Hippopotamus is so hard
to say: Children’s
acquisition of polysyllabic
words

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A thesis submitted in fulfilment of the
requirements for the degree of
Doctor of Philosophy

School of Communication Sciences and Disorders
The University of Sydney
May, 2006
ABSTRACT

Naming pictures of polysyllabic words (three or more syllables (PSWs)) seems to provide speech pathologists with information about communication status not necessarily present when naming pictures of short words (monosyllabic words (MSWs) and disyllabic words (DSWs)). Typically developing children and children with speech, language and literacy impairments err on PSWs even when short words are accurate. In this study, typical behaviour of PSW production was delimited and a model of PSW acquisition was developed because if erroneous PSWs mark impairment, then circumscribing the tolerances of them in typically developing speech is necessary to differentiate it from impairment.

A proportional stratified, cluster sampling procedure was used to locate 354 children, aged 3;0 to 7;11 years, of whom 283 met the selection criteria, including normal hearing, language and cognition. All English phonemes were repeatedly sampled in 166 words, elicited through picture naming, that were varied for syllable number, stress and shape.

Syllable, age and interaction effects were present with more mismatches in PSWs than in short words, decreasing with increasing age. Mismatches were captured in five a priori patterns of deletions, additions and reordering of syllables and segments in words as well as alterations of consonants or vowels in words that preserved the phonotactic shape. However, as all five patterns were word-specific, each affecting a core group of words containing PSWs and DSWs, the syllable effect was modified. It appeared to be a proxy for a complex interaction between segmental and prosodic features common to the core words that included non-final weak syllables, within-word consonant sequences that required labial-velar movements, velar and sonorant sounds and sounds that shared place or manner features, severally or together.

The production changes conformed to the predictions of the model of PSW acquisition. These changes reflected alterations in the phonological representation, motor planning and motor execution skills aspects of the speech processing system. The phonological representation, changing from holistic to fine-grained, was argued as the
key change because information for motor planning and execution was liberated that culminated in increased accuracy.

If children’s productions of the PSWs used in this study exceed the tolerances defined in this thesis, impairment may be indicated. Future research is needed to determine that possibility.
This thesis was completed with the support and advice of many people. Firstly, my supervisors Jan van Doorn, Sharynne McLeod, Toni Borowski, Adrian Esterman and Elise Baker have severally and collectively provided invaluable support and expertise over the period of my candidature. I am appreciative of and grateful for the formative support each of them has proffered me in completing this work. Their collective knowledge, skills and wisdom have complemented one another perfectly, providing me with supervision of great depth and breadth.

I have found the construction of this thesis analogous to learning to view the proverbial trees and forest through binoculars. I particularly want to acknowledge the roles of my principal supervisor Jan van Doorn and my secondary supervisor Sharynne McLeod in skilfully assisting me to adjust the focal length of the binoculars to view appropriately the forest on some occasions and the trees at other times. Both these people have great skill in seeing the big picture and the detail and I have greatly benefited from their different and complementary skills in this regard. This thesis is all the better for their advice.

Jan has provided me with extraordinary, unerring and unstinting, multidimensional support, guidance and enthusiasm for this project since I first approached her as a potential supