest in both the Hensen's cells and IHC. This led the experimenters to conclude that the OHC drove the RL. The vibrations of the BM were small compared to that of the OHC and RL and it would seem that the primary source of energy lies in movement of the OHC carrying the RL with it. In a sense, de Boer (1990) colludes with Khanna et al. (1986) by refuting the possibility of BM movement. This evidence is in sharp contrast to that of the stereocilia bending due to the mechanical motions of the BM.

For a closer examination of the role of RL mechanics, Zwislocki (1986) constructed a model with nonlinear coupling of the RL and tectorial membrane. He noted that nonlinearities observed were similar to those of the auditory nerve firing patterns. At low intensity levels, there was little or no distortion, at slightly higher intensities there was splitting of the peaks, and at even higher intensities, there was a phase shift initially of the order of 90° and later 180°. He suggested that this nonlinearity could be due to the relative change in shearing movements between the tectorial membrane which is coupled to the OHC cilia and RL showing startlingly similar results after observing the rectified waveform of his construction.

ACTIVE MICROMECHANICAL RESPONSES

At a molecular level, the active mechanisms are less well understood but seem to have some basis in the contractile elements within the OHC. Active lengthening and shortening of the OHC by stimulation of its actin filaments, have been demonstrated by several researchers in response to acoustic stimulation, drugs such as caffeine and potassium (Slepecky, Ulfendahl & Flock, 1988; Ulfendahl, Flock & Khanna, 1990) and electric currents (Zenner, Reuter, Plinkert & Gitter, 1990).

Most recently, it has been suggested that these changes can also be induced by mechanical activity, such as that observed in the movement of the cochlear partitions (Kim, 1986; Ulfendahl et al., 1990). Kim (1986) therefore concluded, that it was important to examine the OHC whilst still within an intact Organ of Corti. By isolating the temporal bone from a guinea pig, they induced OHC shortening by applying caffeine. Not surprisingly, the OHC did indeed shorten, and it appeared that the caffeine triggered the release of calcium ions (a substance known to trigger contractile activity in other muscles) (Slepecky et al., 1988; Zenner, 1990). Moreover, the vibration amplitude of the organ of Corti, and tuning of the mechanical response was sharper in the presence of caffeine. Such conclusions led the experimenters to believe that the OHC were capable of influencing the mechanical response of the organ of Corti and therefore played a much more active role in frequency selectivity, non-linearity and tuning frequency of the cochlea than previously supposed.

Zenner et al. (1990) reports that OHC activity can also be stimulated by electric currents. Using a photodiode, they noted the longitudinal movements within the cylindrical cell body of the OHC, that there is shearing of the stereocilia via a lateral sliding of the cuticular plate and simultaneous movement of both the BM and RL in the same direction. The motion of these stereocilia will cause OHC coupling with the IHC via the tectorial membrane and is termed the "fast motile response" (Zenner et al., 1990). It is unlikely that this response is due merely to the actin myosin interaction because of the short latency of the response according to Ashmore and Bronwell (1986 cited in Slepecky et al., 1988). Zenner et al. (1990) hypothesized that the displacement of the cuticular plate with the stereocilia may amplify the signal through closer coupling to the IHC via the tectorial membrane. The sharp focusing of these fast responses is thought to be responsible for the sharp tuning curves.

An alternative explanation was suggested by Kim (1986) in that these apically generated fast responses resulted in an oscillatory motion of the stereocilia. The idea of a bidirectional movement of the stereocilia has been revolutionary and illustrated through the examination of turtle hair cells (Fettiplace, 1985 cited in Nuttall, 1986). Using this information, Kim (1986) proposed that the forward transduction motion forms a feedback loop with the reverse motion. Similar thoughts were expressed by Clopton (1986) who felt that the voltage changes due to the stereocilia bending in one direction would result in greater excitation than in the other but does not suggest any specifics other than it may be sourced by the differential stiffness of the stereocilia depending upon direction of motion. However, other experimenters speculated that the asymmetrical arrangement of stereocilia at the apical ends of the OHC may account for the non-linearity of the cochlea (Khanna et al., 1990, p23).

A second, slower, motile mechanism of the OHC is also described wherein there is a slow depolarisation of OHC. Shortening of the OHCs are observed, as is a reduction in the distance between the BM and RL. The origin of this response is thought to lie in the contraction of actin and myosin elements in the lateral wall of

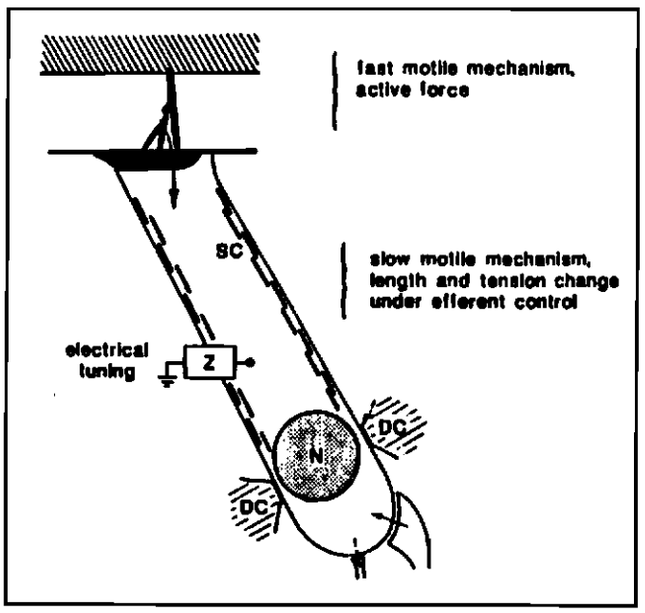

Figure 4. Schematic diagram of an outer hair cell illustrating proposed origins of the fast and slow motile responses and the apical areas rich in subcisternae (SC) (after Kim, 1986, p. 110).

the OHC (Zenner, 1986) unlike the actin-independent fast motile responses. Kim (1986) hypothesized that this slow motile response was responsible for the slow change in length of the OHC. Figure 4 illustrates the anatomical origins of these fast and slow responses suggested by Kim (1986).

There is much uncertainty over whether the fast, motile responses or the slower secondary ones give rise to the selectivity, nonlinearity and sensitivity of the cochlea although much research has been focused on the existence of efferent feedback loops. Efferent fibres from the oliviocochlear bundle are thought to control the fast, amplifying and selective action of the cochlea.

EFFERENT CONTROL A SOURCE OF NONLINEARITY

Contralateral masking is able to suppress ipsilateral DPOAE (Puel, Rebillard & Pujol, 1990), and SOAE (Kujawa & Glattke, 1989). Siegel & Kim (1982) found that stimulation of the contralateral fibres arising from the oliviocochlear bundle (which synapse mainly with the OHC) could alter the strength of the distortion products suggesting OHC involvement in the generation of otoacoustic emissions. Already in 1962 (Fex cited in Warren III & Lieberman, 1989) reported that the cochlear efferent system, arising from the oliviocochlear nucleus (OCN) could inhibit activity in the auditory afferent fibres. A schematic diagram of the anatomical pathway of the efferent fibres can be found in Figure 5. However, Warren III et al. (1989, p.98) report that it had not been conclusively proven that this efferent system arose from the OCN only and they highlight three methods where contralateral sound can influence responses to the ipsilateral stimulus:

1. mechanical propagation of the acoustic stimulus via bone conduction to the contralateral cochlea;

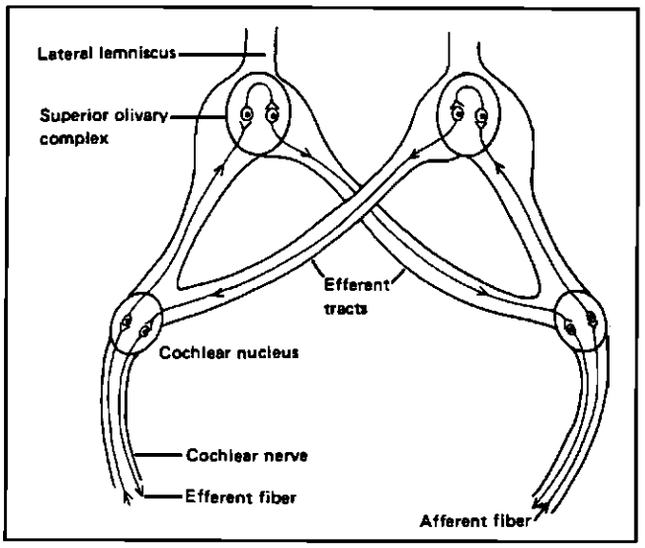

Figure 5. The cochlear efferent system originating from the oliviocochlear nucleus in the superior olivary complex.

2. some neural feedback system of which there could be three possibilities: (a) via the middle ear reflex muscles (stapedius and tensor tympani); (b) the oliviocochlear efferent system and (c) autonomic efferents to blood vessels within the spiral lamina:
3. there may be humoral agents released when the ear is acoustically stimulated and which travel via the circulatory system to the opposite side.

The idea of accoustic crosstalk was eliminated since the intensity of the sound was always less than the level required for contralateral excitation. Likewise, the likelihood of blood circulating agents was also discounted because of the time necessary to travel to the opposite cochlea. The three remaining neural feedback systems appear to be the most feasible explanation. Both Warren III et al. (1989) and Puel et al. (1990) in their studies severed the stapedius and tensor tympani muscles to ensure that the middle ear muscles did not participate in this phenomenon. Finally, through a process of elimination Warren III et al. (1989) state that the oliviocochlear system is the most likely originator of the efferent feedback loop since they argue unconvincingly that when there is removal of the cervical synpathetic system, there is a decrease in the N1 action potential (Hultzcrantz et al., 1982 cited in Warren III et al., 1989) suggesting to them that the autonomic nervous system was in fact used to enhance auditory sensitivity - an idea first suggested by Beickert et al., 1956 (cited in Zemlin, 1982) although to date, there is still no empirical evidence.

Warren III et al. (ibid) therefore attributed this feedback process to the inhibitory cochlear efferents innervating the OHC and originating from the OCN in the central auditory pathway. They further postulate that the medial OCN was responsible for this action because they comprise large, myelinated nerves whereas the lateral OCN consists of largely small, unmyelinated neurones from experiments comparing myelinated and unmyelinated responses to electrical excitation (Gifford & Guinam, 1987).

The idea of a closed feedback loop system and cochlear

efferents to modulate OHC motility is also proposed by Puel et al., (1990), Kim (1986) and Bronwell (1990). Animal observations by Lieberman (1988 cited in Warren III et al., 1989 and in Froehlich, Collet, Valatz & Morgon, 1993) show that auditory afferent stimuli can excite the efferent fibres arising from the medial OCN i.e. large, unmyelinated efferents leading to the OHC (Warr et al., 1986 cited in Dannhof & Bruns, 1993). Moreover, these medial OCN efferent fibres could inhibit activity in the contralateral auditory efferent fibres (Lieberman 1988 cited in Warren III et al., 1989).

Johnstone et al. (1986) suggested that these efferents were used to return the stereocilia to its normal position after being bent in an excitatory manner by the movement of the BM (p.151). In another paper with Rajan (1983), he also noted the protective effects of stimulating the efferent system during TTS and cited this as evidence of their role in the feedback loop.

The high frequency selectivity of the bat has always sparked interest and its efferent innervation was of particular interest to Xie, Henson, Bishop & Henson (1993). They identified a greater number of OHC terminals in areas known to be associated with sharp frequency tuning and selectivity in the bat. In study of mammals such as the cat (Lieberman & Brown, 1986) and the guinea pig (Hashimoto & Kimura, 1987), the trend is towards a greater density of efferent terminals in the basal and middle regions with less in the apical regions. A comparison of vibration responses of the third and fourth turn in the guinea pig cochlea show that there is a sharper tuning in the more basal ends (Khanna et al., 1990) - an observation confirmed by using *in vivo* measurements of the cat cochlea (Lieberman, 1982 cited in Neely & Kim, 1986). A relationship between greater frequency sensitivity and efferent terminal density is therefore implied by these observations (Xie et al., 1993).

Not only is there a regional variation in efferent innervation, but also differences across the rows of OHC noted by several researchers (Fex et al. 1982; Simmons et al. 1990; Fex & Altschuler 1984). Initially, the density of efferent fibres along the first row of OHC was thought to be a consequence of developmental patterns but it has been suggested that this is not so. The population density may be related to amount of synaptic activity and possibly areas of sharp tuning (Xie et al., 1993). However, this in sharp contrast to findings by Khanna et al. (1990) who found that the vibration amplitude and frequency response was sharpest in the third row of OHC. However, Xie et al. (1993) acknowledges that the role of efferent terminals are still unclear and subject to much conjecture.

A lone voice amongst this excitement about efferent feedback loops is that of Dolan & Nuttall (1989) who suggested that there may be no feedback loop or efferent control system since they observed changes in IHC potentials following contralateral stimulation to be constant in amplitude and instantaneous in activation. They remark that such a feedback system would not be able to be activated within such a short latency and with such constant magnitude.

COCHLEAR BIOCHEMISTRY

The bending of the cilia is thought to generate an electric current (depolarisation) along their apical ends which controls the release of neurotransmitter vesicles at the base of the hair cell (Clopton, 1986) and supposedly initiates firing of the auditory nerve (Nuttall, 1986). This characteristic of the OHC in which they are capable of bending in both directions with force distinguishes it from skeletal muscle in which contractions can only be directed in a single direction, whilst the relaxation phase is passive and does not exert force (Bronwell, 1990). Lim (1986) is more specific, and suggests that the stereocilia bending in the excitatory direction only will result in the initiation of neural impulses.

Nevertheless, depolarisation of drug-induced contractions result in an increase in intracellular Ca^{2+}. Nuttall (1986) speaks about the "gating of ions" (p.29), or a physical channel through the cell membrane permitting the passage of ions through. Zenner (1986) demonstrated that by bathing the hair cells in variable ionic concentrated fluid could result in motile responses of the hair cells therefore suggesting as Nuttall (1986) does, that extracellular ions are responsible for motility of the cilia. Ikeda & Takasaka (1993) more specifically reported that the increase in intracellular Ca_{2+} was due to transmembrane influx of calsium from the surrounding endolymph and release from the apical cisterns and Hensen's cells.

Contradictory evidence is presented by Slepecky et al. (1988) in a study of the effects of tetracaine, a local anaesthetic when they found that it inhibited potassium and calcium-induced contractions in muscle but it did not affect contractions of the OHC when applied extracellularly. This led them to the believe that the increase in cellular calcium was of intracellular origin and did not arise from an influx through the permeable cell membrane. Kim (1986) postulated that this slow response was mediated in the area between the cuticular plate and the OHC nucleus - an area characterised by a large number of these subsurface cisternae.

The finding of gamma amino-buytyric acid (Eybauling et al., 1988 cited in Dannhof et al., 1993) and acetylcholine receptors (Zenner et al., 1990) at the synapses of the OHC, suggested that efferent nerves could stimulate release of inositol-trisphosphate which would control the release and uptake of calcium ions into the cytoplasm and modulate OHC contractions. Recent discovery of other neurotransmitters such as choline acetyltransferase and glutamatee decarboxylase present in all OHC efferents and along the entire cochlea (Dannhof et al., 1993) suggested that they perform a similar function.

It is unlikely that the fast motile responses required the mediation of intracellular Ca_{2+} (Zenner et al., 1987 cited in Ikeda & Takasaka, 1993) because of its relative independence of adenosin triphosphate (ATP) involvement (Kachar et al., 1986 cited in Slepecky et al., 1988).

De Boer (1990) speculates that mechanical energy within the scala media or tectorial membrane could be released into the Organ of Corti, or that the energy source could be electrical or even chemical, and idea that appeals to Neely and Kim (1986) as well. They guessed that the source of this energy was electrochemically obtained from the surrounding endolymph. ATP is necessary in all biological systems as an energy source necessary for the maintenance of the system. An active cochlea implies that energy needs to be added to the system and Schacht (1986) reasons

that there is no evidence that the cochlea differs from any other system in the body, and that ATP is formed through energy metabolism procedure called oxidative phosphorylation. ATP is a phosphate compound whose molecular bonds are rich in energy which can be released when required (McGilvery & Goldstein, 1979). Bronwell (1990) strongly disagrees with Schacht (1986) stating that "the movements result from direct conversion of electrical potential energy to mechanical energy come from experiments that demonstrate movements even after cellular stores of ATP are depleted" (p.84). By so doing, he is specifically stating that the physiology of the cochlea is very different to any other body system by not requiring ATP. He states that ATP is produced in stria vascularis and used to drive peripheral cells and not OHC specifically.

Davis (year unknown, cited by Schacht, 1986) was the first to present his "battery theory" where he cites stria vascularis as being the source of this energy and for this reason Schacht (1986) surmises that the cochlea has an unusually low metabolic rate in comparison to other sensory systems because of the contribution of stria vascularis although the exact relationship has yet to be elucidated. Four years later, Bronwell suggested that the stria vascularis is the source of a silent current of potential energy (1990) and it is this current that stimulates the motility of the OHC. OHC are therefore indirectly fueled by ATP via the stria vascularis.

RETURN TO THE PASSIVE MODEL

Lechner (1993) correctly states that the activity of the intact BM is still unclear. Dancer (1992), from a review of the literature also suggests the re-examination of the BM. If the cochlea is as active as suggested by the previous research, Clopton (1986) argues that such an undamped system would be highly unstable and would have a long release time with oscillations continuing for several seconds. This instability is acknowledged by Bronwell (1990) who rationalises that it is these very oscillations which will trigger SOAE.

By comparing the latency between the cochlear microphonic and the input stimulus obtained via direct measurements and those calculated from the Zwislocki travelling wave theory, Dancer (ibid) was able to conclude that measurements were significantly smaller than those calculated, as illustrated in Figure 6. He concluded that the BM was stimulated as a whole immediately and that the BM acted as a Helmholtz resonator at least at frequencies below the characteristic frequency, a theory subscribed to more than a century before. However, he is sceptical about the use of the one-dimensional longwave model proposed by Zwislocki (1948 cited in Zemlin, 1982) because the expectations of a long latency required by this model are not met by the short experimental measurements. They concluded that this bank of resonators was a passive phenomenon until the point of characteristic frequency of the BM, where OHC are thought to contribute towards some active processing superimposed upon a passive hydromechanical phenomenon.

Clopton (1986) also subscribes to this view, in which the passive role of BM resonance is coupled with the active but independent resonation of the tectorial membrane and hair cells. Lizard hair cells were examined

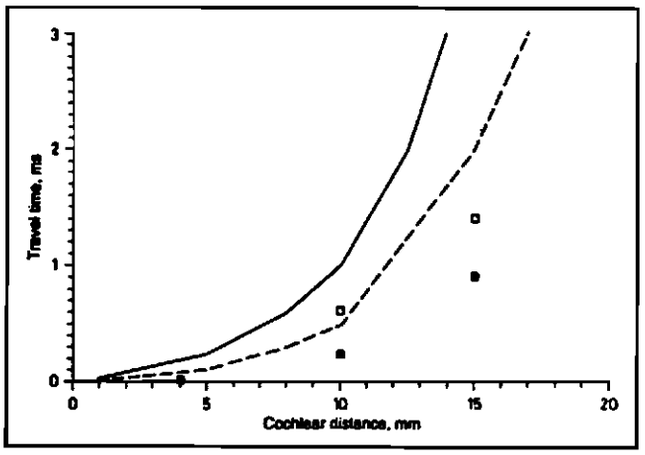

Figure 6. Time taken for a wave to traverse the length of a guinea pig cochlea. Theoretically calculated times (___) are contrasted with actual latencies (■■■■) (after Dancer, 1992, p. 305).

by Peake & Ling (1980) and they found that the BM vibrated as a whole in response to acoustic stimuli and no travelling wave was generated.

Using a newly developed piezopolymer transducer to measure BM displacement, Lechner (1993) constructed a hydromechanical model of the ear and concluded from his observations that the longitudinal stiffness of the BM could provide differential response characteristics, seemingly providing more experimental evidence that perhaps these traditional theories were not to be discarded so quickly.

Kolston, Viergever, de Boer & Diependaal (1989) criticise the assumption of active elements in the cochlea since it was based on observed broad mechanical tuning together with the fine frequency selectivity of the neural responses. In comprehensive cochlea model based on an anatomical evidence, Kolston et al. (1989) suggest that the BM is divided into an arcuate and pectinate zone (refer Figure 7).

The motion of the arcuate zone was influenced by the

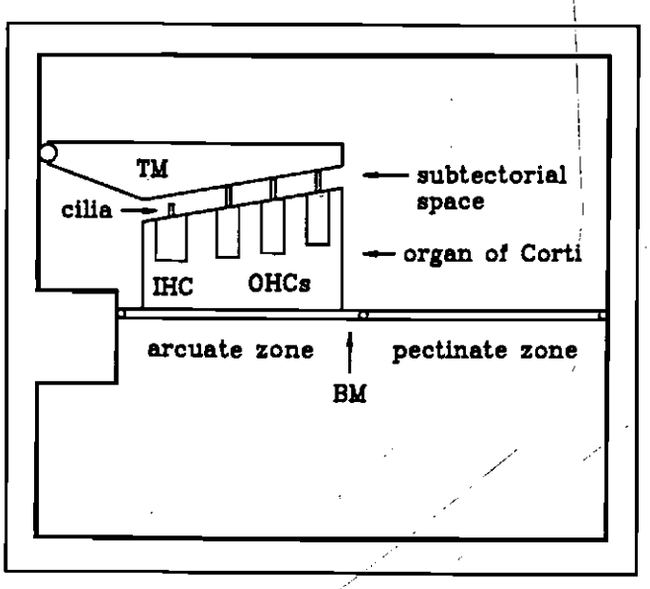

Figure 7. Schematic diagram showing the division of the basilar membrane (BM) into an arcuate and pectinate zone (after Kolston et al., 1989, p. 134).

organ of Corti and tectorial membranes. They postulated that the supporting cells in the pectinate zone acted as feedback mechanisms to the OHC to enable them to control their impedance and consequently indirectly controlling BM motion. This theory is interesting in that it is able to suggest a function for the supporting cells as well which up to now has been speculated to be purely supportive and nutritive (Engström, 1982). This theory is also able to explain the contrast between broad tuning measured in the cochlea and the sharpness of the acoustic nerve response (Johnstone et al., 1986). The authors argue that the probes utilised measured average BM response, largely the response of the pectinate zone. Their conclusion is that sharp frequency selectivity of the cochlea can exist without the use of active elements, if the effect of the arcuate zone were to be taken into account.

Data from Khanna & Leonard (1982 cited in Neely & Kim, 1986) speculate that there is a linear relationship between BM displacement and excitation of hair cells at levels near threshold. De Boer (1983) then extended this idea by suggesting that nonlinearity only becomes evident at high intensities. This idea correlates well with the hypothesis that only excessive gain of the amplifier would generate SOAE (Neely & Kim, 1986).

Several theories subscribe to the coexistence of a passive and active element in the cochlea, but differ in their division of the roles - be it along the threshold of frequency continuum.

AND SO ...

Despite this wealth of data about the OHC, what about the inner hair cells (IHC). Spoendlin (1969 cited in Engström et al., 1982) reports that 90 - 95% of the afferent nerve fibres innervate the IHC. Moreover, most of the auditory information carried by the auditory nerve arise from the IHC (Pfingst, 1986). The purpose of the IHC seems to be to detect the stimulus and mimic the characteristics of the acoustic nerve (de Boer, 1983; Nuttall, 1986). How the stereocilia of these cells are displaced is still questionable although there are postulations that it may be through the viscous forces of the surrounding fluids (Nuttall, 1986) or influence from the active mechanical OHC. Brown & Nuttall (1984 cited in Nuttall, 1986) found that the OHC has sufficient active energy to set the inner hair cell cilia in motion. The exact nature of the coupling between OHC and IHC is still one of the most perplexing question in auditory physiology since it has been generally accepted that there is no direct mechanical coupling via the tectorial membrane.

Nevertheless, Lim (1986) in his detailed review of the microanatomy of the cochlea reports on the existence of IHC imprints on the basal surface of the tectorial membrane. He acknowledges that these are not as distinct and consistent in appearance as those of the OHC but at the same time states that the possibility of IHC (especially those at the apical end) coupling to the tectorial membrane albeit loose should not be ignored. Such evidence suggests that there could be mechanical coupling of OHC responses to the IHC.

By anatomically contrasting the IHC and OHC, a number of differences between these two sensory structures can be noted, most markedly the innervation system (greater number of afferents IHC), tectorial membrane coupling and location along the BM (Lim, 1986, p.142) . IHC tends to be located on the immobile portion of the BM whilst OHC are found on the lateral, more mobile portions. This suggests that the OHC could be responsible for the active mechanics of the cochlea whilst the IHC acts as the passive transducer.

The role of the supporting cells in auditory perception has also been questioned although evidence is still scanty. Traditionally, they have been considered to provide a supporting framework, form a boundary between the endolymph and perilymph, formation of the tectorial membrane and phagocytosis of cell debris (Engström et al., 1982; Oesterle & Dallos, 1989). Oesterle & Dallos (1986) found that both alternating and direct current were compared and the amplitude of the currents were found to be dependent upon the cell location. The closer the cell was situated to the IHC, the larger the direct current component. They postulated that their role could be in the regulation of neurotransmitter concentration in the intercellular spaces (p.231). In a subsequent paper on the same subject, the experimenters concluded that the potentials measured in the supporting cells arise from the electric currents generated by the hair cells and also show a reflection of the tuned responses of the hair cells.

CONCLUSIONS

Research in the area of cochlear micromechanics is still ongoing although much information has been gained through the discovery of otoacoustic emissions. Recording of spontaneous and evoked emissions revived the concept that the cochlea could be *active*, whilst the discovery of distortion product emissions confirmed the presence of *nonlinearity* in the cochlea. The third problem facing biophysicists was the *high frequency selectivity* of the IHC and VIII nerve when compared to the broad tuning curves of the BM. Subsequent research has focussed mainly on the resolution of these three aspects of cochlear physiology.

There is a wealth of fragmentary experimental data examining isolated cochlear behaviour under certain conditions, but the assimilation of this data into a cohesive cochlear model is still elusive. A major problem lies in the construction of a mechanically active cochlear model which is intrinsically unstable hampering investigators (de Boer, 1983, p.572) as well as the limited *in vivo* measurements possibly causing the seemingly contradictory data.

Regardless of these difficulties, there seems to be increasing concensus over several issues:

(a) that non-linearity exists at several levels - the basilar membrane, the mechanical transduction into potentials and between the hair cell potentials themselves (Eggormont, 1993);
(b) that there is an active process occurring within the cochlear (Davis, 1983) primarily mediated by the outer hair cells (Kim, 1986);
(c) that the origin of the emissions are the electromotility of the OHC (Bronwell, 1990) as observed by the obliteration of these responses following noise-exposure, salicylate ingestion and other insults;
(d) that the efferent feedback loop (Xie et al., 1993) and in particular the neurotransmitters (Zanner et al.,

1990) play a critical role in this. Such observations would explain the sharp tuning curves of the cochlea and the presence of otoacoustic emissions and the pivotal role the OHC plays.

Nevertheless, some authors have cautioned against the quick dismissal of the traditionally held theories of hearing and suggest the presence of some crucial passive response of the cochlea occurring concomitantly (Dancer, 1992). There is an overwhelming mass of experimental data on cochlear mechanics and each publication brings with it a new dimension. This paper serves merely to highlight the current trends, but this arena is eternally in a state of flux. Undoubtedly, the cochlea is truly a sensitive, selective and *secretive* instrument!

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Burnout: A Smouldering Problem Amongst South African Speech-Language Pathologists and Audiologists?

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ABSTRACT

The present study aimed to investigate the frequency of burnout occurring within the profession of speech-language pathology and audiology and to examine possible work situation factors unique to the profession, that may be correlated with burnout. A cross-sectional postal survey research design was used, including a standardised measure of burnout as well as a questionnaire inquiring about demographic and work situation variables. Subjects were randomly drawn from names obtained from the South African Medical and Dental Council. Results were analysed statistically using Pearsons correlations, Multivariate Analysis as well as Bonferroni T-tests. The main finding that emerged was that, as a group speech-language pathologists (SPLP's) and audiologists in South Africa are experiencing moderate levels of emotional exhaustion, low levels of depersonalisation as well as high levels of personal accomplishment. Therapists working in hospitals, mainly treating peripheral hearing disorders, working either as audiologists only or speech-language therapists and audiologists, with heavy caseloads and extensive paperwork, and perceiving themselves to be under large amounts of work pressure, appear to be the most susceptible to burnout.

OPSOMMING

Die huidige studie het ten doel om die frekwensie van uitbrand ("burnout") binne die beroep van spraak-taalpatologie en oudiologie te ondersoek en om moontlike werksituasiefaktore wat uniek is aan die beroep en met uitbrand gekorreleer kan word, uit te lig. 'n Veldopname navorsingstegniek is gebruik tesame met 'n gestandaardiseerde uitbrandmeting asook 'n vraelys aangaande demografiese en werksituasie veranderlikes. Proefpersone is toevallig geselekteer uit name van beroepslede wat van die Suid-Afrikaanse Mediese en Tandheelkundige Raad verkry is. Resultate is statisties geanaliseer. Die belangrikste bevinding was dat spraak-taalterapeute en oudioloë in Suid-Afrika as 'n groep redelike vlakke van emosionele uitputting, lae vlakke van persoonlikheidsaftakeling, asook hoë vlakke van persoonlike bekwaamheid ervaar. Terapeute wat in hospitale werksaam is en veral die wat perifere gehoorafwykings behandel, wat as oudioloë of as spraak-taalterapeute en oudioloë werksaam is, wat swaar pasiënt-ladings en uitgebreide administratiewe skryfwerk hanteer, en wat hulself ag as om onder groot werksdruk te wees, blyk die mees vatbaar vir uitbrand te wees.

The term "burnout" was originally coined by Freudenberger in 1974 and was subsequently defined by Maslach (1982) as a syndrome which results in a state of emotional exhaustion, depersonalisation, and reduced personal accomplishment among individuals who work with people. Although burnout has seldom, if ever, been documented in the research literature on South African Speech-Language Pathologists (SPLP's) and Audiologists, it seemed unlikely that these professionals would be immune from this phenomenon-- particularly given the stressful nature of their work with communicatively-impaired persons, and the unique socio-economic and politico-cultural context in which they are expected to practise their profession.

Cherniss (1980), summarises burnout as a process beginning with excessive and lengthy levels of job stress, leading to strain in the worker, i.e. feelings of tension, irritability, fatigue and *emotional exhaustion.* The second stage of the process occurs when workers defensively cope with the job stress by detaching themselves from the job psychologically, developing *depersonalised attitudes* and becoming apathetic, cynical and rigid towards their clients. The final stage occurs when caregivers develop a sense of failure and inadequacy regarding their inability to relate to clients and experience a sense of *reduced personal accomplishment.*

The symptoms or effects of burnout can be classified into three dimensions: physical effects (e.g. headaches, insomnia, gastro-intestinal disturbances and susceptibility to illnesses); psychological effects (e.g. emotional exhaustion, negative attitude changes and apathy); and behavioural effects(e.g. lower work productivity, absenteeism, drug and alcohol abuse and an assumed deterioration of patient care (Maslach & Jackson, 1981; Van Der Ploeg, Van Leeuwen & Kwee, 1990). In addition to the effects on the individual person, the burnout sufferer's family may be affected in terms of increased friction and tension in the home (Barling, 1986).

Finally, burnout may affect employing organisations which receive poor work performance and low productivity from their employees and have to deal with high rates of absenteeism and staff turnover. It can thus be seen that burnout has individual, institutional and familial repercussions thereby affecting the whole of society.

Furthermore, from an ecological perspective, burnout is viewed as an imbalance between environmental demands and people's stress-coping resources, and causes or correlates of burnout may occur anywhere within the ecological system including the individual person, the organisation or work environment, and the broader socio-cultural milieu.

The Person

Individual factors and personality characteristics play a role in the burnout process. For example, age, gender, marital status and the number of years working experience have been correlated with burnout (Bernstein, 1992). Burnout among human service workers has been found to be significantly correlated with neurotic anxiety, unrealistic goals and low self-esteem (Ratcliff, 1988). Furthermore research has correlated burnout with personality factors such as locus of control, hardiness, and Type A personality. For example, Cherniss (1980) suggested that persons with an external locus of control, i.e. people who believe that their lives are influenced by external forces, were more likely to experience burnout; while Kobasa (1979) maintained that persons with high levels of hardiness tended to be resistant to stress because their personalities were characterised by a commitment to personal values, a sense of control over their lives, and a view of change as a challenge. Type A behaviour is the term used to describe people who are intensely ambitious, hard-driving, impatient and aggressive with a keen sense of time urgency. Although people of this type tend to be high-achievers, they tend to experience more heart attacks and be more susceptible to stress than the placid, relaxed Type B person (Cooper and Davidson, 1991). In addition to personal attributes, factors within the work environment can also potentially contribute to burnout.

The Work Environment

Cherniss (1980), believes that differences in jobs and organisations are stronger etiological factors of burnout than are differences in individual characteristics or personality. He is supported by Maslach (1982), who believes that although personality plays a part in burnout, the phenomenon is best understood and modified in terms of situational sources of job related, inter-personal stress. Maslach (1982) believes that burnout is a unique form of stress, in that it is a response to the chronic emotional strain of working extensively with other human beings, particularly when they are experiencing problems.

SPLP's and audiologists do not only deal with communication and hearing problems, they deal with people who also exhibit emotional and physical problems which need to be dealt with in therapy and which can be accompanied by possible negative attitudes on the part of patient and therapist. Moreover therapeutic work is usually demanding and emotionally draining. It is difficult to assess the degree of therapeutic success in the helping professions and how much time is required to see progress in therapy. Most human service work, compared with other types of work, offers very little feedback, thus the therapist must work in the dark, not knowing the success of his or her efforts. A lack of therapeutic success has been cited as one of the most stressful aspects of therapeutic work (Maslach,1982).

Miller and Potter (1982), investigated stress among a sample of 123 members of the American Speech-Language-Hearing Association. They found that 43% of their respondents reported themselves to be moderately burned out. A survey conducted by Van der Gaag (1988), as cited by Kersner and Stone (1991), found that 99% of District Speech Therapy Managers in the United Kingdom felt that stress levels in the profession had increased in the last few years. Moreover, this problem was cited as a major factor affecting the performance of the speech therapists. According to Fimian, Lieberman and Fastenau (1991), who formulated a burnout scale specifically for Speech-language pathologists working in schools found that increasing demands for accountability, together with large caseloads, excessive paperwork, and feelings of isolation, would appear to make SPLP's and audiologists especially prone to stress and burnout. These researchers point out that SPLP's cannot be expected to function effectively if suffering from excessive fatigue, headaches and other reported symptoms of stress. It is of interest that Fimian et al., (1991, p.444), found stress scores in their sample, to be highly correlated with "bureaucratic restrictions, time and workload management and lack of professional supports". Kersner and Stone (1991), found that speech therapists as compared to Occupational and Physical therapists in the United Kingdom experienced the size of their caseload and feelings of isolation as stressful. In fact a very high proportion of their respondents, namely 82%, reported being stressed at work.

The findings from these three overseas studies of stress and burnout within the profession of Speech-language Pathology highlight the need for SPLP's and audiologists' stress symptoms to be taken seriously and for the underlying etiologies to be addressed. These findings also lend support to Cherniss's contention that factors within the work environment play a crucial role in the development of burnout.

Among the work setting variables that have been implicated in previous research as possible correlates or moderators of the burnout syndrome are social support, workload and clientele.

Cobb (1976) defines *social support* as information leading the individual to believe that: 1) he or she is cared for and loved (emotional support), 2) he or she is esteemed or valued (esteem support), and 3) he or she belongs to a network of communication and mutual obligation (network support). According to the buffering hypothesis, as cited by Ross, Altmaier and Russell (1989), persons involved in supportive relationships are able to rely on others to help them when dealing with stress, a resource likely to lessen the adverse effect of stress on physical and mental health. Several researchers cited by MacFarlane (1990), emphasised that social support from co-workers and supervisors is one of the most effective ways to alleviate negative effects of organisational stress.

A further important work variable is that of *workload*. According to Maslach (1982), a large case load means that less time can be spent on each case, fewer services may be provided and there may be little or no follow-up. The helper may develop a quick and emotionally withdrawn method of dealing with her clients to try and avoid the emotional strain of dealing with so many people. This inadequate care provided may in turn induce feelings of inefficiency, failure and a lack of personal accomplishment and thus a large case load may represent a major source of burnout. Fimian et al. (1991, p.433), found that "Time and Workload Management" questions, consisting of items dealing with SPLP's perceptions of time at work, accounted for 32% of the stress variance. High scorers on this factor reported having "too much work to do, no time to get things done, little time to prepare, little time for personal priorities, and too much paperwork."

One also needs to look at the effect of the *type of clientele* on the frequency of burnout. Cherniss (1980), cites the example of helpers who have low functioning clientele. He argues that such persons are likely to believe that there is little they can do to improve their functioning leading to feelings of a poor sense of impact and efficacy. Furthermore such professional caregivers are unlikely to be able to use their clinical skills to the fullest extent and may experience their roles as less consistent with their professional identities. Tuomi (1993, p. 11), explains how quality care for the severely retarded person may just involve "doing something and maybe teaching the patient to cope with simple tasks..." These factors can have an effect on the experience of job stress and the coping reaction.

These stressors within the work environment are likely to be further exacerbated by stressors emanating from broader societal factors.

The Broader Sociocultural Milieu

According to Handy (1988, p.354), "... the root causes of both stress and burnout are often far removed from the individual person or job and may be more appropriately conceptualised in societal and organisational terms". An ecological perspective, where stress can be viewed as a result of an imbalance between environmental demands and resources, is possibly applicable to South African SPLP's and audiologists.

Becker and Isaacs (1993, p.15), believe that "South Africa is a country in transition. There are changes in the structure of society, in terms of social change and the elimination of apartheid, and in terms of massive moves from rural to urban settlement. Concomitant with the promising aspects of societal change, there are, however, other aspects which place strain on the available health care services".

A major source of strain is poverty which has a serious impact on individuals, families, and society in general. According to Phiyega (1992), in South Africa, poverty presents itself in political unrest due to stress and conflict, violence in families and communities, unemployment, lack of provisions and lack of facilities.

Hence, there are economic, political and social stressors operating in this country at the present time. An aspect of the inadequate provision of resources cited by Beecham (1990), concerns the small number of speech and hearing therapy graduates trained in South Africa which results, from Aron's (1991) estimation of 1984 figures, in therapeutic services reaching only 138,000 persons from a possible client population of 3.5 million. In 1986, a survey conducted by the Department of National Health and Population Development found the following: In respect of so called "coloured" people, there was a shortage of 520 therapists. For Asians the shortage was 139 while the shortage for the Black population group was 3396. Aron (1991), provided the following statistics: 223,200 persons with communication disorders receive attention in a period of a year, however, there are approximately three million who have communication disorders. Clearly the ratio of therapists to patients requiring therapy is not improving with time.

These figures lend support to Becker and Isaacs's (1993, p.24), contention that "in South Africa the need to cater to increasing numbers of clients needing assessment and treatment is juxtaposed with the scarcity of trained professionals in the helping professions". From the above statistics it would seem likely that practising SPLP's and audiologists are being required to work with excessively large caseloads.

Secondly, therapists have to adapt their First World training to meet the need of particular social, educational and communicative problems within South Africa's culturally diverse population. Speech therapy and audiology can no longer safely slot into a tertiary level of intervention. SPLP's and audiologists now have to shift to intervention at a primary or secondary level, in communities where these needs are not being met. This may be placing an extra burden on the therapists who no longer confine themselves to giving therapy, but also have to tackle education of communities on relevant issues.

Steenekamp (1993, p.5), states that in the light of the economic situation "there is an increasing demand for the therapist's clinical skills, with a decreasing amount of time available for other demands, eg., research, tutoring, training of students, observation and so forth. Increasing demands from other institutions are only adding to an increasing amount of stress." Aron (1991), commented on the frustration endured, defending and interpreting the profession of speech pathology and audiology to official sources, university administrators and medical personnel. She states that this in fact may be a contributing factor in the burnout syndrome.

Clearly, South African SPLP's and audiologists appear to be subject to stresses at all levels of the social system, and to factors unique to the context of this country. It therefore appeared to be both relevant and timely to investigate the occurrence of burnout within members of this profession and to endeavour to relate frequency of burnout with factors occurring at the individual or personal level, within the work environment as well as the broader sociocultural milieu.

Although Miller and Potter (1982), conducted a national survey of burnout among SPLP's, criticism can be levelled against them because of their failure to use a standardised measure of burnout, such as the Maslach Burnout Inventory (MBI). Instead they merely asked respondents "how burned out they felt".

In order to obtain more valid and reliable data on stress symptom levels in the profession, Fimian et al.,

(1991), developed the Speech-Language Pathologist Stress Inventory (SLPSI). More specifically, they constructed "... an instrument designed to measure job related sources and manifestations of stress experienced by speech-language pathologists in the schools..". These researchers attempted to adapt the MBI to speech pathologists. A possible weakness with the SLPSI is that the authors averaged scores from individual subscales to yield a Total Burnout Scale. Koeske and Koeske (1989, p.142), advise against the use of this procedure for the following reason: "Given the differential associations of the three subscales with one another and with other measures, researchers probably should avoid computing a composite "burnout" score and instead preserve the three subscale scores and relate them separately to other measures whenever appropriate". Furthermore, this inventory was standardised on school speech-language pathologists only and may not necessarily tap possible stressors affecting speech-language pathologists in other job settings.

The present study endeavoured to improve on the methodology utilised in these three overseas studies, and to extend their scope by incorporating standardised measures of burnout, co-worker support and supervisory support and by eliciting information on the broader sociocultural factors unique to South African SPLP's and audiologists. Furthermore, it was hoped that the study would add to the theoretical knowledge of burnout and possibly provide practical suggestions for reducing the potentially deleterious effects on SPLP's and audiologists, their employing organisations and their clients.

METHODOLOGY

AIMS

The aims of the study were:

(1) To investigate the frequency of burnout occurring among speech-language pathologists (SPLP'S) and audiologists.

(2) To determine the relationship between frequency of burnout and certain personal characteristics and work situation variables specific to SPLP'S and audiologists.

INDEPENDENT VARIABLES	DEPENDENT VARIABLES
Personal Factors:	**Burnout:**
Gender	Emotional Exhaustion
Work Experience	Depersonalization
	Reduced Personal Accomplishment
Organisational Factors:	
Caseload	
Place of Work	
Type of Impairment Treated	
Severity of Impairment Treated	
Adult/Child	
Working as SPLP/Audiologist	
Paperwork and Administration	
Language of Client	

Broader sociocultural factors perceived to contribute to the experience of stress, were analysed descriptively and were not included in the statistical analysis as no standardised scale is available to measure the phenomenon.

SUBJECTS

Subject Selection Criteria

A random probability sample of 500 names was drawn from the register of SPLPs and audiologists in the Republic of South Africa registered with the S.A. Medical and Dental Council as at June 1992. Krejcie and Morgan as cited by Christenson (1980, p.299), suggest a sample size of 270 people to be an adequate representation of the total population of 852 people.

Description of Subjects

The sample comprised 500 therapists, 98% of whom were female and 2% were male. Extent of work experience ranged from 1 year to 40 years with a mode of 11 years. With regard to place of work, 35% of respondents were employed in schools; 32% in private practice; 10% in hospitals; 7% in universities; and 16% in other settings. Type of impairment treated was broken down as follows: language-learning disabilities 27%; language 20%; peripheral hearing loss 10.5%; central hearing loss 2%; articulation 8%; fluency 5.5%; traumatic brain injury 2%; mental retardation 3%; aphasia 1.5%; and other 2%. The vast majority of respondents, namely 73.5% worked with children only, while 4.5% worked solely with adults, and 22% provided services for both children and adults. In terms of the focus of intervention, only 7% of the sample were employed solely as audiologists; 44% worked only as speech pathologists; while 49% fulfilled the dual role of SPLP and audiologist.

RESEARCH PROCEDURE

Research Design

In order to investigate the aims of the study, a cross-sectional, survey research design was employed which involved the use of a postal questionnaire.

Description of the Questionnaire

A 9-page questionnaire (set out in Appendix I) was constructed which could be completed in approximately 10-15 minutes. The research instrument was made available in both English and Afrikaans translations as all respondents supposedly received their tertiary level education in either of these languages. A covering letter explained the purpose of the questionnaire, provided assurance of confidentiality, and clarified how and when to return the questionnaire. The questionnaire comprised the following sections: demographic information; open-ended questions on the respondent's perceptions of the influence of certain factors on stress and stress-coping strategies used by the respondents; subscales from Moos and Insel's Work Environment Scale; and the Maslach Burnout Inventory. These sections were included in order to provide information on the relationship between the frequency of burnout being experienced, and biographical as well as work environment variables of the SPLP's and audiologists. Each section is described separately as follows:

Demographic Information

The aim of this section of the questionnaire was to solicit biographical information, namely respondent gender as well as data on factors such as job setting, caseload size, type of impairment, respondents subjective perceptions of severity of client's communication impairment and the amount of time spent on administration of paperwork.

Open Ended Questions

This section of the questionnaire included items aimed to elicit respondents' perceptions of the possible influence of socio-economic and politico-cultural factors on the experience of work stress. Also included were questions soliciting information on strategies used by respondents to cope with stress. Finally, the respondents were asked whether they felt stress-management techniques should be taught to students as well as graduates.

The Work Environment Scale(WES)

The WES is a 90-item, paper and pencil measure developed by Moos and Insel (1974), to assess the social climate of many types of work units, and focuses on relationships among employees, between employees and supervisors, and on the unit's basic organisational structure and functioning. The WES is composed of ten subscales that tap three underlying dimensions: Relationship, Personal Growth, and System Maintenance and Change.

From the Relationship dimension two sub-scales were utilised in this research, namely: Peer Cohesion, and Supervisor Support. These sub-scales assess the extent to which employees are friendly to and supportive of one another, and the extent to which management is supportive of employees and encourages employees to be supportive of one another (Moos, 1986, p.1).

From the Personal Growth or Goal Orientation dimension, one sub-scale was utilised, namely: Work Pressure. This sub-scale assesses the degree to which the press of work and time urgency dominates the work milieu (Moos, 1986).

Internal consistency calculated for each of the ten WES sub-scales using a sample of 1,045 employees, has been found to be within an acceptable range, i.e. 0.69-0.86 (Moos, 1986, p.4).

Importantly, Sub-scale inter-correlations indicate that the sub-scales measure distinct though somewhat related aspects of work environments. Test-retest reliability has also been found to be acceptable. Scales have also been reported to have satisfactory content and face validity as well as construct and criterion validity (Moos, 1987).

The Maslach Burnout Inventory (MBI)

The MBI, is a 22-item self-report scale developed by Maslach and Jackson (1981). Responses involve the frequency of feelings towards each question, ranging from never (0) to "every day" (6). The instrument is composed of three sub-scales measuring the three areas that Maslach and Jackson believe best define the experience of burnout, namely: emotional exhaustion, depersonalisation, and lack of personal accomplishment. The instrument is labelled "Human Services Survey" rather than "Burnout" in order to avoid biasing respondents.

The developers recommend that the inventory be presented as a survey of job-related attitudes without being connected to burnout and that anonymous responses be requested.

In view of the fact that burnout is a multi-dimensional construct, the test does not yield an overall diagnosis of "burned-out" versus "non-burned out" but instead provides three separate, non-additive scores of emotional exhaustion, depersonalisation, and reduced personal accomplishment.

Maslach and Jackson (1986) report that studies using the MBI have obtained high scores for internal consistency reliability, test-retest reliability, and convergent validity, and that the scale is free of social desirability bias.

Offerman (1985) states that the main limitations of the MBI is that it does not indicate the meaning of the score levels. The researcher needs to question what a "moderate" level of burnout means in terms of behaviour (Offerman, 1985, p.421). Nevertheless, the MBI has been in use for nearly twenty years and has been part of the methodology of hundreds of studies.

Research Protocol

Pilot Study

The questionnaire was pre-tested on a small group of English and Afrikaans speaking therapists not included in the final sample.

Distribution

i) The target population comprised 500 registered SPLP's and audiologists.
ii) In an attempt to increase the rate of returned completed questionnaires the researcher included stamped, addressed return envelopes and sent reminder cards requesting respondents to return questionnaires if they had not done so already.

ANALYSIS OF DATA

Initially the data was summarised using a univariate analysis procedure, which provided means where appropriate, standard deviations, modes, and ranges. Following this, results were analysed to establish relationships between the independent and dependent variables using inferential statistics such as Pearson Product-moment Correlations. This analysis was followed by a multivariate analysis of variance, using a General Linear Models Procedure. Finally Bonferroni T-tests were used to further analyse the data, and establish differences between sub-groups. The open-ended questions were analysed descriptively by summarising and describing common themes expressed in the responses.

RESULTS AND DISCUSSION

Although 230 questionnaires were returned only 202 were used as the remainder arrived too late to be incorporated into the statistical analysis. The response rate was therefore 40.4% which Moser and Kalton (1971),

regard as acceptable for mail surveys. Missing data on certain measures being correlated reduced the sample size below 202. Hence sample sizes ranged from 197-202, depending on the measure being correlated. The question on the language spoken by the respondents' patients was not included in the statistical analysis, due to the ambiguity of the responses obtained.

The first step in the data analysis involved obtaining the mean, mode, range and standard deviations of the variables. From the results it appeared that as a group SPLP's and audiologists were suffering from a moderate level of emotional exhaustion (i.e obtained a score between 17-26 on the MBI) although the range extended from a mild to high level of emotional exhaustion. The mean for depersonalisation was 3.8 indicating that as a group the respondents had a low tendency to depersonalise their patients (i.e. obtained a score between 0-6). These findings indicate that respondents have not, as a whole, developed a cynical opinion of their patients, expecting the worst from them and even disliking them. Scores did, however, range from 0-22 with any score above 13 being considered as a high level of depersonalisation. The group indicated a low level of feelings of Reduced Personal Accomplishment (i.e.obtained a score between 0-31) with a mean of 10.23 and scores ranging from 0-28. These results suggest that SPLPS were feeling competent and adequate in their jobs and their ability to relate to and treat their patients. These findings also underscore the fact that despite feeling emotionally exhausted, therapists can still derive a sense of accomplishment from the work and do not necessarily experience negative attitudes towards clients. These results are also consistent with Oktay's (1992) findings that despite relatively high levels of emotional exhaustion experienced by hospital social workers who work with AIDS patients, they felt a substantially high level of personal accomplishment because of the meaningfulness of their work.

Table 1. Burnout Scores

	Mean	RANGE		Std. Dev	Mode
		Low	High		
Emotional Exhaustion	22.2	0	52	23	10.8
Deperson.	3.8	0	22	0	4.3
Personal Accomplish	10.2	0	28	9	5.7

The relationships between the independent and dependent variables are discussed as follows:

Gender

A negative relationship significant at the 0.05 level ($F=6.41$, $p<.05$) was found between depersonalisation and gender and no significant relationship was found between gender and the other two dependent variables of emotional exhaustion and Reduced Personal Accomplishment. The research on gender and burnout is controversial with some researchers finding huge differences in the experiences of burnout between males and females and some finding very little difference. Men are reportedly more susceptible to develop callous feelings about the people they work with and hence more likely to experience depersonalisation (Maslach 1982;). The reasons offered by Maslach (1982) are that men tend less towards close contact with people. However, there is no empirical data to support this reasoning. In addition, the present sample included only four males therefore making the generalisability of gender results more difficult.

Length of Working Experience

A very significant negative relationship at the 0.01 level was found between the number of years the clinician has been working and depersonalisation, although this was not supported by the multivariate analysis ($F=0.92$, $P>.05$) or the Bonferroni T-test. Research has shown that burnout is lower among older and more experienced workers (Maslach 1982; Van der Ploeg et al.,1990; Ross & Altmaier, 1989). It seems that it is not just a case of work experience but also the maturity and stability that accompanies increasing age. Edelwich and Brodsky (1980) suggested that newly qualified professionals are prone to experience burnout when their initial energy and ideals are eroded by the real difficulties and limitations of their profession. This could be especially true for South African trained speech therapists who are taught western techniques during their training which may no longer be appropriate in a multi-cultural society such as South Africa and when the ideal clinic situation during their university training is no longer applicable in the real job context.

Of related interest is that a highly significant relationship at the 0.01 level of confidence was found between the number of years worked and the amount of paperwork completed. Pines and Maslach (1978) as cited by Savicki and Cooley (1987) offer an explanation for the above, suggesting that as workers remain in the field longer, they tend to become less involved in direct therapy work and more involved in administration and administrative duties which may be impacting on burnout in a unique way.

Place of Work

A significant negative relationship was found at the 0.05 level ($F=5.43$, $p<.005$) between place of work and emotional exhaustion, and a very significant relationship at the 0.01 level ($F=2.85$, $p<.05$) existed between place of work and depersonalisation. T-tests revealed that therapists working in a hospital setting tended to experience more emotional exhaustion than therapists working in private practice, and therapists working in institutions experienced more emotional exhaustion than those working in private practise. These findings suggest that the clinical setting and the work environment play a role in the type and severity of stress experienced by professionals.

Caseload

Also of interest is the significant correlations at the 0.005 level between place of work and caseload and at the 0.05 level between place of work and the severity of the client treated. These relationships possibly offer an

explanation for the relationship between place of work and emotional exhaustion. Furthermore a significant relationship existed between place of work and depersonalisation (F=2.85, p<.05). Hospital therapists tended to experience more depersonalisation than either school therapists or private practitioners. A very significant relationship at the 0.01 level (F=5.43, P<.001) was found between case load and emotional exhaustion. According to Maslach (1982, p.38), a large case load may lead to a situation of "too many people and too little time to adequately serve their needs-- a situation ripe for burnout." Furthermore larger caseloads mean that more energy is depleted in order to perform satisfactorily.

Type of Impairment

A significant relationship at the 0.05 level (F=2.50, P<.05) exists between the type of defect treated and depersonalisation. T-tests revealed that treating peripheral hearing disorders tended to be associated with greater depersonalisation of patients than treating both a language and a language/ learning disability. This could possibly be attributed to the fact that treating a peripheral hearing disability usually involves three or four sessions or perhaps even one diagnostic session, therefore the therapist is not afforded the opportunity to establish a relationship with her patients.

Paperwork

A very significant relationship was found at the 0.001 level (F=2.67, p<.05) between the amount of paperwork completed in a week and emotional exhaustion. According to Maslach (1982), administrative tasks and paperwork can interfere with the therapists' direct work with the patient as it could take up therapy time. In fact many of the therapists reported in the open-ended questions, that paperwork often needed to be done after hours as there was usually not enough time during the workday to complete all the necessary administration. Hence long work hours may be leading to feelings of emotional exhaustion.

Co-Worker Support

A very significant relationship exists at the 0.001 level between emotional exhaustion and co-worker support. This relationship was, however, not in the expected direction. Statistical analysis of the data, revealed the presence of a few outlying values which could have grossly distorted the data, resulting in a spurious rather than a meaningful or substantive correlation.

Work Pressure

Work Pressure and emotional exhaustion were highly correlated with each other and a very significant relationship at the 0.001 level (F=5.76, P<.001) existed between them. Cherniss (1980, p.44) maintains that "stress occurs when there is a perceived imbalance between resources and demands. Demands can be external (for instance formal job requirements) or internal (for example, personal goals, needs, and moral values)." Since it appears that external demands such as caseload, impairment treated, and lack of social support did not seem to be correlated significantly or were minimally correlated with the burnout phenomenon, it would seem that these demands are possibly internal as reported by some of the private practitioners in their open-ended questions. It is possible that practitioners were not perceiving their work demands realistically and were constantly plagued by a sense of urgency and lack of time to complete their work.

Descriptive Analysis of Open-ended Responses

Question 1 - Work Stressors

Common themes emerged in the responses of private practitioners and those working at schools and hospitals. Rules, regulations and bureaucracy, writing of detailed reports as well as inspections were considered as stressful factors at work. Those working in schools needed to use groupwork as a therapeutic technique due to time constraints and a situation of too many pupils and too few therapists and they tended to find groupwork stressful and emotionally draining. They claimed that this method was associated with poor progress of pupils due to insufficient treatment time. Poor cooperation between teachers, parents and therapists was a problem cited by many respondents. Private therapists complained of poor cooperation of parents with home programmes. They were pressurised to obtain results in a certain period of time and often parents and teachers had unrealistic expectations of therapy results. A few therapists found it stressful that patients who travel from far expect results within periods as short as in three sessions.

Furthermore, private therapists were expected to make an immediate diagnosis, leaving them no time to test thoroughly and arrive at a carefully considered diagnosis. Working in isolation was found to be extremely difficult as one cannot confirm results and diagnosis with another therapist. Financial handling of a private practice and collection of fees was reported to be highly stressful. Lack of training in certain areas of treatment was also found to be stressful for some therapists. Inadequate test materials and inappropriate standardised tests due to cultural and language biases increased the stresses of therapy. Many therapists felt that the profession has not seemed to have established itself. Some respondents highlighted the fact that one continually needed to promote the profession as there was insufficient knowledge about speech-language pathology and audiology and the contribution it can make. Time restraints and time pressure were found to be stressful by the majority of therapists irrespective of their job context. Time management was not confined to therapy but included school visits, speaking to parents, writing reports and programmes. There appeared to be little time for research and reading to keep pace with the unending amount of new information. Therapists often needed to work after hours to keep up to date with administration and paperwork. Therapists reported sometimes feeling ill-equipped to deal with emotional support and counselling during the session and the emotional difficulties involved in working with severely impaired patients who show little improvement.

Question 2 -Societal Stressors

Handy (1988) cautions that societal and organisational causes of stress cannot be ignored simply because there are no easy solutions to solving these problems. Figure 1 indicates that 30% of the respondents felt that broader societal factors did not contribute to their experience of stress. However, among the 70% of respondents who perceived themselves to be affected by socio-economic and politico-cultural factors, common themes were expressed.

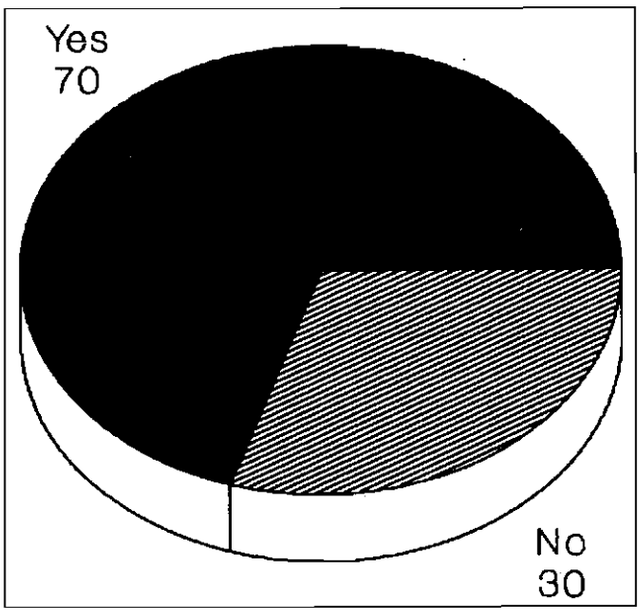

Figure 1. Affected by Sociocultural Factors.

Therapists found it stressful that children from poor economic backgrounds seem to show little progress in therapy. One of the most important demands confronting human service staff is the expectation of competence and many caregivers are motivated to achieve a sense of efficacy or psychological success in their work (Cherniss, 1980). Lack of progress in therapy might therefore be stressful for therapists. The respondents attributed this occurrence to poor parental education levels, the fact that patients often do not attend therapy, follow home programmes or advice given and do not understand the implications of the disorder. In addition to this, caregivers often have to work and there is little stimulation in the home. Another related issue was that many patients cannot afford to come regularly to therapy. Furthermore, new medical aid cutbacks have frequently required reducing the number of therapy sessions and thus therapists feel that because of rising costs they are more accountable to achieve rapid results. Many therapists were also distressed at the prospect of not being able to treat patients who could not afford clinic fees.

Several respondents reported that for those therapists not in private practise, the number of posts available has been reduced resulting in large workloads and little job satisfaction.

Salaries have been cut or are not being increased making it difficult to meet the rising cost of living. Political unrest results in therapists fearing for their safety and the security of their families. A few therapists found that travelling to work was stressful as they feared rioting or being attacked. The above are examples of physical work stressors which can potentially influence workers' perception of job comfort.

There appeared to be uncertainty as to the future of the profession in a Third World country where primary needs are not being met. There is often a lack of reliable transport to and from the townships and violence and stayaways seriously disrupt provision of services. The poor economy and uncertain politics-- including political differences among co-workers, impacts on enthusiasm and ease of working conditions.

From a sociocultural point of view therapists remarked on the difficulty of working with patients from different cultures and different languages. Person-role conflict can contribute to burnout (Cherniss, 1980). Many therapists indicated that they felt unprepared to work with other communities because they lack the necessary knowledge and skills. The implications of these findings are that if the SPLP's and audiologists are not adequately trained for new rôle demands, the consequences are likely to be high levels of person-role conflict, job stress, dissatisfaction and burnout (Cherniss, 1980).

Some therapists commented on the language barrier between teachers and therapists and the difficulty in advising teachers on how to handle second language learners. On the other hand those therapists serving only white South Africans were concerned that they were not addressing the needs of the larger community. Furthermore, many of the children treated live with their grandparents and subsequently it was difficult to obtain medical and genetic histories. Finally, parents may not bring their children for an assessment until they are older and the problem has become compounded and multifaceted and in some cases resulting in poor prognoses.

Question 3 -Stress-coping strategies

"Coping refers to changing cognitive and behavioral efforts used to manage internal or external demands perceived as exceeding the resources of the individual" (Folkman, Lazarus, Gruen & De Longis, 1986, p.23). Strategies used to cope with stress varied and appear to be highly individualistic. Common techniques utilised involved regular exercise, time away from work, religious beliefs as well as careful planning and organisation of work schedules and demands. Some negative strategies such as smoking, overeating and drinking coffee were also reported.

Question 4 - Stress-management course during training

The majority of respondents, namely, 62% of the respondents felt that a stress management course should be incorporated into the training curricula of speech-language and hearing pathologists. Others felt that the course was too full and that to include another subject would only serve to increase the stress experienced by students. Furthermore, it was felt that if time was available it should rather be utilised for areas that were not taught in detail. Others felt that such a course would be useless without specific job experience, and that different work contexts cause different forms of stress.

Wilder and Plutchik cited in Paine (1982, p.115) agree, believing that " just giving knowledge to professional trainees about stress and the phenomenon of burnout during training will probably have few long term effects".

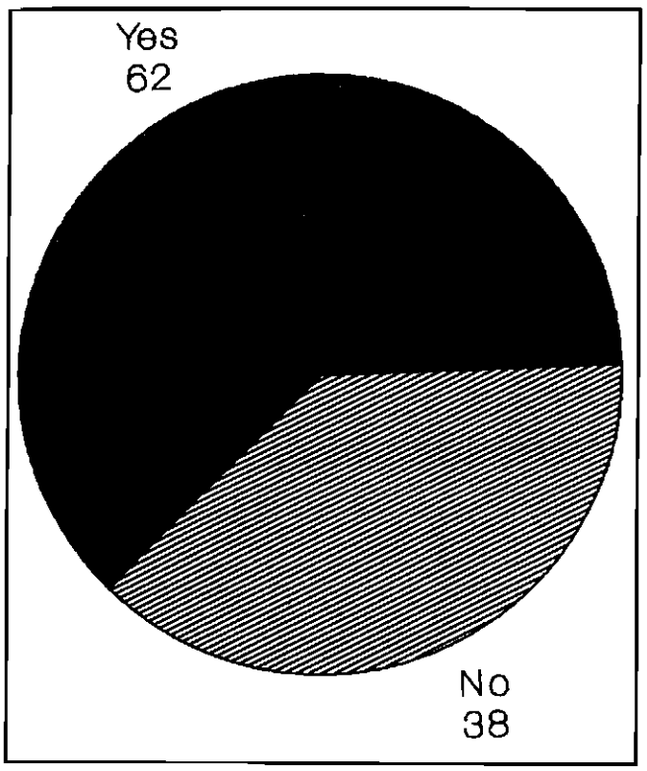

Figure 2. Stress Management Course for Students.

Question 5 -Stress-management course for qualified therapists

A high proportion of respondents, namely 80%, felt that a stress-management course should be made available for qualified speech-language and hearing pathologists. It was, however, specified by many respondents that this course should not be run by fellow speech-language therapists and audiologists as the subject matter was regarded as too personal. Among those who felt the course was unnecessary, reasons given were that

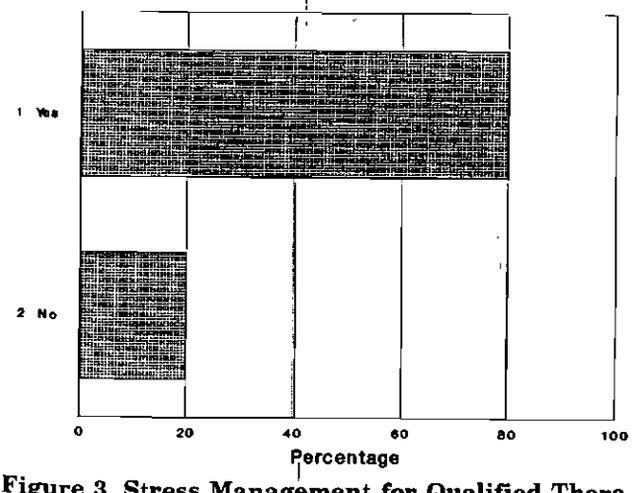

Figure 3. Stress Management for Qualified Therapists

stress management is a personal choice and is too varied to apply to everyone.

CONCLUSIONS

The data suggest that although moderate levels of burnout characterised the sample on average, certain job characteristics tended to make SPLP's more susceptible to this experience. Furthermore, despite the fact that many respondents were subject to difficult work conditions which tended to give rise to feelings of emotional exhaustion, the majority of therapists reported deriving a sense of accomplishment from their work and relatively low levels of depersonalisation.

It is important to note that this study provided correlational data and thus no conclusions about causal relations among socio-demographic factors, work setting variables and burnout can be drawn. Nevertheless, the findings from the study do have implications for clinical practice and job design; research; and the training and continuing education of speech-language pathologists and audiologists.

Clinical Practice and Job Design

In view of the fact that certain job settings such as hospitals, appear to contain more potential for job stress than other contexts, it is recommended that employers of SPLPS and audiologists pay attention to the structure and design of the job. For example, support meetings, informal case discussions, supervision and buddy or mentorship systems are alternate strategies that could possibly be built into work structures. These support mechanisms would appear to have particular relevance to newly qualified therapists with limited work experience who were shown to be particularly prone to experience high rates of depersonalisation. It is also suggested that care be taken to control the number of difficult cases allocated to therapists and the supervision of those cases.

Moreover, in view of the significantly high correlation between depersonalisation and treatment of peripheral hearing disorders, it is recommended that-- where practically feasible-- supervisors endeavour to allocate a wide range of patients with different types and degrees of communication impairment to the therapists in their employment. In addition, the complaint expressed by a large number of respondents regarding excessive paperwork, suggests the need for employers and clinicians to brainstorm ways of possibly streamlining routine administrative tasks, particularly in large bureaucratic organisations.

Research

It is recommended that future studies incorporate personality variables into the research design and analysis as these factors may predispose some SPLPs and audiologists to be susceptible to burnout. It is possible that certain personality characteristics are looked for in the selection procedures for training in the profession or- to quote one respondent- "Perhaps the feeling of work pressure instilled in us during our training, is an image that we carry with us into the 'real' world, thus affecting our perceptions of work demands."

Another important aspect which was omitted from the statistical analysis in the present study and which needs to be researched, was the effect of languages spoken by the clients of SPLPS and audiologists on burnout. Furthermore a subjective measure of client communication impairment was utilised in this study. It is suggested that future research endeavours to incorporate more objective measures of this variable.

A further fruitful area for future research is the different coping styles adopted by speech-language pathologists and audiologists as they can influence how individuals respond to stress.

The present study focused on general work stresses experienced by a national sample of therapists working in various job settings. Future research needs to focus on specific stresses associated with specific job contexts such as AIDS patients, neurological disorders and so forth.

A further limitation of the study centred on the use of the Work Environment Scale which measures perceptions of respondents regarding their work milieu. Perceptions may have been unintentionally distorted or subjects might have provided socially desirable answers. For this reason future research could probably incorporate more objective indices of the job by focussing on the actual number of cases seen each week, and the actual time devoted to paperwork.

Training and Continuing Education

The fact that 62% of the respondents were in favour of a stress management course being incorporated into the undergraduate training curriculum and 80% felt that a course should be made available to qualified SPLPs and audiologists, underlines the need to address this gap in professional education.

In conclusion, it is hoped that this study offers important guidelines for future research and the development of intervention programmes and for future research and education. If speech pathologists and audiologists are to survive the demands of the 1990's, and are to continue to be influential and effective professionals, they will need to identify and manage stress-related problems before the impact of these problems becomes excessive and their solution difficult.

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Appendix I

Dear Speech Pathologist/ Audiologist

As a requirement for my degree, I am conducting a study of occupational stress among South African Speech-Language Pathologists and Audiologists, and the specific work situations which clinicians are currently experiencing. I believe that therapists working in this country are having to deal not only with the day-to -day stresses of all helping professionals but also with the unique economic and socio-political conditions prevalent in our society.

Your participation in this study will add to our knowledge and understanding of work stress within our profession. Furthermore, depending on the level of stress found to be experienced, intervention strategies may need to be recommended both at a training and occupational level. It would therefore be highly appreciated if each one of you could take the time to fill out the enclosed questionnaire thereby helping to ensure that the findings of the study are representative of the profession of Speech-Language Pathology and Audiology.

Please would you assist by answering each item as openly and honestly as possible, and when completed, sealing the questionnaire in the envelope provided, and posting it back to me by the 24th of April at the latest. There are no wrong or right answers. Rather, what I am looking for, is the response that is most accurate for you.

Please note that your responses will be kept strictly confidential and you will remain anonymous as your name is not required anywhere on this questionnaire. Supplied with this questionnaire is a postcard with your name written on it. Kindly return the postcard separately, informing me that the questionnaire has been returned and no follow-up questionnaires will be sent to you.

If you are interested in the results or have any questions, I will be only too willing to give you feedback at a mutually acceptable time.

I can be contacted at telephone number: 453-7025.

Thank you again for your time and cooperation.

Yours sincerely

Marilyn Swidler

DEMOGRAPHIC DATA

1. Your sex: 1) Female _____ 2) Male _____

2. How many years have you worked in the profession since graduation?

3. Please check the main work setting in which you are currently employed.

   a) Hospital-Clinic _____ b) Private Clinic _____

   c) School _____ d) Insitution _____

   e) University _____ f) Private Practise _____

   g) Other _____

4. As of this time, my client caseload per week is:

   a) 1-15 _____ b) 16-30 _____ c) 31-45 _____

   d) 46-60 _____ e) 60 or more _____

5. Most of my clients have defects of: (select only one).

   a) Articulation _____ b) Language _____

   c) Language/learning difficulties _____

   d) Aphasia _____ e) Traumatic Brain Injury _____

   f) Degenerative neurological disorders _____

   g) Dysphagia _____ h) Fluency _____

   i) Peripheral Hearing Disorders _____

   j) Central Hearing Disorders _____

   k) Mental Retardation _____

   l) Other _____ (Specify)

6. Are the majority of your caseload:

a) Mildly Impaired ____

b) Moderately Impaired ____

c) Severely Impaired ____

7. Do you mainly treat adults or children?

a) Adults ____ b) Children ____

c) Both Equally ____

8. Do you work as an audiologist or speech-language pathologist?

a) Audiologist only ____

b) Speech-language pathologist only ____

c) Audiologist and Speech-language pathologist ____

9. Estimate percentage of work week devoted to paperwork (e.g., writing Individualised Educational Programs, reports, correspondence.)

a) 0-10% ____ b) 11-20 ____ c) 21-30% ____

d) 31-40% ____ e) 41-50% ____

f) 51% or more ____

10. Are the majority of your clients:

a) English Speaking ____

b) Afrikaans Speaking ____

c) Speak an African/Black Language ____

OPEN-ENDED QUESTIONS

1. (a) Are there any particular factors at work that you find stressful?

{ } YES { } NO

(b) If yes, please describe.

2. (a) Do you feel that any broader societal factors contribute to your experience of stress e.g. socio-economic, politico-cultural factors?

{ } YES { } NO

(b) If yes, please elaborate.

3. What strategies do you use to cope with stress?

4. Do you feel that a stress management course should be incorporated into the training curricula of speech-language and hearing therapists, or do you think this is unnecessary?

5. Do you think that a stress-management course/workshop should be made available for qualified speech-language and hearing therapists?

WORK ENVIRONMENT

The following statements are about the place in which you work. The statements are intended to apply to all work environments. However, some words may not be quite suitable for your work environment, for example the term "supervisor" can also refer to a manager, department head, or the person or persons to whom an employee reports.

You are to decide which statements are true of your work environment and which are false. If you think the statement is True or mostly true of your work environment, make an X in the corresponding box in the column labelled True. If you think the statement is False or mostly false of your work environment, make an X in the corresponding box in the column labelled false. If a statement is not applicable to your work environment please mark the N/A column. Please be sure to answer every statement.

SECTION A

	TRUE	FALSE	N/A
1. People go out of their way to help a new employee feel comfortable.			
2. The atmosphere is somewhat impersonal.			
3. People take a personal interest in each other.			

	TRUE	FALSE	N/A
4. Employees rarely do things together after work.			
5. People are generally frank about how they feel.			
6. Employees often eat lunch together.			
7. Employees who differ greatly from the others in the organisation don't get on well.			
8. Employees often talk to each other about their personal problems.			

SECTION B

	TRUE	FALSE	N/A
1. Supervisors really stand up for their people.			
2. Employees discuss their personal problems with supervisors.			
3. Supervisors expect far too much from their employees.			
4. Employees generally feel free to ask for a raise.			
5. Supervisors often criticise employees over minor things.			
6. Supervisors usually give full credit to ideas contributed employees.			
7. Supervisors tend to discourage criticisms from employees.			
8. Supervisors tend to talk down to employees.			
9. Supervisors usually compliment an employee when he does something well.			

SECTION C

	TRUE	FALSE	N/A
1. People often have to work overtime to get their work done.			
2. People cannot afford to relax.			
3. You can take it easy and still get your work done.			
4. There is no time pressure.			
5. It is very hard to keep up with your workload.			
6. Nobody works too hard.			
7. There are always deadlines to be met.			
8. There is a constant pressure to keep working.			
9. There always seems to be an urgency about everything.			

HUMAN SERVICES SURVEY

The purpose of this section is to discover how Speech-language Pathologists and Audiologists as human service or helping professionals, view their jobs and the people with whom they work closely. The term "client" refers to the people for whom you provide service, care, treatment or instruction -- even though you may use another term in your work, eg., patient, student, employee, etc.

There are 22 statements of job-related feelings. Please read each statement carefully and decide if you ever feel this way about **your** job. If you have **never** had this feeling, write a "0" (zero) before the statement. If you have had this feeling, indicate **how often** you feel it by writing the number (from 1 to 6) that best describes how frequently you feel this way.

HOW OFTEN

0 Never	1 A few times a year or less	2 Once a month or less	3 A few times a month	4 Once a week	5 A few times a week	6 Every day

HOW OFTEN

0 - 6 **STATEMENTS**

1. ___I feel emotionally drained from my work.
2. ___I feel used up at the end of the workday.
3. ___I feel fatigued when I get up in the morning and have to face another day on the job.
4. ___I can easily understand how my clients feel about things.
5. ___I feel I treat some clients as if they were impersonal objects
6. ___Working with people all day is really a strain for me.
7. ___I deal very effectively with problems of my clients.
8. ___I feel burned out from my work.
9. ___I feel I'm positively influencing other people's lives through my work.
10. ___I've become more callous toward people since I took this job.

11. ___I worry that this job is hardening me emotionally.
12. ___I feel very energetic.
13. ___I feel frustrated by my job.
14. ___I feel I'm working too hard on my job.
15. ___I don't really care what happens to some clients.
16. ___Working with people directly puts too much stress on me.
17. ___I can easily create a relaxed atmosphere with my clients.
18. ___I feel exhilarated after working closely with my clients.
19. ___I have accomplished many worthwhile things in this job.
20. ___I feel like I'm at the end of my rope.
21. ___In my work, I deal with emotional problems very calmly.
22. ___I feel clients blame me for some of their problems.

Spraakklankdistorsie by Neuromotoriese Spraakafwykings: 'n Vergelyking tussen Serebellêre Disartrie en Verbale Apraksie

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OPSOMMING

Spraakklankdistorsie word algemeen in die literatuur beskryf as 'n kenmerk van neuromotoriese spraakafwykings soos serebellêre disartrie en verbale apraksie. Die doel van die studie is 'n vergelykende ondersoek na die temporale en ruimtelike aspekte van spraakklankdistorsie by twee persone met verworwe serebellêre disartrie en een persoon met verworwe verbale apraksie. Die spraakparameters stemaanvangstyd van die [d], afsluitingsduur van die [d], konsonantduur van die [s] en [l], formante van die [l] en die omvang van akoestiese energie van die [s], is spektrografies ondersoek in 'n aantal uitinge met verskillende klankstrukture. Die resultate dui daarop dat ruimtelike en temporale distorsie van artikulatoriese bewegings voorkom by die proefpersone met serebellêre disartrie sowel as by die proefpersoon met verbale apraksie. Daar is egter verskille opgemerk in die aard en graad van die spraakklankdistorsie by die onderskeie afwykings. Die teoretiese implikasies van hierdie verskille word bespreek met verwysing na 'n model van normale spraakproduksie.

ABSTRACT

Speech sound distortion is considered to be a salient feature of neuromotor speech disorders such as cerebellar dysarthria and apraxia of speech. The aim of this study was to compare the temporal and spatial aspects of speech of two persons with acquired cerebellar dysarthria and of one person with acquired apraxia of speech. Voice onset time of [d], duration of articulatory closure of [d], duration of [s] and [l], formants of [l] and the range of acoustic energy of [s] were analysed spectrographically in a number of utterances with various sound structures. The results indicated that spatial and temporal distortion of articulatory movements occurred in all three subjects. However, differences in the nature and degree of speech sound distortion in the two different disorders were observed. The theoretical implications of these differences are discussed with reference to a model of normal speech production.

Spraakklankdistorsie word algemeen in die literatuur beskryf as 'n kenmerk van neuromotoriese spraakafwykings soos serebellêre disartrie en verbale apraksie (Brown, Darley & Aronson, 1970; Kent, Netsell & Abbs, 1979; Itoh & Sasanuma, 1984; Hardcastle 1987; Odell, McNeil, Rosenbek & Hunter, 1990; Odell, McNeil, Rosenbek & Hunter, 1991). Serebellêre disartrie en verbale apraksie is egter die resultaat van die aantasting van verskillende neurale dele, wat betrokke is by verskillende stadiums of fases van die spraakproduksieproses. Verbale apraksie word tradisioneel gesien as 'n afwyking in spraakprogrammering terwyl disartrie getipeer word as 'n afwyking in die uitvoering van spraakbewegings. Daar is egter aanduidings in die literatuur dat serebellêre disartrie en verbale apraksie sekere ooreenstemmings toon in die aard van waargenome spraakklankdistorsies soos byvoorbeeld verlenging van woordsegmente, lettergreepspraak en temporale diskoördinasie van spraakstrukture wat by albei afwykings voorkom (Kent et al., 1979; Kent & Rosenbek, 1982). Die rede hiervoor is onbekend. Vorige akoestiese studies aangaande verbale apraksie en serebellêre disartrie het slegs enkele aspekte soos vokaalformante en segmentele duur ondersoek en die vraag ontstaan presies watter temporale en ruimtelike aspekte van distorsie by die twee afwykings ooreenkom en verskil. 'n Omvattende, objektiewe akoestiese analise van verskillende fasette van spraakklankproduksie sal distorsie by hierdie afwykings verder toelig. Die presiese aard van spraakklankdistorsie kan aanduidings gee van die aard van die twee tipes neuromotoriese afwykings en ook lig werp op die bydrae van die kortikaal-motoriese dele en die serebellum tot die beheer van spraakbewegings.

Navorsing oor die spesifieke spraakkenmerke van serebellêre disartrie en verbale apraksie word hoofsaaklik gekenmerk deur twee eksperimentele ondersoekmetodes. Hierdie metodes behels subjektiewe metodes soos breë fonetiese perseptuele transkripsies en objektiewe metodes soos akoestiese analises, elektropalatografiese studies en fibroskopiese studies. Vroeë subjektiewe ondersoeke

aangaande serebellêre disartrie is hoofsaaklik gerig op simptoombeskrywings. Op grond van subjektiewe perseptuele studies word die kenmerkende simptome van serebellêre disartrie in drie verbandhoudende hoofsimptoomgroepe verdeel, nl. simptome gekenmerk deur artikulatoriese onakkuraatheid bv. "onpresiese konsonante" en vokaaldistorsies, simptome gekenmerk deur prosodiese oormaat bv. oormatige en gelyke klem, verlengde foneme en stadige spraakspoed en simptome gekenmerk deur fonatories-prosodiese onvermoë bv. monotone spraak, monoluidheid en heesheid (Darley, Aronson & Brown, 1969b; Brown et al.,1970). Grunwell en Huskins (1979) beklemtoon dat hierdie simptome van serebellêre disartrie deurlopend teenwoordig is en kumulatief van aard is. Hulle beskryf die kumulatiewe aantasting van spraakverstaanbaarheid as 'n tekort aan intonasie en normale ritme met sogenaamde "scanning speech", verlengde konsonante, periodieke foutiewe stemgewing en nasaliteit as resultaat. Hierdie perseptuele simptoombeskrywings slaag egter nie altyd daarin om tussen verskillende tipes disartrie te onderskei nie (Zyski & Weisiger, 1987) en die aard van die afwyking kom ook nie duidelik na vore nie.

Enkele ondersoeke met objektiewe analisemetodes soos akoestiese en kineradiografiese studies wat die aard van spraaksimptome by serebellêre disartrie beter toelig, is uitgevoer. Opsommend beskou, is die volgende waarnemings deur Kent en Netsell (1975) en Kent et al. (1979) gemaak : verlengde artikulatoriese beweging van die tong, geringe vokaaldistorsie weens swak anterior-posterior aanpassing van tongposisie, konstante onakkurate artikulasie van dorsale afsluitingsklanke, verlengde segmentduur, gelyke en oormatige klem, afwykende fundamentele frekwensiewaardes en variasie in fundamentele frekwensiewaardes. Vanuit hierdie resultate blyk dit dat spraakklankdistorsie 'n kernsimptoom is van serebellêre disartrie.

Studies oor die spraakkenmerke van persone met verbale apraksie is kontroversieel van aard, deels as gevolg van die kwessie van die ontledingsmetode. Aanvanklike studies aangaande verbale apraksie het hoofsaaklik gebruik gemaak van subjektiewe, perseptuele analiseprosedures soos distinktiewe eienskapsanalises en gemerktheidsanalises (Klich, Ireland & Weidner, 1979). Op grond van hierdie resultate is die kernsimptoom van apraksie dan beskryf as vervangings. Nuwe navorsing deur middel van meer objektiewe studiemetodes soos akoestiese ontledings, getroue fonetiese transkripsies, en elektropalatografiese waarnemings dui egter daarop dat alhoewel ware klankvervangings ook deel vorm van die simptoomkompleks van verbale apraksie, baie van die "vervangings" wat in vroeë studies geïdentifiseer is, in werklikheid spraakklankdistorsies was (Itoh & Sasanuma, 1984; Kent & Rosenbek, 1983; Hardcastle, Morgan Barry & Clark, 1985; Van der Merwe, Uys, Loots & Grimbeek, 1988; Odell et al., 1990; Odell et al., 1991). Tans word dit algemeen aanvaar dat spraakklankdistorsie 'n kernsimptoom van verbale apraksie is.

Akoestiese studies van verbale apraksie en studies wat van direkte waarnemingsmetodes van die artikulators gebruik maak, verskaf direkte en meer presiese inligting aangaande afwykende motoriek. Uit hierdie studies kan 'n goeie aanduiding verkry word van spraakklankdistorsies by verbale apraksie en die motoriese prosesse daarby betrokke. Kent en Rosenbek (1983) gee 'n simptoombeskrywing van 'n verbaal-apraktiese spreker op grond van foute geïdentifiseer tydens akoestiese analises, nl. stadige spraakspoed met verlenging van klankoorgange, vermindering in intensiteitsvariasies oor sillabes heen, stadige en onakkurate beweging na ruimtelike teikens vir konsonant- en vokaalproduksie, probleme met tydsberekening en koördinasie van stemgewing met die beweging van ander artikulators, periodieke foute met segmentseleksie of opeenvolging en inisiëringsprobleme. Ander akoestiese ondersoeke van verbale apraksie bevestig die resultate van Kent en Rosenbek (1983) en vind byvoorbeeld ook afwykings in interartikulator-sinchronisasie en verlengde segmentele duur (Sands, Freeman & Harris, 1978; Hardcastle, 1987; Itoh, Sasanuma, Tatsumi, Murakami, Fukusaki & Suzuki, 1982; Collins, Rosenbek & Wertz, 1983; Kent & McNeil, 1987; Van der Merwe, Uys, Loots, Grimbeek & Jansen, 1989).

Uit die voorafgaande literatuuroorsig is dit duidelik dat spraakklankdistorsie as kernsimptoom by sowel serebellêre disartrie as by verbale apraksie geïdentifiseer is, maar dat die aard van die spraakklankdistorsies nog nie genoegsaam uitgelig is nie. Vergelykende studies tussen verbale apraksie en serebellêre disartrie kan meer lig werp op die motoriese aard van moontlike ooreenkomste en verskille in die spraakklankdistorsies. Daar bestaan egter weinig sulke studies. In 'n resente perseptuele vergelykende ondersoek tussen serebellêre disartrie, verbale apraksie en konduksie-afasie deur middel van objektiewe, getroue fonetiese transkripsies is kortliks gevind dat die persone met verbale apraksie en serebellêre disartrie as 'n groep meer ooreenkomste toon met mekaar as met konduksie-afasie (Odell et al., 1991). Die verbale apraksie groep het egter minder distorsies vertoon as die serebellêre disartrie groep, nl. 64% teenoor 81%, asook meer sillabeklemfoute en verlengings van intersegment klankoorgange. Geen aanduiding word egter verskaf van die bewegingsaspekte betrokke by die waargenome foute nie. Kent en Rosenbek (1982) vind in 'n vergelykende akoestiese ondersoek dat sprekers met verbale apraksie sowel as sprekers met serebellêre disartrie prosodiese afwykings soos artikulatoriese verlengings en sillabesegregrasie toon en verduidelik dit as die resultaat van kompensasie vir die neuromotoriese aantasting. Gillmer en Van der Merwe (1983) vind dat sowel sprekers met serebellêre disartrie as sprekers met verbale apraksie afwykende stemaanvangstydwaardes (SAT) vertoon en dat SAT-waardes meer gevarieer het vir die sprekers met serebellêre disartrie. Weens 'n tekort aan objektiewe vergelykende studies en die feit dat bestaande studies slegs enkele spraakparameters ondersoek het, is daar tans steeds 'n tekort aan omvattende inligting betreffende die aard en omvang van spraakklankdistorsie by die onderskeie afwykings asook verklarings vir moontlike ooreenkomste.

Spraaksimptome soos spraakklankdistorsie wat na spesifieke neurale aantasting voorkom, kan gedeeltelik verklaar word aan die hand van kennis oor die funksie van die betrokke aangetaste neurale deel. Verbale apraksie en serebellêre disartrie verteenwoordig letsels in verskillende dele en op verskillende vlakke van die brein. Serebellêre disartrie word met aantasting van die serebellum in verband gebring (Kent & Netsell, 1975; Kent et al., 1979, Grunwell & Huskins, 1979). Ten spyte van uitgebreide navorsing oor die funksies van die serebellum

is daar egter steeds weinig bekend oor die rol daarvan in spraakmotoriek (Gentil, 1990). Posturale en neuromotoriese simptome geassosieer met serebellêre letsels, nl. asinergie, disdiadokokinese van spraakbewegings, intensietremor gedurende beweging en hipotonus van spiere lei tot die ruimtelike en temporale distorsie van spraakbewegings tydens die uitvoerstadium van die spraakproduksieproses (Darley, Aronson & Brown, 1969a). Daar is egter aanduidings in die literatuur dat die serebellum ook betrokke is by hoëvlak motoriese programmering van liggaamsbeweging deur middel van 'n oop serebro-serebellêre kringbaansisteem (Allen & Tsukahara, 1974; Brooks, 1986). Vanuit so 'n teorie kan daar geredeneer word dat alhoewel die serebellum en die motoriese korteks nie dieselfde funksies in die motoriese beheer van spraak vervul nie, aantasting van albei areas moontlik kan lei tot probleme met die voorbereiding van 'n "motoriese program" vir spraakproduksie (Kent & Rosenbek, 1982).

Tradisioneel word die spraakproduksieproses beskryf as bestaande uit hoofsaaklik drie vlakke, nl. linguistiese enkodering, artikulatoriese programmering en laastens die uitvoer van bewegings (Itoh & Sasanuma, 1984). In die lig van die neurofisiologiese onderskeid wat gemaak word tussen motoriese beplanning en programmering, verskaf hierdie tradisionele model nie genoegsame verklarings en interpretasiemoontlikhede vir navorsing aangaande neuromotoriese spraakafwykings nie. Van der Merwe (1994) postuleer dat daar vier hoofvlakke van spraakproduksie bestaan, nl. linguisties-simboliese beplanning, motoriese beplanning, motoriese programmering en uitvoer van beweging. Van der Merwe (1994) maak dus, in teenstelling met die huidige tendens in literatuur van neuromotoriese spraakafwykings om "beplanning" en "programmering" as dieselfde begrip te hanteer, 'n duidelike onderskeid tussen hierdie terme. Sy postuleer verder dat dit wel moontlik is dat die serebellum sekere progammeringsfunksies vervul in spraak soos die programmering van ruimtelik-temporale bewegingspesifikasies (byvoorbeeld spoed en tonus) voordat werklike bewegings plaasvind, maar dat hierdie programmeringsfunksies verskil van die beplanningsfunksies van die assosiasie-areas tydens spraakproduksie. Brooks (1986) se uiteensetting van die motoriese hierargie bevestig so 'n teorie. Op grond van die model van Van der Merwe (1994) is dit dus moontlik dat spraakklankdistorsie by serebellêre disartrie die resultaat kan wees van die aantasting van beide die uitvoer- en programmeringsvlakke van die spraakproduksieproses.

Alhoewel daar nog nie uitsluitsel bestaan oor die funksies van kortikale en subkortikale motoriese dele geassosieer met verbale apraksie nie, postuleer Van der Merwe (1994) dat kortikale dele soos die area van Broca, die kortikaal-motoriese assosiasie-areas en ook die posteriorpariëtale areas betrokke is by die motoriese beplanning van spraakproduksie. Verbale apraksie reflekteer dan moontlik probleme met die beplanningsfase van spraakproduksie (Van der Merwe, 1994). In die geval van subkortikale skade, van veral sekere dele van die basale ganglia wat ook tot apraktiese simptome lei (Kertesz, 1984), is dit egter moontlik dat daar ook afwykings in die programmering van spraakbewegings is. Volgens die model van Van der Merwe (1994) kan spraakklankdistorsies by verbale apraksie dus die resultaat wees van probleme met die beplanning van ruimtelik-temporale spesifikasies van struktuurbewegings binne die grense van ekwivalensie asook met die programmering van bewegings.

Op grond van die model van Van der Merwe (1994) bestaan daar dus teoreties 'n moontlikheid dat sekere ruimtelike en temporale aspekte van die kernsimptoom spraakklankdistorsie soos wat dit voorkom by serebellêre disartrie en verbale apraksie, moontlik kan oorvleuel op die vlak van motoriese programmering. 'n Tekort aan uitgebreide, objektiewe, vergelykende navorsing van die spraakkenmerke van persone met serebellêre disartrie en verbale apraksie, beperk egter die begrip van afwykende spraakproduksieprosesse betrokke by hierdie twee neuromotoriese spraakafwykings. 'n Uitgebreide akoestiese ondersoek na beide die ruimtelike en temporale aspekte van spraakklankdistorsie by serebellêre disartrie en verbale apraksie, binne 'n omvattende teoretiese model, kan dus meer lig werp op die aard van hierdie neuromotoriese spraakafwykings.

METODE

Doelstellings

Die doel van die studie is die akoestiese ontleding van sekere spraakparameters in die spraak van persone met serebellêre disartrie en verbale apraksie om so vergelykende data in te samel aangaande die voorkoms en aard van akoesties identifiseerbare spraakklankdistorsie by die onderskeie groepe. Om die akoestiese identifikasie van die aard van spraakklankdistorsie moontlik te maak, word die volgende betroubare en akoesties identifiseerbare spraakparameters van normale sprekers, sprekers met serebellêre disartrie en sprekers met verbale apraksie telkens ondersoek en vergelyk:

- Die spraakparameter *stemaanvangstyd* (SAT) soos gemeet tydens die produksie van 'n stemhebbende eksplosiewe klank, aangesien stemaanvangstyd 'n aanduiding verskaf van die sinchronisasie van glottale sluiting en supraglottale artikulasie (Tyler & Waterson, 1991).

- Die spraakparameter *afsluitingsduur* soos gemeet tydens die produksie van 'n stemhebbende eksplosiewe klank, aangesien afsluitingsduur temporale aspekte van spraakproduksie, soos die spoed van artikulatoriese beweging en ruimtelike aspekte soos die omvang en akkuraatheid van artikulasiebewegings reflekteer.

- Die spraakparameter *konsonantduur* soos gemeet tydens die produksie van 'n frikatiewe klank en 'n kontinuante klank, aangesien konsonantduur temporale aspekte van spraakproduksie soos die spoed van artikulatoriese bewegings reflekteer.

- Die spraakparameters *formantfrekwensiewaardes* van die eerste, tweede en derde formante van 'n kontinuante klank, aangesien formantwaardes ruimtelike aspekte van spraakproduksie soos die omvang en akkuraatheid van artikulatoriese bewegings reflekteer.

- Die spraakparameter *aard van die energiespektrum* soos gemeet tydens die produksie van 'n frikatiewe klank, aangesien frekwensie-omvang en plek van gekonsentreerde energie ruimtelike aspekte van spraak-

produksie soos die omvang en akkuraatheid van artikulasiebewegings reflekteer.

Proefpersone

Kriteria vir die seleksie van proefpersone en kontrolepersone

Die volgende algemene kriteria is gestel:

- Die persone se taalbegrip, ouditiewe begripsvermoëns en visuele vermoëns moet van so 'n aard wees dat die persoon die instruksies verstaan en die materiaal kan lees.
- Die proefpersone moet nie 'n binourale gehoorverlies van groter as 12% hê nie aangesien 'n groot gehoorverlies 'n invloed op spraak kan hê.

Proefpersone met serebellêre disartrie:

- Die proefpersone moet deur 'n neuroloog gediagnoseer wees as breinbeseerd met serebellêre skade. Die neuromotoriese aantasting moet so suiwer as moontlik tot die serebellum beperk wees.
- Die proefpersone moet disartriese spraak vertoon.
- Die sprekers moet gepaardgaande kenmerkende liggaamlike neuromotoriese simptome toon ter bevestiging van serebellêre skade bv. ataksie, dismetrie, disdiadokokinese, intensietremor en hipotonie.

Proefpersone met verbale apraksie:

- Die proefpersone moet deur 'n neuroloog gediagnoseer wees as breinbeseerd met 'n fokale letsel wat nie 'n serebellêre lokalisasie het nie.
- Die proefpersone moet verkieslik 'n suiwer verworwe verbale apraksie vertoon en indien 'n gepaardgaande afasie voorkom mag dit slegs minimaal wees.
- Die proefpersone moet voldoen aan kriteria soos gestel deur Kent en Rosenbek (1983) nl:
  * onvlot spraakproduksie met probeer-en-tref artikulasiebewegings.
  * onkonstante foutproduksie by herhaalde produksie van dieselfde woord.
  * disprosodie.
  * probleme met inisiëring van uitinge.
- Die graad van apraksie moet die herhaling van uitinge moontlik maak. Geen gepaardgaande disartriesimptome mag voorkom nie.

Kontrolepersone:

- Die kontrolepersone moet normaalsprekende volwassenes wees wat geen spraakafwykings of geskiedenis van spraak- of neurologiese afwykings het nie.
- Die kontrolepersone moet : van dieselfde geslag as die proefpersone wees; binne die ouderdomsgrens van die proefpersone val; moet dieselfde spreektaal as die proefpersone hê.

Geselekteerde proefpersone en kontrolepersone

Proefpersone met serebellêre disartrie:

- Twee sprekers met verworwe serebellêre disartrie wat voldoen aan die vasgestelde vereistes is gevind.
- Proefpersoon 1 (Pp 1) is 'n manlike spreker wat na 'n motorongeluk in 1979 algemene geringe breinskade en ernstige serebellêre skade opgedoen het. Hy toon tans neuromotoriese liggaamlike simptome soos ataksie, dismetrie, hipotonie, disdiadokokinese en intensietremor.
- Proefpersoon 2 (Pp 2) is 'n manlike spreker wat ongeveer in 1989 ligte tekens begin toon het van balansprobleme. Die oorsaak van die aantasting is in Maart 1992 gediagnoseer as serebellêre degenerasie weens veelvuldige sklerose. Veelvuldige sklerose neem meestal oorsprong in die serebellum (Bannister, 1973). Alhoewel veelvuldige sklerose geleidelik 'n gemengde neurologiese toestand tot gevolg kan hê, toon Pp 2 slegs kenmerkende liggaamlike neurologiese simptome van 'n serebellêre aard.
- Proefpersoon 2 se algemene graad van aantasting blyk groter te wees as die van Pp 1, aangesien Pp 2 'n erger graad van liggaamlike simptome vertoon as Pp 2 en ook meer disartries voorkom.

Proefpersoon met verbale apraksie:

- Een persoon met verworwe verbale apraksie wat voldoen aan die vasgestelde vereistes is gevind. Die spreker met verbale apraksie is 'n manlike spreker, proefpersoon 3 (Pp 3), wat 'n gepaardgaande minimale Broca Afasie vertoon (AQ=64) volgens die Western Aphasia Battery (Kertesz, 1982).
- Proefpersoon 3 het verworwe breinskade opgedoen as die resultaat van twee serebro-vaskulêre insidente onderskeidelik in 1984 en 1989. Infarksies het voorgekom in die anterior been van die linker interne kapsula en in die regter oksipitale gebied. Die spreker toon 'n regsydige hemiplegie maar daar is geen aanduiding van 'n waarneembare boonste motorneuron gesig- of tongparese nie.
- Proefpersoon 3 toon verbale apraksie in 'n erge graad maar is in staat tot nabootsing van woorde. Tydens spraak kom duidelike soekbewegings en worstelgedrag voor, asook pogings tot selfkorreksie, onkonstante distorsies en vervangings, en onkonstante produksies met die herhaling van uitinge.

Materiaal

Die materiaal is so gekies dat dit die omvattende ruimtelike en temporale ondersoek van spraakklankdistorsie in 'n verskeidenheid van kontekste moontlik maak, om sodoende 'n meer verteenwoordigende beeld te verkry van spraakproduksie by die onderskeie diagnostiese groepe.

Die materiaal is saamgestel deur die kontinuante klank [l], die stemhebbende eksplosiewe klank [d] en die frikatiewe klank [s] te varieer in die inisiële en mediale klankposisies van onsineenhede en woorde, binne sinsverband met 'n KVKV- en KVKVK-struktuur onderskeidelik. Die klanke is gekies omdat dit verskillende wyses van artikulasie verteenwoordig en akoesties maklik identifiseerbaar is. Die vokaal [a:] is telkens met die klanke in die onsineenhede gekombineer en is soos die ander klanke in die woorde en sinne lukraak gekies. Twee verskillende klankstrukture is gekies om so spraak-

klankdistorsie in materiaal van verskillende uitinglengte te ondersoek.

Die materiaal bestaan uit 12 onsineenhede en 10 woorde binne sinsverband. Die onsineenhede is telkens 5 keer herhaal en die sinne drie keer. In totaal het elke persoon dus 90 uitinge geproduseer. Tabel 1 gee 'n volledige uiteensetting van die wyse van die samestelling van die teikenmateriaal en die gemete spraakparameters binne elke uiting.

Tabel 1. Samestelling van die teikenmateriaal en die gemete spraakparameters binne elke uiting

1.1

Klank		[d]		
Konteks	Klank-kombi-nasie	Klank-posisie	Para-meters	Mate-riaal
Onsin-woorde	KVKV	inisieël	SAT	data
		mediaal	AD	sada
	KVKVK	inisieël	SAT	dadaf
		mediaal	AD	sadaf
Sinne	KVKVK	inisieël	SAT	dames
		mediaal	AD	dadel

1.2

Klank	[s]					
Konteks	Klank-kombi-nasie	Klank-posisie	Parameters			Mate-riaal
Onsin-woorde	KVKV	inisieël	KD	FO	Piek	sasa
		mediaal	KD	FO	Piek	dasa
	KVKVK	inisieël	KD	FO	Piek	sasaf
		mediaal	KD	FO	Piek	dasaf
Sinne	KVKVK	inisieël	KD	FO	Piek	sabel
		-	-	-	-	-

1.3

Klank	[I]				
Konteks	Klank-kombi-nasie	Klank-posisie	Parameters		Mate-riaal
Onsin-woorde	KVKV	insieël	KD	F1-F3	lala
		mediaal	KD	F1-F3	dala
	KVKVK	inisieël	KD	F1-F3	lalaf
		mediaal	KD	F1-F3	dalaf
Sinne	KVKVK	inisieël	KD	F1-F3	laken
		-	-	-	-

Apparaat

Opname-apparaat

- 'n Nakamichi 550 "Versatile stereo casette system".
- 'n Bever Dynamic M 201 N(C) mikrofoon.
- BASF Chrome Maxima 60 minute magneetbandkasette.

Analise-apparaat

- 'n Nakamitchi 550 kassetspeler is gebruik om die spraaksein soos opgeneem op BASF Chrome Maxima magneetbandkassette na die Kay DSP Sonagraph te stuur.
- Die spraaksein kan met behulp van die JBL Pro III luidsprekers gemonitor word.
- Die spraaksein word geanaliseer deur 'n digitale seinprosesseerder van Kay Elemetrics Corp. nl. Sonagraph Model 5500 en vertoon op 'n NEC Multisync II vertoonskerm. Drie verskillende toepaslike opstellings is vir die onderskeie analises gebruik.
- 'n Weergawe van die beeld wat op die skerm verskyn kan met behulp van 'n termiese drukker, Kay DSP drukker model 5510 verkry word.

Prosedure vir spraakseinopname

- Die spraakopnames is in die klankdigte opnamelokaal van die Taallaboratorium van die Universiteit van Pretoria gedoen.
- Die mikrofoon is op 'n afstand van 10 cm voor die persoon se mond geposisioneer om ekspirasiegeraas op die opname tot die minimum te beperk.
- Die materiaal is vooraf aan die persone gegee om deur te lees sodat hulle bekend kon raak daarmee. Die volgorde van die materiaal is konstant gehou vir al die sprekers.
- Die proefpersone is gevra om elke woord vyf keer direk na mekaar te herhaal en elke sin drie keer.
- Vir die verbaal-apraktiese spreker is die opname effens gewysig deurdat die proefpersoon die geleentheid gegee is om die uiting 'n paar keer te oefen (Kent & Rosenbek, 1983). Daar is deurentyd 'n opname gemaak totdat vyf produksies van elke uiting verkry is.

Analise van data

Analise van die spraakparameter stemaanvangstyd (SAT)

- Vir die meting van SAT is 'n analise-opstelling met 'n gekombineerde vertoning bestaande uit 'n golfvorm met 'n amplitudeverloop en 'n grondtoonverloop sowel as 'n spektrogram gebruik. By die bepaling van SAT-waardes is die twee vertonings voortdurend vergelyk om sodoende die betroubaarheid van metings te verhoog.
- 'n Positiewe stemaanvangstyd word gedefinieer as die tyd wat verloop vanaf die aanvang van die vrylating van ploffing tot by die aanvang van die eerste

vertikale striasie op die spektrogram wat glottale pulsering verteenwoordig (Lisker en Abramson, 1964). SAT-waardes lê op 'n kontinuum en kan positiewe en negatiewe waardes aanneem. In die geval van 'n negatiewe SAT-waarde gaan glottale pulserings die ploffing vooraf en word die meting gedoen vanaf die aanvang van glottale pulserings tot by die ploffingsgedeelte.

Analise van die spraakparameter afsluitingsduur

Afsluitingsduur is gedefinieer as die periode in millisekondes wat verloop vanaf die einde van die voorafgaande vokaal tot voor die aanvang van die ploffing van die eksplosief. Wanneer daar nie aanduidings van 'n volledige afsluiting waarneembaar was op die golfvorm nie, is die spektrogram gebruik ter vergelyking om so betroubaarheid van metings te verhoog.

Analise van die spraakparameter-konsonantduur

Vir die meting van konsonantduur is analise-opstellings gekies wat gelyktydig 'n spektrogram, 'n gekombineerde golfvorm en 'n gemiddelde amplitudespektrum van 'n spesifieke gedeelte van 'n uiting vertoon. Die frekwensie-omvang van die analise-opstellings het verskil nl. 0-4 kHz vir die [l] en 0-16 kHz vir die [s]. Konsonantduur is gedefinieer as die periode in millisekondes (msek) wat 'n konsonant spektrografies waarneembaar is.

Analise van die eerste, tweede en derde formant-frekwensiewaardes van die [l]

- Vir die meting van die formantfrekwensiewaardes is dieselfde frekwensie-omvang gekies as wat gebruik is vir die analise van konsonantduur van die [l] (nl. 0-4 kHz).
- Die tydkursors op die spektrogram is so geplaas dat dit 'n verteenwoordigende stabiele deel van die [l] afbaken en 'n gemiddelde amplitudespektrum daarvan verkry. Met behulp van frekwensiekursors is die formantfrekwensiewaarde vanaf die gemiddelde spektrum bepaal deur die tweede energiepiek as F1, die derde piek as F2 en die vierde piek as F3 te noteer. Die gemiddelde amplitude-spektrum en spektrogram is deurentyd vergelyk.

Analise van die omvang van energie en plek van gekonsentreerde energie van die [s]

- Vir die meting van die omvang van akoestiese energie en plek van gekonsentreerde energie van die [s] is dieselfde opstelling gebruik as by konsonantduur (d.w.s. 0-16 kHz).
- Met behulp van tydkursors is 'n verteenwoordigende deel van die [s] op die spektrogram afgebaken en frekwensiekursors geplaas op die onderste en boonste grense.
- Die plek van gekonsentreerde energie is bepaal deur die energiepiek met die hoogste waarde op die amplitudespektrum te identifiseer. Waar twee ewe sterk pieke waargeneem is, is die waarde van die tweede piek van energie genoteer.

Verwerking van data

Verwerking van SAT-metings

Vir die berekening van hierdie SAT-foutwaarde is SAT-waardes van -180 millisekondes tot +15 millisekondes (msek) aanvaar as die normale perke (Zlatin, 1974). Die gemiddelde SAT-foutwaarde vir elke groep uitinge van elke persoon is bereken deur die hoeveelheid millisekondes bokant 15 of onder 180 oor die drie herhalings bymekaar te tel en deur drie te deel (Van der Merwe et al., 1989). Hierna is 'n gemiddelde SAT-foutwaarde vir elke persoon bereken. 'n Gemiddelde SAT-foutwaarde vir die onderskeie diagnostiese groepe is vervolgens bereken uit die gemiddelde foutwaardes van die betrokke proef- en konrolepersone.

Verwerkings van afsluitingsduurmetings van die [d] en konsonantduurmetings van die [l] en [s]

Die resultate van afsluitingsduurmetings van die [d] en konsonantduurmetings vir die [l] en die [s] is telkens op dieselfde wyse verwerk. Eerstens is 'n gemiddelde duurwaarde vir die eerste drie herhalings van elke onsineenheid en elke woord van elke persoon bereken. Uit die gemiddeldes van elke persoon is tweedens 'n gemiddelde duurwaarde vir elke onsineenheid en elke woord vir die betrokke diagnostiese groepe bereken. Uit die gemiddelde duurwaardes van die verskillende onsineenhede is derdens 'n totale gemiddelde duurwaarde vir onsineenhede bereken vir elke diagnostiese groep en vierdens op dieselfde wyse 'n totale gemiddelde duurwaarde vir woorde vir elke diagnostiese groep. Laastens is 'n gemiddelde duurwaarde bereken vir elke diagnostiese groep, uit die som van die onderskeie gemiddelde waardes vir onsineenhede en woorde tesame.

Verwerkings van die resultate van formant-frekwensiewaardes van die [l]

Die gemete formantfrekwensiewaardes van die eerste drie formante van die [l] is telkens op dieselfde wyse verwerk. Eerstens is daar vir elke persoon gemiddelde formantfrekwensiewaardes vir formante een, twee en drie bepaal uit die som van die onderskeie gemete formant-frekwensiewaardes vir onsineenhede en woorde tesame. Tweedens is gemiddelde formantfrekwensiewaardes vir elke formant van elke diagnostiese groep bepaal uit die som van die betrokke gemiddelde formantfrekwen-siewaardes van die persone. Derdens is formantratio's bepaal vir elke persoon en elke diagnostiese groep vir formant twee teenoor formant een (F2:F1) en vir formant drie teenoor formant een (F3:F1) volgens die metode van Dalston (in Baken en Daniloff, 1991).

Verwerking van die resultate van omvang van akoestiese energie en die plek van gekonsentreerde energie van die [s]

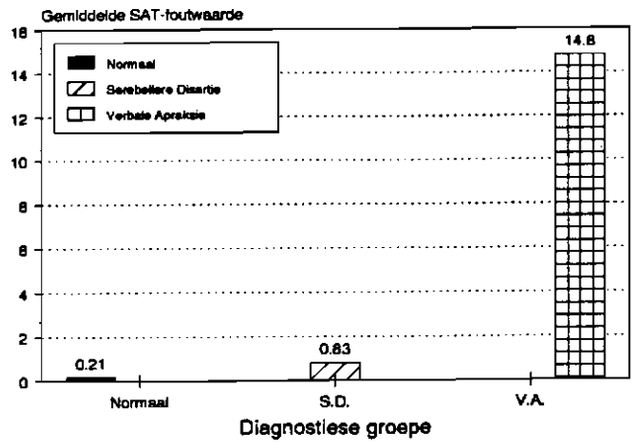
Vir die bepaling van die omvang van akoestiese energie is die gemiddelde minimum en maksimum frekwensie-waardes van elke persoon en elke diagnostiese groep bereken. Die gemiddelde minimum en maksimum frekwensiewaardes van elke persoon is bereken uit die

som van die gemete onderskeie minimum en maksimum frekwensiewaardes van onsineenhede en woorde tesame. Uit hierdie persoongemiddeldes is vervolgens gemiddelde minimum en maksimum frekwensiewaardes vir die onderskeie diagnostiese groepe bepaal. Persoon- en diagnostiese groepgemiddeldes is verder op dieselfde wyse bereken vir die plek van gekonsentreerde energie van die [s].

RESULTATE EN BESPREKING

Resultate en bespreking van stemaanvangstydmetings

Die resultate van hierdie spraakparameter dui op verskille in die aard van die waargenome spraakklankdistorsie by die onderskeie afwykings. Figuur 1 illustreer die gemiddelde SAT-foutwaardes van die verskillende diagnostiese groepe. Die verbaal-apraktiese spreker toon die grootste foutwaarde (nl.14.8) van die verskillende groepe.



Figuur 1. Gemiddelde SAT-foutwaardes van die onderskeie diagnostiese groepe.

Ontleding van die SAT-data toon dat die serebellêre disartriesprekers se SAT-resultate konstant afwykend negatiewe SAT-waardes toon by Pp 2 terwyl Pp 1 se waardes rondom die normale perke sentreer. Teoreties beskou impliseer 'n negatiewe SAT-waarde dat fonasie 'n aanvang neem voordat die lugvrylating vir afsluitingsklankproduksie plaasvind (Lisker & Abramson, 1964). Produksie van die [d] vereis hoofsaaklik integrasie van produksiekomponente soos stemgewing, velêre en alveolêre sluiting om die opbou van lugdruk moontlik te maak en verder verbreking van die alveolêre afsluiting met gevolglike ploffingsproduksie. By nadere ondersoek blyk dit egter dat die gemete negatiewe SAT-waardes en waarneembare stemvoorloop by Pp 2 die resultaat is van 'n perseptueel hoorbare nasalering van die aanvangsklank asook swak afsluitings- en ploffingsproduksie wat meting bemoeilik het (sien resultate aangaande afsluitingsduurmetings vir verdere toeligting). Stemgewing by Pp 2 is dus wel akkuraat in tyd, maar blyk skynbaar afwykend negatief te wees weens genasaleerde aanvangsdistorsie van die [d], omdat duidelike afsluitingsproduksie nie plaasgevind het nie. Dit blyk dus asof die aanvang van die ploffingsgedeelte vertraag is, moontlik weens swak velêre sluiting as gevolg van hipotonie of onwillekeurige bewegings. Daar is dus sprake van swak interartikulatorsinchronisasie weens stadige velêre sluiting en nie weens stadige inisiëring van stemgewing nie. Die resultate dui dus moontlik op intakte beplanning van die artikulatoriese bewegings maar op probleme met die uitvoer van die beplande bewegings.

Die feit dat Pp 1 nie soortgelyke afwykende SAT-resultate vertoon as Pp 2 nie, is moontlik 'n aanduiding dat die SAT-afwykings by die serebellêre disartriesprekers direk verband hou met die erns van die aantasting. Kent et al. (1979) vind ooreenstemmende resultate deurdat SAT-waardes van klanke soos die [t], [p] en [k]-klanke verleng word namate die graad van aantasting toeneem.

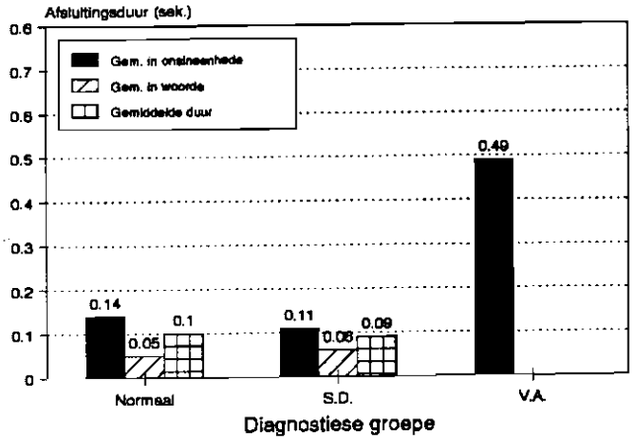
Die verbaal-apraktiese spreker in die huidige studie toon in teenstelling met die serebellêre disartriesprekers 'n hoë SAT-foutwaarde en ook slegs SAT-waardes van 'n positiewe aard. Die positiewe SAT-waarde dui daarop dat glottale pulserings (d.w.s. fonasie) 'n aanvang neem nadat die ploffing van die afsluiting vir die [d] geproduseer is. Die vertraging in stemgewing by Pp 3 reflekteer moontlik probleme met die temporale interartikulator-sinchronisasie van tongbeweging en glottale sluiting wat 'n spektrografies waarneembare distorsie van die [d] as byna 'n [t] tot gevolg het. Aangesien die SAT-waardes van die spreker in hierdie studie nooit die gegewe positiewe SAT-waarde van +40 msek (Zlatin, 1974) vir stemlose klanke bereik het nie ('n gemiddelde SAT-waarde van 26.6 msek kom voor), kan die afleiding gemaak word dat die spreker nie die [d] fonologies vervang het met 'n [t] nie en dat 'n spraakklankdistorsie eerder teenwoordig is. Soortgelyke afleidings is deur Van der Merwe et al. (1989) gemaak.

Die SAT-resultate van die verbaal-apraktiese spreker in die huidige studie stem ooreen met bevindinge van Freeman, Sands en Harris (1978) naamlik dat sprekers met verbale apraksie geen stemvoorlope vir stemhebbende afsluitingsklanke het nie. Navorsing toon oor die algemeen dat stemhebbende klanke meer stemloos gemaak word deur verbaal-apraktiese sprekers as omgekeerd (Wertz, LaPointe en Rosenbek, 1984). Kent en Rosenbek (1983) vind in teenstelling met huidige bevindinge SAT-foute van 'n groot negatiewe aard by sommige van hul proefpersone en wys daarop dat probleme met koördinasie en tydsberekening akoesties verskillend manifesteer by verskillende verbaal-apraktiese sprekers. Daar kan gespekuleer word dat verbaal-apraktiese sprekers moontlik ideosinkratiese aantasting van sinchronisasie van fonasie en artikulasie vertoon en dat SAT-foute, alhoewel dit voorkom by verbaal-apraktiese sprekers, onvoorspelbaar is in terme van die aard van die SAT-foute (Freeman et al., 1978; Van der Merwe et al., 1989). Daar moet egter in gedagte gehou word dat slegs data van een verbaal-apraktiese spreker in die huidige studie beskikbaar is, wat dus spekulasies hieromtrent aansienlik beperk.

Resultate van afsluitingsduurmetings

Figuur 2 toon dat die serebellêre disartriesprekers se gemiddelde afsluitingsduurwaarde (nl. 0.09 sek) gering korter is as die van die normale sprekers (nl. 0.1 sek) terwyl die verbaal-apraktiese spreker die langste afsluitingsduurwaarde vertoon (nl. 0.49 sek).

Dis insiggewend dat die produksie van 'n swak alveolêre afsluiting vir die [d], waarneembaar is by beide serebellêre disartriesprekers. Spektrografiese ontleding toon dat feitlik geen onderbreking in glottale pulserings met



Figuur 2. Gemiddelde afsluitingsduurwaardes van die [d] van die onderskeie diagnostiese groepe, soos bereken vir onsineenhede, woorde en vir woorde en onsineenhede tesame.

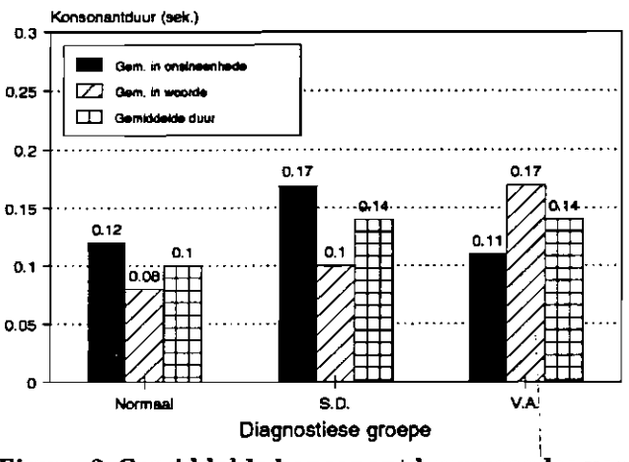
aanduidings van 'n ploffing waarneembaar is op die golfvorm nie, terwyl die spektrogram ook 'n mate van aaneenlopendheid in die formante vertoon. Die aaneenlopende teenwoordigheid van glottale pulserings en energie op die spektrogram bemoeilik dus die bepaling van die afsluitingsgedeelte van die [d] in die woord en het tot gevolg dat verkorte tot normale afsluitingsduur gemeet word by die serebellêre disartriesprekers. Hierdie tendens dra dus by tot die gemete negatiewe SAT-waardes by veral Pp 2. Proefpersoon 2 se SAT-waardes was gevolglik in twee van die totaal van nege uitinge nie meetbaar nie, weens die feit dat 'n duidelike ploffing vir die [d] nie teenwoordig was nie. Die resultate en afleidings van die huidige studie aangaande swak afsluitingsklankproduksie by die serebellêre disartriesprekers word ondersteun deur die resultate van vorige studies. Kent en Netsell (1975) vind konstante afsluitingsklankdistorsie van die [t]-, [d]- en [g]-klanke deur serebellêre disartriesprekers deurdat die afsluitingsgedeelte van die klank of weggelaat word, (waarskynlik waarneembaar as 'n vokaalagtige distorsie), of met 'n frikatiewe kwaliteit geproduseer word. Hulle rapporteer ook 'n afwesigheid van 'n prominente ploffing van die [g]-klank en skryf dit toe aan 'n onvermoë van die tong om kontak te maak met die alveolêre rif weens onvoldoende spierkrag of onwillekeurige bewegings. Hierdie resultate dui moontlik op probleme op 'n uitvoervlak van spraakproduksie. Dis egter ook moontlik dat die voorafgaande resultate uitvalle op 'n programmeringsvlak van spraakproduksie kan reflekteer, waartydens daar sprake is van "spier-spesifieke" programmering van omvang en rigting van spraakbewegings (Van der Merwe, 1994).

In teenstelling met die serebellêre disartriespreker in die studie (Pp 2) toon die verbaal-apraktiese spreker (Pp 3) spektrografies beskou 'n duidelike afsluitings- of ploffingsgedeelte maar stemgewing en ploffing word "afsonderlik" geproduseer. Fonasie neem dus 'n aanvang nadat die afsluiting opgehef is. Hierdie resultate dui daarop dat daar nie probleme voorkom met die kwaliteit van afsluitingsproduksie by die verbaal-apraktiese spreker nie. Verlengde afsluitingsduurwaardes by verbaal-apraktiese sprekers word ook deur ander navorsers gerapporteer (Kent & Rosenbek, 1983; Hardcastle et al., 1985). Verlenging van afsluitingsduur by die verbaal-apraktiese spreker kan moontlik verklaar word as 'n kompensatoriese reaksie om sodoende meer tyd toe te laat vir die motoriese beplanning van die daaropvolgende bewegingskomponente van die uiting (Kent & Rosenbek, 1982; 1983). Hierdie verklaring word moontlik ondersteun deur die waarneming in die huidige studie dat die verbaal-apraktiese spreker langer afsluitingsduurwaardes vir KVKVK-eenhede as vir KVKV-eenhede vertoon. Navorsing aangaande die invloed van verskillende kontekste op die spraak van verbaal-apraktiese sprekers dui daarop dat die KVKVK-eenheid vir 'n verbaal-apraktiese spreker moeiliker is om te beplan as die KVKV-eenheid (Van der Merwe et al., 1988; 1989). Langer afsluitingsduurwaardes sou dan moontlik meer tyd toelaat vir die spreker om die uiting te beplan.

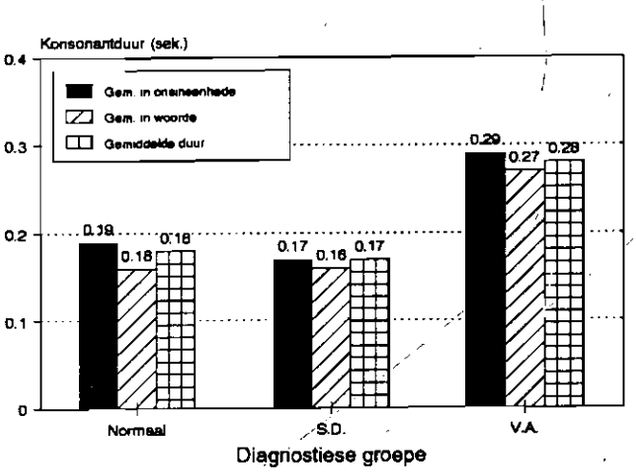
Resultate en bespreking van konsonantduurmetings van die [l] en die [s]

Figure 3 en 4 illustreer die resultate van konsonantduurmetings. Die serebellêre disartriesprekers en die verbaal-apraktiese spreker toon volgens die resultate ongeveer dieselfde mate van temporale distorsie by die [l]-klank, deurdat die mate van verlengde kontinuantduur min of meer gelyk is (sien Figuur 3). Vir die [s]-klank toon die verbaal-apraktiese spreker egter 'n groter mate van temporale distorsie as die serebellêre disartriesprekers.

Die serebellêre disartriesprekers toon volgens die



Figuur 3. Gemiddelde konsonantduurwaardes van die [l] van die onderskeie diagnostiese groepe.



Figuur 4. Gemiddelde frikatiewe duurwaardes vir die [s] van die onderskeie diagnostiese groepe.

resultate verlengde konsonantduur vir beide die [l] en die [s]-klanke. Verlengde segmentele duur by sprekers met serebellêre disartrie is ook deur ander navorsers bevind (Kent & Netsell, 1975; Kent et al., 1979; Kent & Rosenbek, 1982). Die huidige resultate stem ooreen met die van Kent et al., (1979) wat verlengde konsonantduur ooreenkomstig die graad van aantasting vind by serebellêre disartriesprekers. Temporale distorsie in die vorm van verlengde konsonantduur by die serebellêre disartriesprekers kan eerstens verklaar word as die direkte gevolg van neuromotoriese simptome soos hipotonie, ataksie en onwillekeurige bewegings wat 'n afname in die spoed van bewegings kan veroorsaak (Grunwell & Huskins, 1979) en dus moontlik probleme op 'n uitvoervlak van spraakproduksie reflekteer. Tweedens kan verlengde duur beskou word as die resultaat van kompensasie vir die onderliggende simptome, om sodoende meer tyd toe te laat vir die evaluasie van terugvoer aangaande die posisies en bewegings van die artikulators (Kent & Rosenbek, 1982). Kent et al., (1979) noem in aansluiting by so 'n beskouing dat wanneer sprekers met serebellêre disartrie genoeg tyd tot hulle beskikking het, hulle toepaslike artikulatoriese posisies kan bereik.

In die huidige studie vertoon Pp 1 duurwaardes langer as die normale vir die [l] maar by die frikatiewe [s]-klank kom distorsie voor in die vorm van duurwaardes korter as die normale. Kent et al., (1979) rapporteer ook duurwaardes kleiner as die normale vir die [s]-klank vir persone met minder ernstige serebellêre disartrie maar verskaf geen ander verklaring daarvoor as die graad van aantasting nie. Daar kan gespekuleer word dat Pp 1 moontlik as gevolg van 'n unieke kompensasiewyse spraak vinniger as die normale produseer of dat vinniger as normale [s]-produksie 'n unieke spraakkenmerk van die persoon was voordat die verworwe spraakafwyking ingetree het. Formele metings van spraakspoed en uitinglengte is egter nie beskikbaar ter verdere uitbreiding van die spekulasies rondom spraakspoed nie. Metings van die akoestiese omvang van energie van die [s] het egter meer lig gewerp op die artikulasie-eienskappe van die [s] (sien verdere bespreking).

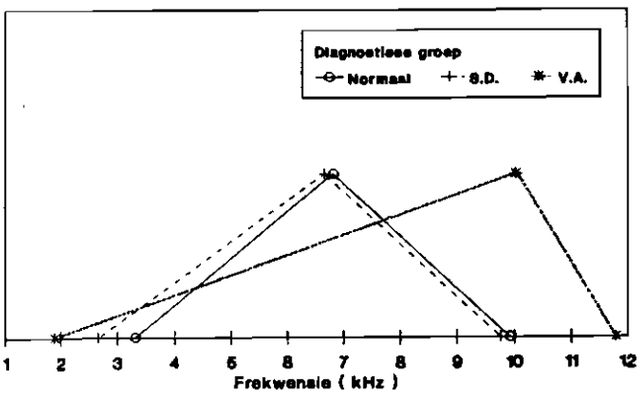
Die verbaal-apraktiese spreker toon ook soos die serebellêre disartriesprekers temporale distorsie van die [s] maar verskille in die aard en graad daarvan is opgemerk. 'n Groter mate van temporale spraakklankdistorsie kom voor by die [s] van die verbaal-apraktiese spreker deurdat duurwaardes groter is as die waardes van die serebellêre disartriesprekers en die normale waardes (sien Figuur 4). Hierdie resultaat stem ooreen met algemene bevindinge dat verbaal-apraktiese sprekers verlengings van woordsegmente toon (Kent & Rosenbek, 1983; Kent & McNeil, 1987; Van der Merwe et al., 1989). Navorsers soos Kent en McNeil (1987) voer aan dat verlengde segmentele en intersegmentele duur by verbaal-apraktiese sprekers die direkte resultaat kan wees van foutiewe fonetiesmotoriese kodering van die uiting. Ander outeurs beskou weer verlengde segmentele duur teoreties as 'n kompensatoriese metode (Kent & Rosenbek, 1982; Van der Merwe et al., 1989).

'n Interessante spektrografiese waarneming by duurmetings van die verbaal-apraktiese spreker is die konstante voorkoms van intersillabe-pouserings, selfs waar normale duurwaardes bereik is. In teenstelling hiermee het intersillabe-pouserings nooit by die serebellêre disartriesprekers voorgekom nie en is aaneenlopende produksies sonder duidelike afsluitings eerder opgemerk. Kent en McNeil (1987) vind in ooreenstemming met hierdie resultate intersegmentduur langer as die normale by verbaal-apraktiese sprekers. Hierdie bevindinge vind dus tot 'n mate aansluiting by die teorie dat intersillabepouserings as 'n kompensatoriese metode gebruik word.

'n Verdere interessante waarneming wat by die duurmetings van die [s] sowel as die [l]-klank van die verbaal-apraktiese spreker waarneembaar is en nie by die sprekers met serebellêre disartrie voorkom nie, is dat die verbaal-apraktiese spreker gering groter duurwaardes vir KVKVK-eenhede vertoon as vir KVKV-eenhede. Van der Merwe et al., (1989) vind ooreenstemmende groter duurwaardes vir KVKVK-eenhede as vir KVKV-eenhede by verbaal-apraktiese sprekers. Kontekste wat moontlik hoër eise aan die spreker stel in terme van motoriese beplanning het dus moontlik verlengde duur tot gevolg (Van der Merwe et al., 1989). Die afleiding kan dus gemaak word dat die verbaal-apraktiese spreker in die huidige studie ook moontlik probleme vertoon met die beplanning van spraak.

Resultate en bespreking van die meting van die omvang van akoestiese energie van die [s]-klank

Figuur 5 illustreer die bevindinge van die meting van die omvang van akoestiese energie van die [s]-klank.



Figuur 5. Gemiddelde minimum en maksimum frekwensie-waardes en plek van gekonsentreerde energie vir die [s] van die verskillende diagnostiese groepe.

Die moontlikheid dat unieke [s]-produksie by Pp1 voorkom, word verder ondersteun deur resultate van die meting van die omvang van akoestiese energie by die [s] van Pp1. Die serebellêre disartriesprekers as groep vertoon ruimtelike distorsie van die [s] deurdat die omvang van die [s] skuif na 'n effens kleiner waarde met die minimum waarde meer afwykend as die maksimum waarde (sien Figuur 5). 'n Verlaging in die minimum frekwensiewaardes van die [s] kan moontlik dui op 'n verminderde konstriksie vir [s]-produksie. Proefpersoon 1 toon 'n gering groter omvang van akoestiese energie as Pp 2 wat daarop kan dui dat 'n groter mate van [s]-distorsie voorkom by Pp 1 ten spyte van normale en korter as normale duurwaardes. Proefpersoon 1 toon dus 'n groter mate van ruimtelike spraakklankdistorsie vir die [s]-klank as Pp 2, terwyl Pp 2 weer 'n groter mate van temporale spraakklankdistorsie vir die [s] vertoon. Die omvang en akkuraatheid van

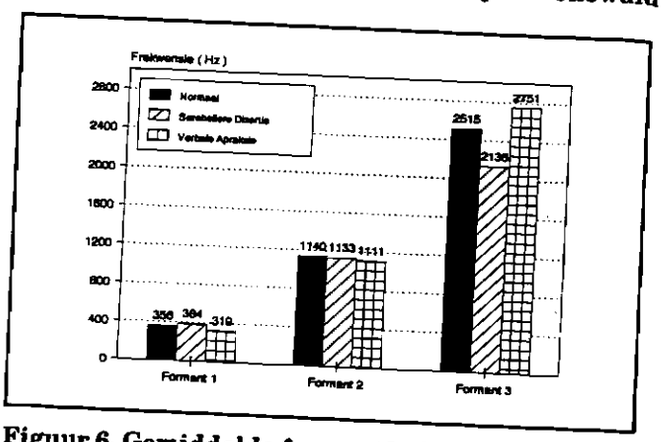
artikulatoriese bewegings is dus moontlik by die serebellêre disartriesprekers aangetas ooreenkomstig die graad van neuromotoriese simptome. Daar moet egter deurentyd by die interpretasie van resultate in gedagte gehou word dat ongekontroleerde veranderlikes soos gewoontepatrone van spraakproduksie en selfs individuele strukturele verskille in tandformasie 'n rol kan speel by die voorkoms van spraakklankdistorsie.

Die verbaal-apraktiese spreker toon 'n groter mate van ruimtelike spraakklankdistorsie van die [s] as die serebellêre disartriesprekers, deurdat die omvang van akoestiese energie heelwat wyer is as die omvang van die normale en serebellêre disartriesprekers (sien Figuur 5). 'n Afname in die algemene intensiteit van die uiting kom ook voor, wat spektrografies waarneembaar is as 'n vermindering in die donkerheidsgraad van die optekening en dus die bepaling van die gebied van ruis aansienlik bemoeilik. Die voorkoms van 'n groot omvang van akoestiese energie kan die gevolg wees van 'n groter opening van konstriksie tydens [s]-produksie. Die verbaal-apraktiese spreker vertoon dus moontlik probleme met die fyn posisionering van die artikulators om 'n sterk gekanaliseerde lugstroom te verseker. Kent en Rosenbek (1983) postuleer dat probleme met akkurate artikulatoriese posisionering by verbale apraksie gedeeltelik verklaar kan word deur 'n teorie van motoriese kontrole waar ruimtelik-temporale skemata "or abstract goals in space and time" (Kent & Rosenbek, 1983, p.246) vir spraakproduksie aangeleer en gestoor word, sodat individuele motoriese programme vanuit die skemata gespesifiseer word. By verbale apraksie is die spreker dus moontlik in staat tot die onttrekking en formulering van spesifikasies van nie-verbale bewegings (soos kou en sluk), maar ervaar hy of beperkte toegang tot die skemata van spraakproduksie of die skemata is onbetroubaar weens aantasting daarvan. Aangesien Pp 3 ook subkortikale skade het, kan daar egter ook op grond van die model van Van der Merwe (1994) gespekuleer word dat hierdie ruimtelike distorsie kan dui op programmeringsprobleme. Dis dus moontlik dat die spreker probleme het om die omvang en rigting van beweging te spesifiseer vanuit die beplande motoriese programme net voordat beweging uitgevoer moet word. Verdere verklarings en bespiegelings rondom hierdie resultate word egter beperk deur 'n gebrek aan data oor [s]-produksie by ander verbaal-apraktiese sprekers, asook 'n tekort aan normatiewe data aangaande [s]-produksie by normale sprekers.

Resultate en bespreking van formantmetings van die [l]

Figuur 6 illustreer die gemiddelde formantwaardes van F1, F2 en F3 van die [l]. Dit blyk dat die grootste afwyking vanaf die normale formantwaardes voorkom by F3 van die onderskeie diagnostiese groepe. Wat die ruimtelike bewegingsaspekte van die [l]-klank betref, toon beide diagnostiese groepe geen akoesties identifiseerbare spraakklankdistorsie by die formante verantwoordelik vir die perseptuele identifikasie van die klank as 'n [l] nie (Pickett, 1980).

Ruimtelike spraakklankdistorsie is egter wel waargeneem by formant drie van die serebellêre disartriesprekers deurdat F3 'n verlaging toon (sien Figuur 6). F3 word soms geassosieer met die alveolêre afsluiting vir [l]-



Figuur 6. Gemiddelde formantfrekwensiewaardes vir formante een, twee en drie van die [l] van die onderskeie diagnostiese groepe

produksie, sowel as allofoniese variasie van die [l] (Pickett, 1980). In die literatuur is ongelukkig min bekend oor die fisiese resonansieveranderlikes geassosieer met F3 van die [l]. 'n Verlaging in F3 kan moontlik aanduidend wees van die produksie van 'n swak alveolêre afsluiting, byna soos vir [r]-produksie waar die tongpunt nie die alveolêre rif raak nie. So 'n afleiding korreleer dus met vorige waarnemings van swak afsluitingsklankproduksie by die serebellêre disartriesprekers in die huidige studie en kan weer eens dui op probleme met die uitvoering of programmering van spraakproduksie.

Die verbaal-apraktiese spreker toon in kontras met die serebellêre disartriesprekers eerder 'n verhoging in F3 as 'n verlaging (sien figuur 6). Die F3-waarde van die verbaal-apraktiese spreker val egter steeds gering binne die normale perke en dui dus moontlik nie op ruimtelike spraakklankdistorsie nie. 'n Toename in die gemiddelde F3-waarde van die [l] kan ook geassosieer word met kwaliteit van afsluitingsproduksie, maar 'n tekort aan beskikbare data oor normale F3-waardes en veranderlikes daarmee geassosieer, beperk die formulering van verklarings. 'n Opvallende waarneming van [l]-produksie by die verbaal-apraktiese spreker is egter die neiging tot swak energie oor 'n verspreide frekwensieomvang en dat die gemiddelde drywingsdigtheidspektrum ook nie sterk formantpieke aantoon vir die [l] nie. So 'n swak en verspreide omvang van energie kan dus die bepaling van die plek van meting bemoeilik en ook die meting van 'n groot F3-waarde by die verbaal-apraktiese spreker tot gevolg hê. Slegs beperkte data is in die literatuur beskikbaar aangaande formantwaardes van die [l] by verbaal-apraktiese sprekers. Kent en Rosenbek (1983) vind dat verbaal-apraktiese sprekers geneig is tot foute met die [l] en [r]-klanke deurdat die klanke soms uitgelaat word en soms met mekaar vervang word en dat die formante van die [l] na aan mekaar gespasieer is. Soortgelyke waarnemings is nie in die huidige studie gemaak nie.

ALGEMENE BESPREKING

Afwykende SAT-waardes by die serebellêre disartriesprekers (veral Pp 2) kom voor as die resultaat van swak alveolêre en vertraagde velêre afsluitingsproduksie en die resultate dui dus op afwykings in die omvang en

akkuraatheid van artikulatoriese bewegings as sulks. Die ruimtelike bewegingsafwykings is moontlik die resultaat van onderliggende neuromotoriese probleme soos versteurde spiertonus en onwillekeurige bewegings en blyk ook verband te hou met die graad van serebellêre aantasting. Hierdie resultate kan afwykings in uitvoer en programmering van spraakbewegings reflekteer.

Die verbaal-apraktiese spreker daarteenoor is moontlik wel in staat tot akkurate artikulatoriese bewegings aangesien goeie kwaliteit alveolêre en velêre afsluitings voorkom by SAT-metings. Dit blyk dus asof probleme met die temporale beplanning van produksiekomponente van die [d] lei tot vertraagde stemgewing by die verbaal-apraktiese spreker en nie afwykings in die bewegings self nie. Hierdie afleiding word bevestig deur bevindinge van Hardcastle (1987) aangaande bewegingsaspekte in die spraak van verbaal-apraktiese sprekers, naamlik: "The component gestures were thus normal spatially: what was disturbed was their temporal integration and their occurrence at inappropriate places" (Hardcastle, 1987, p.126).

Afwykings in konsonantduur van die [l] en die [s] is by die sprekers met serebellêre disartrie sowel as by die spreker met verbale apraksie opgemerk. Die serebellêre disartriesprekers toon verlengde duur ooreenkomstig die graad van aantasting moontlik weens probleme met die uitvoer van spraakbewegings. Die verbaal-apraktiese spreker toon 'n groter mate van temporale distorsie vir die [s] as die serebellêre disartriesprekers, intersillabe pouserings en langer duurwaardes vir KVKVK-eenhede as vir KVKV-eenhede, wat alles moontlik voorkom as die direkte gevolg van of as kompensasie vir 'n onderliggende beplanningsprobleem. Die moontlikheid van 'n bydraende probleem in programmering is nie uitgesluit nie, veral in die lig van die subkortikale skade van die proefpersoon.

Die serebellêre disartriesprekers sowel as die verbaal-apraktiese spreker toon ruimtelike distorsie van die [l] en [s] maar verskille in die aard en graad daarvan kom voor. Die verbaal-apraktiese spreker toon 'n groter mate van ruimtelike distorsie vir die [s] en toon ook 'n wyer omvang van akoestiese energie as die serebellêre disartriesprekers. By die [l]-klank kom 'n verhoging in F3 voor inteenstelling met 'n verlaging in F3 van die serebellêre disartriesprekers. Ruimtelike distorsie van die [s] en [l] kan probleme met die programmering en uitvoering van spraakbewegings by die serebellêre disartriesprekers reflekteer en kan dui op uitvalle met beplanning en programmering van spraakbewegings by die verbaal-apraktiese spreker. Dis dus moontlik dat serebellêre disartriesprekers en die verbaal-apraktiese spreker se ruimtelike spraakklankdistorsie aanduidend kan wees van 'n ooreenstemming op die vlak van motoriese programmering.

Vanuit die studie is dit duidelik dat daar 'n behoefte bestaan aan 'n omvattende teoretiese raamwerk of model van spraakproduksie waarbinne navorsingsdata geïnterpreteer kan word en waarbinne daar na oplossings vir bestaande vraagstukke rondom neuromotoriese spraakafwykings gesoek kan word. Daar bestaan ook 'n behoefte aan verdere vergelykende navorsing binne die verskillende groepe neuromotoriese spraakafwykings om sodoende die kliniese onderskeid tussen simptome wat voorkom weens aantasting van 'n beplannings-, programmerings- en uitvoerstadium van die spraakproduksieproses moontlik te maak.

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'n Elektroglottografiese Analise van Sekere Stemparameters: Normatiewe Aanduidings

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OPSOMMING

'n Omvattende stemevaluasie behels meer as net die evaluasie van perseptuele en organiese aspekte. Vir 'n volledige stemevaluasie is dit belangrik dat verskeie objektiewe metings die diagnostiese battery aanvul. Ten einde normatiewe riglyne vir sekere kwantitatiewe elektro-glottografiese metings vir die Universiteit van Pretoria se Spraaknavorsingslaboratorium daar te stel, is 25 mans en 25 dames met perseptueel normale stemme, uit 'n ouderdomspektrum van 8 tot 80 jaar, ondersoek met betrekking tot gemiddelde fundamentele frekwensie, piek-tot-piek frekwensiëfluktuasie, piek-tot-piek amplitudefluktuasie en harmoniek/ruis-verhouding. Resultate dui aan dat al hierdie parameters sensitief is vir verandering in stemproduksie as gevolg van veroudering, vokaal- en luidheidsveranderinge. Die waarde van die verkreë data vir navorsing en die kliniese praktyk word bespreek.

ABSTRACT

A comprehensive voice evaluation comprises more than just the evaluation of perceptual and organic aspects. Objective voice analysis should supplement the diagnostic battery. In order to obtain normative indications for the Speech Research Laboratory at the University of Pretoria, 25 men and 25 women ranging in age from 8 to 80 years and with perceptually normal voices were tested with regard to fundamental frequency, cycle to cycle frequency fluctuation (jitter), cycle to cycle amplitude fluctuation (shimmer) and harmonic/noise ratio. Results indicate that these parameters are sensitive to changes in voice production caused by ageing, changes in loudness and the production of different vowels. The implications of these results for research and clinical practice are discussed.

'n Omvattende stemevaluasie behels meer as net die evaluasie van perseptuele en organiese aspekte. Vir 'n volledige stemevaluasie is dit belangrik dat verskeie objektiewe metings die diagnostiese battery aanvul (Gould, 1988; Glaze, Bless & Susser, 1990). Stemlaboratoria, bestaande uit onder andere verskeie akoestiese meetinstrumente, het die afgelope dekade vinnig toegeneem (Gould, 1988). Die ideale stemlaboratorium verskaf optimale informasie vir diagnose en behandeling van 'n stempasiënt en kan gebruik word vir verdere navorsing om steeds meer gesofistikeerde pasiëntsorg te verseker (Sataloff, Spiegel, Carroll, Darby, Hawkshaw & Rulnick, 1990). Die Spraaknavorsingslaboratorium van die Universiteit van Pretoria beskik oor die nodige instrumentasie vir die uitvoer van elektroglottografiese (EGG) metings, maar weens 'n gebrek aan normatiewe data is dit moeilik om hierdie tegniek sinvol aan te wend. Hierdie behoefte aan norme blyk ook uit die literatuur. (Wilcox & Horii, 1980; Hollien, 1987; Colton & Conture, 1990; Fitch, 1990; Glaze et al., 1990; Sataloff et al., 1990). Hierdie studie beoog dus die uitbreiding van stemanalisemetodiek deur die daarstelling van normatiewe riglyne vir EGG-metings, vir gebruik met normale en patologiese stemme.

Die elektroglottograaf is 'n objektiewe, nie-indringende meetinstrument wat gebruik word om stembandaktiwiteit te ondersoek sonder veel ongemak of inmenging met fonasie (Gould, 1988). Dit meet die elektriese stroom tussen twee elektrodes aan weerskante van die larinks soos wat dit deur die nekweefsel en stembande beweeg (McFarlane & Watterson, 1991). Die resultaat is 'n weerstandsgolfpatroon. Normale stembandvibrasie produseer 'n reeks relatief eweredige weerstandsgolwe en word as 'n gelykmatige klank gehoor, ten spyte van minimale fluktuasie in die golfpatroon (McFarlane & Watterson, 1991). Die stembande is 2 onafhanklike vibrators wat elk funksioneer op grond van die inherente fisiologiese eienskappe (bv. stembandmassa, -spanning, spieraktiwiteit, neurale aktiwiteit en kardio-vaskulêre

betrokkenheid) daarvan. Indien die gekombineerde werking van die twee afsonderlike stembande 'n reeks weerstandsveranderinge tot gevolg het wat varieër in terme van tyd en/of amplitude, word die stem as grof, skor of hees waargeneem (Horii, 1980; Hollien, 1987; Orlikoff & Kahane, 1991).

Akoestiese metings, naamlik piek-tot-piek frekwensiefluktuasie ("jitter") en piek-tot-piek amplitudefluktuasie ("shimmer") reflekteer onderskeidelik die stabiliteit en reëlmaat van stembandvibrasie. Lae piek-tot-piek frekwensiefluktuasie (PPFF)-waardes dui dus op relatief hoë stabiliteit in die frekwensie van stembandvibrasie en lae piek-tot-piek amplitudefluktuasie (PPAF)-waardes dui op 'n hoë mate van reëlmaat in die amplitude van stembandvibrasie (Orlikoff en Kahane, 1991). Uit die literatuur blyk dit dat PPFF en PPAF baie hoër waardes by growwe, skor, en hees stemme het. Piek-tot-piek fluktuasies is ook baie groter in patologiese stemme as in normale stemme (Horii, 1980; Hollien, 1987; Brown, Morris & Michel, 1989; Linville, Korabic & Rosera, 1990). Onlangs is 'n kwantitatiewe stemanalise-program vir die Kay DSP-Sonagraph (model 5500) beskikbaar gestel. Hierdie program bepaal, m.b.v. 'n elektroglottograaf, outomaties gemiddelde fundamentele frekwensie (gem. fo), PPFF, PPAF en gee 'n harmoniek/ruis-verhouding (wat 'n aanduiding gee van die hoeveelheid ruis of heesheid in die stem).

Navorsing dui daarop dat 'n akoestiese analise van die stem moontlik die eerste akkurate informasie aangaande patologiese verandering in die larinks verskaf (Baken, 1987). Veroudering impliseer nie noodwendig 'n patologiese toestand nie, maar normale anatomiese en fisiologiese verandering tree wel met veroudering in (Hollien, 1987). Veranderinge in perseptuele en akoestiese eienskappe in die verouderende stem kan aan ouderdomsverwante anatomiese en fisiologiese veranderinge op molekulêre, sellulêre en orgaanvlak toegeskryf word, wat dwarsdeur die hele liggaam plaasvind (Aronson, 1985; Chodzko-Zajko & Ringel, 1987; Biever & Bless, 1989; Orlikoff, 1990a). Volgens Orlikoff (1990a) word die fonatoriese sisteem die meeste van enige komponent in die spraakmeganisme deur veroudering geaffekteer. Dit blyk dus dat 'n behoefte aan bruikbare norme vir verskillende ouderdomsgroepe bestaan.

METODE

DOELSTELLINGS

Die doel van die studie is die uitvoering van 'n EGG-analise van spesifieke stemparameters van sprekers met perseptueel normale stemme, ten einde normatiewe riglyne daar te stel. Die subdoelstellings is om die invloed van ouderdom asook vokaal- en luidheidsveranderinge op die volgende stemparameters na te gaan:

- Gemiddelde fundamentele frekwensie (gem. fo) by manlike en vroulike sprekers
- Piek-tot-piek frekwensiefluktuasie (PPFF)
- Piek-tot-piek amplitudefluktuasie (PPAF)
- Harmoniek/ruis-verhouding (H/R-verhouding)

NAVORSINGSONTWERP

Hierdie studie behels 'n kruisseksie-opname (Guy, Edgley, Arafat & Allen, 1987) deur middel van die korrelatiewe navorsingstegniek (Smit, 1983). 'n Kwotasteekproef word gebruik om proefpersone te selekteer. Proefpersone word sodoende in verskillende kombinasies van ouderdom en geslag geordeen, om 'n objektiewe beeld van die stemeienskappe van persone van verskillende geslagte, in spesifieke ouderdomsgroepe, langs 'n ouderdomskontinuum te verkry. Hierdie tipe navorsingsontwerp het dan ook die voordeel dat veranderlikes onder natuurlike omstandighede bestudeer kan word en die ko-variasie tussen die onderskeie veranderlikes ondersoek kan word. Informasie wat deur die opname-studie verkry word, kan na die hele populasie veralgemeen word (Guy et al., 1987). Hierdie tipe studie is dus voordelig om te gebruik vir die opstel van 'n normbasis.

PROEFPERSONE

Kriteria vir die seleksie van proefpersone:

Ouderdom:

Aangesien die beplande databasis vir 'n ouderdomspektrum opgestel word, is proefpersone binne die volgende vyf oudersomsintervalle ondersoek:

8 tot 10 jaar - Die kinders moet geen tekens van puberteit toon nie (Glaze et al., 1990), aangesien spesifiek 'n prepuberteitsanalise van die stem gemaak word.

19 tot 23 jaar -Hierdie post-puberteitsanalise van die stem behoort optimale stembandfunksionering te reflekteer, aangesien maksimum effektiwiteit in liggaamlike funksionering ongeveer in hierdie tydperk plaasvind (Orlikoff, 1990a).

30 tot 40 jaar-Orlikoff (1990a) postuleer dat liggaamlike funksionering toenemend vinniger begin afneem vanaf ongeveer dertigjarige ouderdom. Deur hierdie groep in te sluit kan die aanvang van stemveroudering gemonitor word.

50 tot 60 jaar-Hierdie kategorie word ingesluit om die status van stembandfunksionering te evalueer net voor werklike veroudering begin intree.

70 tot 80 jaar:-Na die sesde lewensdekade is dit moeilik om groepsgemiddelde op persone toe te pas, selfs al vind normale veroudering plaas (Orlikoff, 1990b). As gevolg van baie kontroversie in die literatuur (Shipp & Hollien, 1969; Horii & Ryan, 1981; Hollien, 1987), blyk dit nodig te wees om aparte norme, spesifiek vir hierdie ouderdoms-groep, daar te stel.

Ander faktore:

5 Manlike en 5 vroulike proefpersone per ouderdomsgroep is geselekteer op grond van perseptueel normale stem. Geen relevante mediese probleme mag teenwoordig wees nie. Persone mag nie meer as 20 sigarette per dag rook nie, moet oor normale gehoor beskik, nie oormatig oorgewig wees nie en nie medikasie gebruik wat 'n uitdrogingseffek op die larinks het nie (Orlikoff, 1990a; Hollien, 1987; Horii, 1980; Fitch, 1990; Baken 1987).

MATERIAAL

Die vokale /a:/ en /i:/ word geselekteer vir hierdie studie. Uit die literatuur blyk dit dat hierdie twee vokale die meeste vir EGG-opnames gebruik word (Childers & Lee, 1991). Die vokale /a:/ en /i:/ verteenwoordig die grootste moontlike fisiologiese omvang vir vokaalproduksie (Fitch, 1990). Aangesien persone met stempatologie dikwels probleme ondervind met luidheidsveranderings, word elke vokaal ook met verhoogde luidheid geproduseer sodat 'n basis verkry kan word waarmee patologiese luidheidverandering vergelyk kan word.

APPARAAT

Die volgende apparaat is gebruik vir die stemopnames: "Portable Electro-Laryngograph" met elektrodes, Electro-Voice Mikrofoon Model 631B, Kay DSP Sonagraph Model 5500 en NEC Multisync II vertoonskerm. Die opstelling van die apparaat is gedoen soos voorgestel in die handleiding van die sonagraaf (Kay Elemetrics Corp., 1989). Die analise is met behulp van die outomatiese stemanaliseprogram, model 5625, van die DSP Sonagraph gedoen.

PROSEDURE VIR DATAVERSAMELING

Die plasing van die elektrodes op die proefpersoon se larinks het volgens die prosedure, soos aanbeveel deur McFarlane en Watterson (1991) en Colton en Conture (1990), geskied. Optimale elektrodeplasing en opname-instellings is telkens getoets deur voorafgaande proefopnames (Kay Elemetrics Corp., 1989). Die vokaal /a/ en /i/ is op dieselfde wyse geproduseer, opgeneem en ontleed. Elke vokaal is vir 2 sekondes geproduseer by normale gesprekstoonhoogte en -luidheid, gevolg deur 'n produksie van 2 sekondes teen verhoogde luidheid. Elke uiting is 3 maal herhaal en afsonderlik ontleed, om sodoende die invloed van intrapersoonlike variasie te bekamp.

PROSEDURE VIR DATA-ANALISE

Die analiseprosedure by elke uiting, het bestaan uit die afbakening van ongeveer 100 siklusse van 'n stabiele, middelgedeelte van die Lx-sein, soos op die skerm geposisioneer. (Horii, 1980; Linville et al., 1990). Die onderskeie parameters is dan outomaties bereken deur die aktivering van die stemanaliseprogram.

- **Die meting van gemiddelde fundamentele frekwensie**
  Fundamentele frekwensie word bepaal deur die vibrasiespoed van die stembande en bepaal die toonhoogte van fonasie. Die gemiddelde fo is telkens bereken vir 'n periode van ongeveer 100 siklusse.

- **Die meting van PPFV**
  Lieberman (1963) definieer PPFF ("jitter") as die siklus-tot-siklus fluktuasie in fundamentele frekwensie. Die stemanaliseprogram gebruik 'n manipuleerde vorm van Koike se formule (Kay Elemetrics Corp., 1989) om PPFF te bereken. Resultate word as persentasie (%) weergegee.

- **Die meting van PPAF**
  PPAF ("shimmer") of soos Horii (1980) dit definieer, siklus-tot-siklus amplitudefluktuasie, word in hierdie studie bepaal deur die verskil tussen die mees positiewe en mees negatiewe pieke te bereken (Kay Elemetrics Corp., 1989). Die verkreë PPAF-waardes word in desibel (dB) uitgedruk.

- **Die meting van harmoniek/ruis-verhouding**
  Die H/R-verhouding druk die verskil in dB uit tussen die harmoniese en ruiskomponente in die afgebakende deel van die stemgolf. Dus, hoe kleiner die verskilwaarde tussen die amplitude van die harmoniese komponent en die amplitude van die ruiskomponent, hoe kleiner is die H/R-verhoudingswaarde. 'n Klein H/R-verhouding dui op 'n hoë mate van ruis in die stem en word as heesheid gehoor (Yumoto, 1988).

PROSEDURE VAN DATAVERWERKING

'n Variansie analise is op die finale data gedoen met behulp van PROC ANOVA en die SAS-programpakket. Hierdie analise het getoets vir enige betekenisvolle verskille tussen die verskeie veranderlikes. Die peil van betekenis was bepaal by $p<0.05$. Uit die data is statistiese gegewens aangaande die verskeie veranderlikes verkry om sodoende frekwensieverdelings, gemiddeldes, standaardafwykings, minimum- en maksimumwaardes te bereken. Uit die finale data is vertrouensintervalle ook opgestel vir verskeie veranderlikes. 'n 95% vertrouensinterval is gekonstrueer sodat met 95% sekerheid gesê kan word dat hierdie interval wel die populasie-gemiddeld sal bevat (waar populasie beduie op die totale groep van persone waarop hierdie studie betrekking het). Hierdie interval is gebruik om 'n skatting te maak van die onbekende populasiegemiddeld (Steyn, Smit & Du Toit, 1987; Bowermann & O'Connel, 1990).

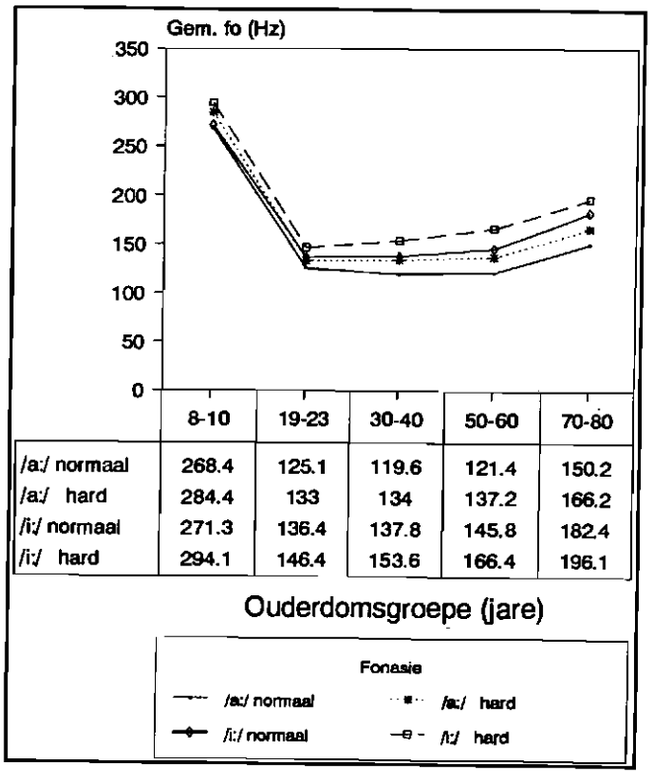
RESULTATE EN BESPREKING

Die resultate word beskryf en bespreek aan die hand van die onderskeie subdoelstellings.

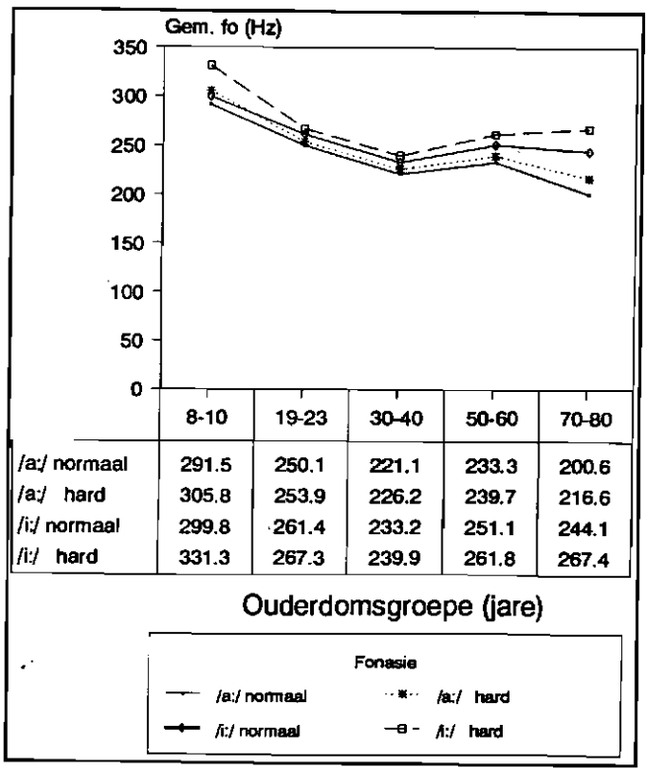
GEMIDDELDE FUNDAMENTELE FREKWENSIE

- **Ouderdomsverwante verandering in gemiddelde fundamentele frekwensie van mans en vroue.**

Die gem. fo van die mans- en vrouegroep verskil statisties betekenisvol op 'n peil van 5%. Die resultate vir die 2 groepe word dus afsonderlik verskaf. In figuur 1 word die gem. fo van mans in verskillende ouderdomsgroepe weergegee vir produksie van /a:/ en /i:/ met normale en verhoogde luidheid.



Figuur 1: Die verandering in gem. fo van mans in verskillende ouderdomsgroepe tydens produksie van /a:/ en /i:/ met normale en verhoogde luidheid.



Figuur 2: Die verandering in gem. fo van vroue in verskillende ouderdomsgroepe tydens produksie van die vokale /a:/ en /i:/ met normale en verhoogde luidheid.

Daar is 'n skerp daling in gem. fo na puberteit. Slegs die 8-10 jaar groep verskil statisties, op 'n 5% peil van betekenis, van die ander ouderdomsgroepe. Die verlaging in fo na puberteit, is die logiese gevolg van fisiese groei van die fonasiestruktuur. Dit word gevolg deur 'n neiging tot verhoging in gem. fo met veroudering, wat moontlik toegeskryf kan word aan ouderdomsverwante veranderinge wat in die larinks plaasvind, bv. verdunning van die stembande a.g.v. atrofie, dehidrasie van die laringale mukosa, vermindering in die elastisiteit van die laringale ligamente, toenemende ossifikasie en kalsifikasie van die kraakbenige strukture van die larinks en afname in sentrale senuweestelselkontrole (Aronson, 1985; Chodzko-Zajko & Ringel, 1987; Orlikoff, 1990b). Die gem. fo waardes verkry in die huidige studie korreleer met die resultate van ander navorsers (Aronson, 1985; Colton & Casper, 1990; Childers & Lee, 1991).

In figuur 2 word die gem. fo van vroue in verskillende ouderdomsgroepe weergegee tydens produksie van die vokale /a:/ en /i:/ met normale en verhoogde luidheid.

Figuur 2 vertoon 'n geleidelike verlaging in gem. fo van die vokale /a:/ en /i:/ vanaf die ouderdomsgroep 8-10 jaar tot by die ouderdomsgroep 30-40 jaar. Hierdie verlaging in die gem. fo van vroue is nie so groot as die verlaging in gem. fo wat by mans in dieselfde tydperk voorkom nie. Die laagste gemiddelde fo-waardes word deur die groep 70-80 jaar vertoon. Die gemiddelde fo-waardes van die verskillende ouderdomsgroepe verskil egter nie statisties, op 'n 5% peil van betekenis, nie.

Dit kom voor asof die invloed van veroudering nie eenvormige gem. fo veranderinge by alle vroue teweegbring nie, terwyl 'n styging in gem. fo by feitlik alle mans voorkom. Uit die literatuur blyk baie kontroversie rondom die invloed van veroudering op die gem. fo van vroue (McGlone & Hollien, 1963) en sommige navorsers (Aronson, 1985), voel dat hierdie verskillende neigings nie verklaar kan word nie. Hollien (1987) postuleer egter dat menopouse die omgekeerde van puberteit is. Die neiging van mans se gem. fo om na die ouderdom van 50-60 jaar toenemend te begin styg en vroue se gem. fo wat neig om te daal, staan in die literatuur bekend as die "sentrale neiging" (Orlikoff, 1990b) wat Hollien (1987) se siening dat die menopouse die omgekeerde effek as puberteit op gem. fo het bevestig.

- **Vokaalverwante verandering in gem. fo van mans en vroue**

Soos dit blyk uit figure 1 en 2 is die gem. fo van /i:/ telkens hoër as vir /a:/. Die /i:/ is 'n hoë, voorvokaal en produksie van hierdie vokaal behels dat die tong gelig word. Met die oplig van die tong word die hioïedbeen en larinks opwaarts getrek en die laringale spiere word gestrek. Gevolglik verhoog die elastisiteit van die stembande en het hoër gem. fo waardes vir /i:/ tot gevolg (Aronson, 1985).

- **Luidheidsverwante veranderinge in gem. fo van mans en vroue**

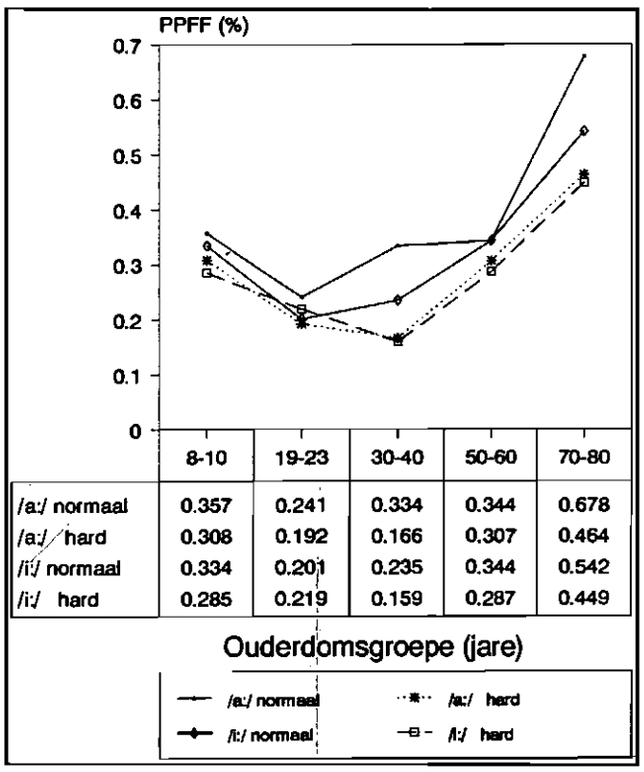
Fonasie met verhoogde luidheid het telkens hoër gem. fo-waardes as normale fonasie tot gevolg. Hierdie verhoging in gem. fo tydens harde fonasie kan gesien

word as die resultaat van veranderinge in o.a. subglottale lugdruk wat vir klankpeilvariasie benodig word.

Tydens harde fonasie kom die grootste gem. fo-verhoging by die 70-80 jaar voor. Verskeie outeurs rapporteer 'n toename in die veranderlikheid van gem. fo van bejaardes wat toegeskryf kan word aan 'n verlies aan aanpasbaarheid as gevolg van 'n vermindering in spiertonus en -krag, ossifikasie en ander ouderdomsverwante veranderinge in die bindweefsel van die laringale kraakbeen. (Hollien, 1987; Colton & Casper, 1990; Orlikoff, 1990a; Biever & Bless, 1989; Brown et al., 1989).

PIEK-TOT-PIEK FREKWENSIEFLUKTUASIE

Statisties betekenisvolle verskille kom nie by die piek-tot-piek frekwensiefluktuasie (PPFF) ("jitter")-waardes van mans en vroue voor nie. Om hierdie rede word die verkreë resultate gekombineer en weergegee in figuur 3.



Figuur 3:PPFF-waardes van mans en dames in verskillende ouderdomsgroepe tydens produksie van /a:/ en /i:/ met normale en verhoogde luidheid.

- Ouderdomsverwante verandering in PPFF

Lae PPFF-waardes reflekteer relatief hoë stabiliteit in stembandvibrasie. Die groep 19-23 jaar verkry dan ook die laagste gemiddelde PPFF-waarde vir /a:/ en /i:/, wat dui op die mees stabiele stembandvibrasie van al die ouderdomsgroepe. Orlikoff (1990a) rapporteer dat liggaamsfunksionering maksimum effektiwiteit tussen 20-29 jarige ouderdom bereik. Die lae PPFF-waardes van die groep 19-23 jaar korrelleer dan ook met hierdie stelling van Orlikoff. Teen dertigjare ouderdom begin homeostatiese funksionering, sowel as kompensatoriese en regulatoriese kontrole in die liggaam afneem. PPFF bereik dan ook 'n maksimum gemiddelde waarde (figuur 3) by die groep 70-80 jaar en verskil statisties betekenisvol, op 'n 5% peil van betekenis, van die ander ouderdomsgroepe. Hierdie hoër PPFF-waardes wat korreleer met 'n toename in ouderdom dui dus op 'n geleidelike verlies in stabiliteit in stembandvibrasie en word geassosieer met growwe, skor en hees stemme (Hollien, 1987; Horii, 1980; Orlikoff, 1990a).

Alle bejaardes vertoon nie hoë PPFF-waardes nie. Hierdie verskynsel word in die literatuur verklaar aan die hand van die fisiese gesondheid van die proefpersone, veral wat betref kardiovaskulêre gesondheid (Biever & Bless, 1989; Brown et al., 1989; Orlikoff, 1990b). Orlikoff (1990a) vind dat gesonde, bejaarde mans se PPFF ooreenstem met die PPFF van mans in hul twintigerjare, terwyl bejaarde mans met aterosklerose baie hoër PPFF-waardes as die gesonde jong en bejaarde mans vertoon. Dit is dus duidelik dat sekere gesondheidsverwante faktore PPFF-resultate kan beïnvloed. Dit is verder ook bekend dat alle liggaamlike sisteme nie ewe vinnig verouder nie en dat laringale veroudering by sommige persone vinniger as by ander kan plaasvind (Chodzko-Zajko & Ringel, 1987). By die opstel van normatiewe riglyne moet die wye omvang van PPFF-waardes van bejaardes dus ingedagte gehou word en kan groepsgemiddelde nie sonder meer op die geriatriese populasie toegepas word nie.

- Vokaalverwante verandering in PPFF

Die verskillende vokale het nie 'n statisties betekenisvolle invloed op PPFF nie, alhoewel dit voorkom asof /a:/ meer konstante resultate oplewer. Hierdie resultate korreleer ook met die van Wilcox & Horii (1980).

- Luidheidsverwante veranderinge in PPFF

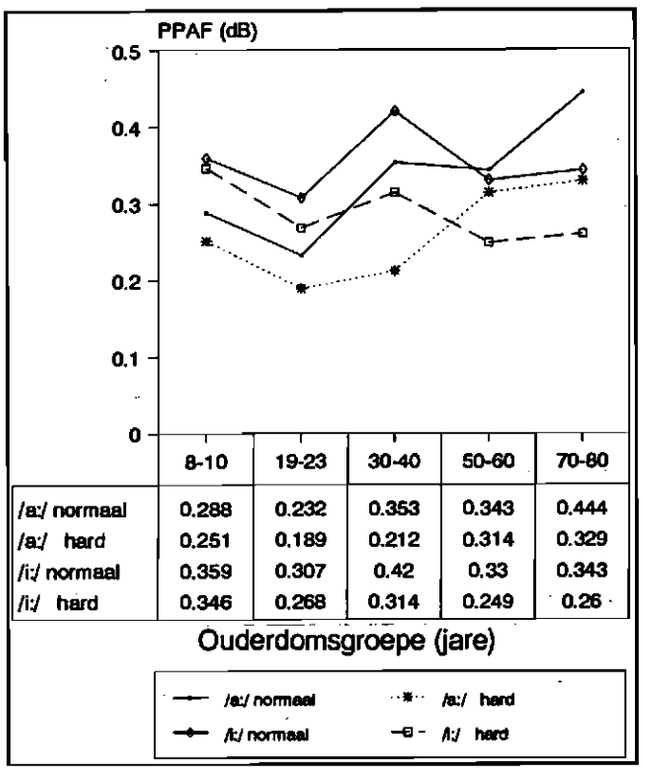
Uit die resultate van PPFF blyk dit dat fonasie met verhoogde luidheid feitlik konstant laer waardes oplewer as fonasie met normale luidheid. Glaze et al. (1990) postuleer dat luidheidsveranderinge teweeggebring word deur veranderinge in subglottale lugdruk en die mediale kompressie van die stembande wat gevolglik die stembandvibrasiepatroon verander deur verlenging van die geslote fase van stembandvibrasie. Die veranderinge wat in die spraakproduksiemeganisme plaasvind vir harde fonasie kan dus moontlik bydra tot groter stabiliteit in die vibrasiepatroon van die stembande en lewer gevolglik laer PPFF-waardes op.

PIEK-TOT-PIEK AMPLITUDEFLUKTUASIE

Geen statisties betekenisvolle verskille kom by die piek-tot-piek amplitudefluktuasie (PPAF) ("shimmer")-waardes van die twee geslagte voor nie en daarom word mans en dames se resultate gekombineerd in figuur 4 weergegee. Figuur 4 stel die verandering van PPAF met toename in ouderdom voor, vir die vokale /a:/ en /i:/ tydens produksie met normale en verhoogde luidheid.

- Ouderdomsverwante veranderinge in PPAF

Die PPAF-waardes van die verskillende ouderdomsgroepe verskil nie statisties, op 'n 5% peil van betekenis,



Figuur 4: PPAF-waardes van mans en dames in verskillende ouderdomsgroepe tydens produksie van /a:/ en /i:/ met normale en verhoogde luidheid.

van mekaar nie. Lae PPAF-waardes reflekteer 'n hoë mate van reëlmaat in stembandvibrasie. Die groep 19-23 jaar behaal vir beide vokale /a:/ en /i:/ die laagste PPAF-waardes wat dui op die mees reëlmatige stembandvibrasie van al die ouderdomsgroepe. Hierdie resultate korreleer met Orlikoff (1990a) se stelling dat maksimum effektiwiteit in liggaamsfunksionering ongeveer in die tydperk 20-29 jaar plaasvind. Glaze et al. (1990) vind dat PPAF-waardes vir kinders 5-11 jaar buite die PPAF-waardes van volwassenes lê. Die groep 8-10 jaar van die huidige studie, vertoon ook hoër waardes by kinders op grond van voortdurende anatomiese en morfologiese struktuurveranderinge op hierdie ouderdom. Tydens die maak van opnames vir die huidige studie is ook gevind dat opnames oor die algemeen moeiliker vir kinders as volwassenes gemaak word, a.g.v. moeiliker elektrodeplasing. 'n Swak golfpatroon is ook in sommige gevalle verkry, wat die gevolg kan wees van meer vetweefsel in die nek wat algemeen by kinders voorkom (Colton & Conture, 1990; Baken, 1987), maar ook die gevolg van swak elektrodekontak op die klein en hooggeplaaste larinks. Hierdie veranderlikes dra moontlik by tot die hoër PPAF- en PPFF-waardes wat vir kinders in die huidige, sowel as ander studies verkry is (Colton & Conture, 1990; Glaze et al., 1990).

Net soos die geval by PPFF, korreleer die hoër gemiddelde PPAF-waardes met 'n toename in ouderdom en dui op 'n geleidelike verlies aan reëlmaat in stembandvibrasie soos wat 'n persoon verouder. Hoë PPAF- en PPFF-waardes is direkte korrelate van 'n growwe, skor en hees stem, en kan verwag word dat die verouderende stem toenemend grof, skor en hees sal klink. Dit is egter nie altyd die geval nie. Tydens die huidige studie behaal sommige bejaardes PPAF-waardes wat korreleer met die waardes van die groep 19-23 jaar. Net soos die geval by PPFF kan die afleiding gemaak word dat fisiese gesondheid met stemfunksie verband hou. Alhoewel die proefpersone van die huidige studie gesond was, is faktore soos arteriosklerose en osteoporose nie spesifiek gekontroleer nie. Hierdie veranderlikes, wat nie in dieselfde mate by die bejaarde proefpersone voorkom nie, kon ook moontlik bydra tot hoër PPAF- (en PPFF)-waardes (Chodzko-Zajko & Ringel, 1987; Brown et al., 1989; Orlikoff, 1990b).

- **Vokaalverwante veranderinge in PPAF**

By vergelyking van PPAF-resultate van /a:/ en /i:/ blyk dit dat die vokaal /a:/ beter is om te gebruik vir die meting van PPAF as /i:/, aangesien dit voorkom asof /i:/ meer onkonstante resultate oplewer as /a:/. Hier kan onkonstante PPAF-resultate van /i:/ moontlik toegeskryf word aan die opwaartse verplasing van die larinks tydens produksie van /i:/, aangesien die elektrodes spesifiek geplaas word vir produksie van die vokaal /a:/ en nie vir /i:/-produksie aangepas word nie.

- **Luidheidsverwante veranderinge in PPAF**

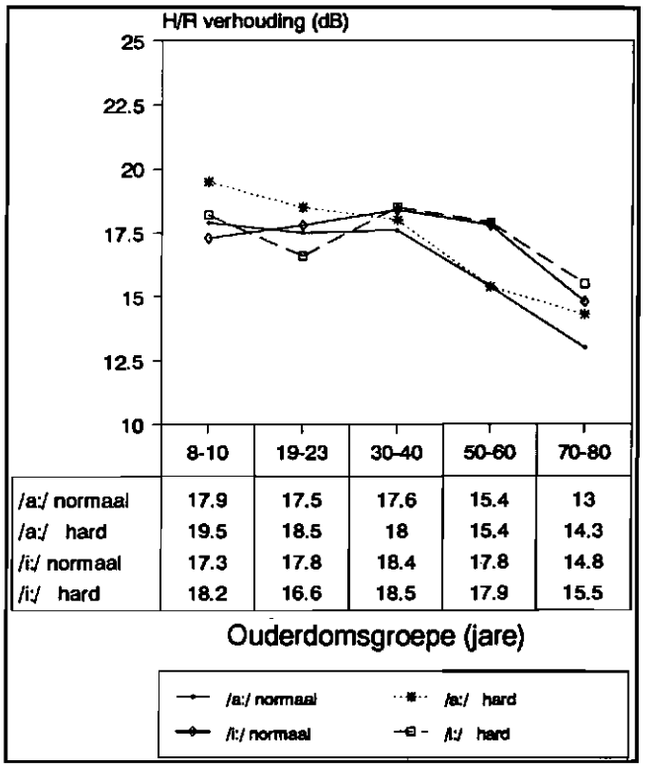
Figuur 4 toon aan dat fonasie met verhoogde luidheid telkens laer PPAF-waardes as normale fonasie tot gevolg het. Dit wil voorkom asof die veranderinge wat in die stemproduksie-meganisme vir fonasie met verhoogde luidheid plaasvind, bydra tot groter reëlmaat in stembandvibrasie en gevolglik laer PPAF-waardes oplewer as normale fonasie. Dit is dus duidelik uit huidige resultate dat stemluidheid gekontroleer moet word tydens metings.

HARMONIEK/RUIS-VERHOUDING

Die H/R-verhoudingswaardes (H/R-verhouding) van mans en vroue verskil nie statisties betekenisvol, op 'n peil van 5% betekenis, van mekaar nie en daarom is die resultate gekombineer en weergegee in figuur 5. Figuur 5 stel die verandering in H/R-verhouding met veroudering vir die vokale /a:/ en /i:/ tydens produksie met normale en verhoogde luidheid voor.

- **Ouderdomsverwante veranderinge in H/R-verhouding**

In figuur 5 is dit duidelik dat H/R-verhoudingswaardes 'n dalende tendens met veroudering vertoon. Die H/R-verhoudingswaardes verskil nie statisties, op 'n 5% peil van betekenis, vir die groepe 8-10, 19-23, 30-40 en 50-60 jaar nie. Die H/R-waardes van die 70-80 jaar groep, vir fonasie teen normale luidheid, verskil wel statisties betekenisvol van die ander groepe. In teenstelling met PPFF en PPAF reflekteer 'n hoër H/R-verhouding beter stembandfunksionering. Volgens Yumoto (1988) is die H/R-verhouding 'n goeie aanduiding van die graad van heesheid wat in die stem voorkom, aangesien die H/R-verhouding aandui in hoe 'n mate die harmoniese komponent deur die ruiskomponent in die stem verplaas word. Uit figuur 5 wil dit dus voorkom asof ouderdomsverwante involusie van die laringale strukture heesheid tot gevolg kan hê, en moontlik tot



Figuur 5: Die H/R-verhoudingswaarde van persone in verskillende ouderdomsgroepe tydens produksie van /a:/ en /i:/ met normale en verhoogde luidheid.

perseptuele verskille tussen ou en jong stemme bydra (Shipp & Hollien, 1969; Hollien, 1987). Alle bejaarde persone behaal egter nie lae H/R-verhoudingswaardes in die huidige studie nie. Soos in die geval by PPFF en PPAF kan die afleiding gemaak word dat alle persone se laringale strukture nie dieselfde mate van involusie met veroudering ondergaan nie (Chodzko-Zajko & Ringel, 1987), en dat heesheid eerder met patologie van die larinks as met veroudering verband hou.

- **Vokaalverwante verandering in H/R-verhouding**

Soos dit blyk uit die resultate van PPAF, PPFF en ook H/R-verhouding, lewer die vokaal /a:/ meer konstante resultate op as /i:/. Die meeste studies wat H/R-verhouding ondersoek, gebruik dan ook die vokaal /a:/ vir opnames (Yumoto, 1988).

- **Luidheidsverwante verandering in H/R-verhouding**

Uit figuur 5 blyk dit dat hoër gemiddelde H/R-verhoudingswaardes telkens vir harde fonasie as vir normale fonasie behaal word. Dit blyk dus dat harde fonasie telkens beter stemband-funksionering tot gevolg het as normale fonasie.

- ***AANDUIDINGS VIR DIE DAARSTELLING VAN 'N NORMATIEWE BASIS***

Die resultate van die gemiddelde fo-waardes vir mans en vrouens word o.g.v. die betekenisvolle statistiese verskille tussen die 2 groepe, afsonderlik beskou. Hoewel slegs die 8-10-jaar-groep van die mans statisties, op 'n 5% peil van betekenis, van die ander ouderdomsgroepe verskil, word die gegewens vir die verskillende ouderdomsgroepe nogtans afsonderlik verskaf. Dit word gedoen na aanleiding van vorige navorsingsbevinding wat daarop dui dat luisteraars perseptuele verskille tussen ouderdomsgroepe waarneem. (Horii & Ryan, 1981; Biever & Bless, 1989; Brown et al., 1989). Gegewens van gemiddelde fo-waardes, word verskaf in bylaag 1. 'n Statistiese berekening van 95% vertrouensintervalle is nie vir die gem. fo-waardes gedoen nie, omdat die data vir mans en vroue nie gekombineer kon word nie en die groepe gevolglik te klein was.

'n Normatiewe basis vir verskillende ouderdomsgroepe betreffende PPFF-, PPAF- en H/R-verhoudingswaardes word verskaf in bylae 2, 3 en 4 respektiewelik. Die resultate van mans en vroue kan gekombineer word omdat geen betekenisvolle verskil bestaan nie. Die gegewens vir elke parameter is verkry deur statistiese berekenings van vertrouensintervalle, wat geld vir 95% van die populasie. Aangesien die produksie van /a:/ deurgaans meer konstante en betroubare resultate gelewer het, is dié waardes vir 'n normatiewe basis geselekteer. Die verkreë resultate van PPFF-, PPAF- en H/R-verhoudingswaardes korreleer met dié van ander navorsers en kan dus as betroubaar aanvaar word. (Horii, 1980; Kay Elemetrics Corp., 1989; Brown et al., 1989; Wilcox & Horii, 1980; Orlikoff en Kahane, 1991; Glaze et al., 1990).

GEVOLGTREKKINGS

Uit die resultate van die huidige studie kan die volgende afleidings gemaak word:

- Gem. fo-waardes van mans en vrouens verskil betekenisvol. Gem. fo van mans vertoon 'n kurviliniêre verloop met ouderdom, naamlik 'n betekenisvolle verlaging in gem. fo vanaf 8-10 jaar tot 30-40 jaar, waarna geleidelike styging in gem. fo met verdere veroudering plaasvind. Individuele verskille kom egter voor. Die gem. fo van vroue verlaag ook vanaf die ouderdomsgroep 8-10 jaar tot en met 30-40 jaar, maar met toenemende ouderdom vind egter een van drie veranderinge plaas naamlik min verandering, 'n effense verlaging of eers 'n verlaging en dan 'n verhoging.
- Geen statisties betekenisvolle verskille kom vir PPFF, PPAF en H/R-verhouding van mans en dames voor nie. Een normbasis kan dus vir mans en dames per ouderdomsgroep opgestel word.
- PPFF en PPAF verhoog met veroudering terwyl die H/R-verhouding verlaag. Individuele verskille kom egter, veral by die geriatriese populasie, voor.
- Die vokaal /a:/ lewer meer konstante resultate op as die vokaal /i:/ vir PPFF, PPAF en H/R-verhouding en behoort dus as basis vir ouderdomsnorme gebruik te word.
- Fonasie met verhoogde luidheid veroorsaak hoër gem. fo-waardes, laer PPFF- en PPAF-waardes en hoër H/R-verhoudingswaardes as fonasie met normale luidheid.
- 'n Normbasis vir die onderskeie parameters is daargestel op grond van die statistiese berekening van 95%-vertrouensintervalle, wat gebruik is om 'n skatting te maak van die onbekende populasiegemiddeld.

SLOT

Die huidige studie is 'n kwantitatiewe analise van sekere stemparameters d.m.v. EGG. Resultate van die studie dra by tot die UP-Spraaknavorsingslaboratorium se beskikbare analisemetodiek deur die daarstelling van 'n normatiewe basis (sien bylaes 1 tot 4) vir gebruik in die kliniese en navorsingsituasie. Alhoewel subjektiewe evaluasie van die stem steeds noodsaaklik is, moet die stem ook objektief geanaliseer word sodat perseptuele, organiese en akoestiese data mekaar aanvul en sodoende 'n meer omvattende diagnostiese en terapeutiese metodiek daarstel.

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Bylae 1

Normatiewe aanduidings vir gem. fo van mans en vroue in verskillende ouderdomsgroepe tydens normale en harde fonasie van /a:/

Vokaal /a:/	Ouderdomsgroep	Gem. fo (Hz) met normale fonasie		Gem. fo (Hz) met harde fonasie	
		Laagste waarde	Hoogste waarde	Laagste waarde	Hoogste waarde
Mans	8-10	237.3	290.7	240.8	310.29
	19-23	99.2	150.4	103.7	164.1
	30-40	108.3	126.6	125.9	140.7
	50-60	84.4	167.5	94.9	191.4
	70-80	111.2	181.6	122.9	198.5
Vroue	8-10	250.1	314.2	274.2	338.1
	19-23	216.8	323.5	221.3	330.1
	30-40	194.9	249.7	196.1	249.4
	50-60	175.7	271.5	202.9	281.3
	70-80	174.9	221.2	184.2	241.0

Bylae 2

Normatiewe aanduidings vir die hoogste en laagste PPFF-waardes ("jitter") vir persone in verskillende ouderdomsgroepe tydens normale en harde fonasie van /a:/

		PPFF (%) met normale fonasie		PPFF (%) met harde fonasie	
Vokaal	Ouderdoms-groep	Laagste waarde	Hoogste waarde	Laagste waarde	Hoogste waarde
/a:/	8-10	0.251	0.464	0.194	0.423
	19-23	0.212	0.27	0.163	0.221
	30-40	0.184	0.484	0.123	0.208
	50-60	0.228	0.459	0.216	0.397
	70-80	0.381	0.975	0.318	0.609

Bylae 3

Normatiewe aanduidings vir die hoogste en laagste PPAF-waardes ("shimmer") vir persone in verskillende ouderdomsgroepe tydens normale en harde fonasie van /a:/

		PPAF (dB) met normale fonasie		PPAF (dB) met harde fonasie	
Vokaal	Ouderdoms-groep	Laagste waarde	Hoogste waarde	Laagste waarde	Hoogste waarde
/a:/	8-10	0.185	0.391	0.173	0.328
	19-23	0.158	0.305	0.132	0.244
	30-40	0.226	0.479	0.154	0.269
	50-60	0.224	0.461	0.175	0.453
	70-80	0.273	0.614	0.204	0.452

Bylae 4

Normatiewe aanduidings vir die hoogste en laagste H/R-verhoudingswaardes vir persone in verskillende ouderdomsgroepe tydens normale en harde fonasie van /a:/

		H/R-verhouding (dB) normale fonasie		H/R-verhouding (dB)	
Vokaal	Ouderdoms-groep	Laagste waarde	Hoogste waarde	Laagste waarde	Hoogste waarde
/a:/	8-10	15.3	20.7	17.4	21.7
	19-23	14.9	20.1	16.6	20.4
	30-40	15.2	19.9	15.9	20.1
	50-60	13.2	17.7	12.8	17.9
	70-80	8.9	17.1	10.7	17.8

INFORMATION FOR CONTRIBUTORS

The South African Journal of Communication Disorders publishes reports and papers concerned with research, and critically evaluative theoretical and philosophical conceptual issues dealing with aspects of human communication and its disorders; service provision; training; and policy.

The South African Journal of Communication Disorders will not accept material which has been published elsewhere or that is currently under review by other publications.

MANUSCRIPT STYLE AND REQUIREMENTS

Manuscripts should be accompanied by a covering letter providing the author's address and telephone numbers. All contributions are required to follow strictly, the style specified in the *Publication Manual of the American Psychological Assoc.* (3rd ed., 1983)(APA Pub. Man.), with complete internal consistency. **Four** copies of triple-spaced high quality type-written manuscripts with numbered pages, and wide margins should be submitted. They should be accompanied by ONE identical disc copy of the paper; (1) in Wordperfect 5.1 (with an extension .wp5). Filenames should include the first author's initials and a clearly identifiable keyword or abbreviation thereof and should be typewritten on the last line of the last page of the Reference List (for retrieval purposes only).

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TABLES AND FIGURES which should be prepared on separate sheets (one per page), should be copied for review purposes and only the copies sent initially. Figures, graphs, and line drawings that are used for publication however, must be originals, in black ink on good quality white paper, but these will not be required until after the author has been notified of the acceptance of the article. Lettering appearing on these should be uniform and professionally done, allowing for a 50% reduction in printing. On no account should lettering be typewritten on the illustration. Any explanation or legend should appear below it and should not be included in the illustration. The titles of tables, which appear above, and figures, which appear below, should be concise but explanatory. Both should be numbered in Arabic numerals in order of appearance. The number of illustrative materials allowed, will be at the discretion of the Editor (usually about 6).

REFERENCES

References should be cited in the text by surname of the author and the date, e.g., Van Riper (1971). Where there are more than two authors, after the first occurrence, *et al.* after the first author will suffice, except for six or more when *et al.* may be used from the start. The names of all authors should appear in the Reference List, which should be listed in strict alphabetical order in triple spacing at the end of the article. All references should be included in the List, including secondary sources, (APA Pub. Man. 1983, p.13). Only acceptable abbreviations of journals may be used, (see DSH ABSTRACTS, October; or *The World List of Scientific Periodicals)*. The number of references should not exceed much more than 30, unless specifically warranted.

EXAMPLES

Locke, J.L. (1983). Clinical psychology: The explanation and treatment of speech sound disorders. *J. Speech Hear. Disord., 48* 339-341.

Penrod, J.P. (1985). Speech discrimination testing. In J. Katz (Ed.), *Handbook of clinical audiology* (3rd ed.). Baltimore: Williams & Wilkins.

Davis, G.A. & Wilcox, M.J. (1985). *Adult aphasia rehabilitation: Applied pragmatics.* San Diego, CA: College-Hill.

EDITING

Acceptable manuscripts may be returned to the author for revision. Additional minor changes may also be made at this stage, but a note on the manuscript acknowledging each alteration made by the author, is required. The paper is then returned to the editorial committee for final editing for style, clarity and consistency.

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QUERIES, CORRESPONDENCE & MANUSCRIPTS: should be addressed to The Editor, *South African Journal of Communication Disorders,* South African Speech-Language-Hearing Association, P.O. Box 31782, Braamfontein, 2017, South Africa.

INLIGTING VIR BYDRAERS

Die *Suid-Afrikaanse Tydskrif vir Kommunikasieafwykings* publiseer verslae en artikels wat gemoeid is met navorsing, of handel oor krities evaluerende, teoretiese en filosofiese konseptuele kwessies wat oor menslike kommunikasie en kommunikasieafwykings; diensverskaffing; opleiding en beleid gaan.

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MANUSKRIP STYL EN VEREISTES:

Manuskripte behoort deur 'n dekkingsbrief vergesel te word wat die skrywer se adres en telefoonnommers bevat. Daar word van alle bydraers verwag om die styl, soos gespesifiseer is in die *"Publication Manual of the American Psychological Assoc.* (3rd ed., 1983) (APA Pub. Man."), nougeset te volg met volledige interne ooreenstemming. Manuskripte moet getik, van hoë gehalte en in drievoud spasiëring met wye kantlyne wees. **Vier** kopieë van die manuskrip moet verskaf word. **EEN** hiervan moet 'n identiese skyfkopie van die artikel wees in "Wordperfect" 5.1 (met 'n uitbreiding .wp5). Lêername behoort die eerste skrywer se voorletters en 'n duidelike identifiseerbare sleutelwoord of afkorting daarvan in te sluit en moet op die laaste lyn van die bladsy van die verwsyingslys getik word (slegs vir naslaan doeleindes).

As 'n reël moet bydraes nie 30 bladsye oorskry nie, maar langer artikels sal aanvaar word indien die addisionele lengte dit regverdig. Op die eerste bladsy van **TWEE** van die afskrifte moet die titel van die artikel, naam van die skrywer(s), en instansie (of adres) verskyn. In ooreenstemming met die "APA Pub. Man." se styl word daar **NIE** van skrywers verwag om enige kwalifikasies te verskaf nie. Op die eerste bladsy van die twee oorblywende afskrifte moet slegs die titel van die artikel verskaf word. Die tweede bladsy van alle afskrifte moet slegs 'n opsomming (100 woorde) in beide Engels en Afrikaans bevat. Afrikaanse opsommings sal vir buitelandse bydraers voorsien word. Hoofopskrifte moet, waar van toepassing, in die volgende volgorde verskaf word: **METODE, RESULTATE, BESPREKINGS, GEVOLGTREKKINGS, ERKENNINGS en VERWYSINGS.** Alle paragrawe moet ingekeep word.

TABELLE EN FIGURE wat op afsonderlike bladsye (een bladsy per tabel/illustrasie) moet verskyn, moet vir referent doeleindes gekopieer word en slegs die kopieë moet inisieel verskaf word. Figure, grafieke en lyntekeninge wat vir publikasie gebruik word, moet egter oorspronklike weergawes wees en moet in swart ink op wit papier van 'n hoë gehalte wees. Die oorspronklikes sal slegs verlang word nadat die artikel vir publikasies aanvaar is. Letterwerk wat op bogenoemde verskyn, moet eenvormig wees, professioneel gedoen word en daar moet in gedagte gehou word dat dit leesbaar moet wees na 'n 50% verkleining in drukwerk. Letterwerk by illustrasies moet onder geen omstandighede getik word nie. Verklarings of legendes moet nie in die illustrasie nie, maar daaronder, verskyn. Die opskrifte van tabelle (wat bo-aan verskyn), en die onderskrifte van figure, (wat onderaan verskyn), moet beknop, maar verklarend wees. Numering moet deur middel van Arabiese syfers geskied. Tabelle en figure moet in die volgorde waarin hulle verskyn, genommer word. Die aantal tabelle en illustrasies wat ingesluit word, word deur die Redakteur bepaal (gewoonlik nie meer as 6 nie).

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Verwysings in die teks moet voorsien word van die skrywer se van en die datum, b.v., Van Riper (1971). Wanneer daar egter meer as twee skrywers is, moet daar na die eerste verskaffing van al die outeurs, van *et al.* gebruik gemaak word. In die geval waar daar egter ses of meer outeurs ter sprake moet *et al.* van die begin af gebruik word. Al die name van die skrywers moet in die Verwysingslys verskyn wat aan die einde van die artikel voorkom. Verwysings moet alfabeties in trippel spasiëring gerangskik word. Al die verwysings moet in die Verwysingslys verskyn, insluitende sekondêre bronne, ("APA Pub. Man." 1983, p.13). Slegs aanvaarbare afkortings van tydskrifte se titels mag gebruik word, (sien "DSH ABSTRACTS, October"; of *The World List of Scientific Periodicals").* Die aantal verwysings moet nie meer as 30 oorskrei nie, tensy dit geregverdig is.

LET OP DIE VOLGENDE VOORBEELDE:

Locke, J.L. (1983). Clinical psychology: The explanation and treatment of speech sound disorders. *J. Speech Hear. Disord., 48,* 339-341.

Penrod, J.P. (1985). Speech discrimination testing. In J. Katz (Ed.), *Handbook of clinical audiology* (3rd ed.). Baltimore: Williams & Wilkins.

Davis, G.A. & Wilcox, M.J. (1985). *Adult aphasia rehabilitation: Applied pragmatics.* San Diego, CA.: College-Hill.

REDIGERING

Manuskripte wat aanvaar is, mag na die skrywer teruggestuur word vir hersiening. Addisionele kleiner veranderinge mag ook op hierdie stadium aangebring word, maar 'n nota ter aanduiding van alle veranderinge wat op die manuskrip voorkom, moet verskaf word. Die artikel word dan aan die redaksionele komitee vir finale redigering van styl, duidelikheid en konsekwentheid teruggestuur.

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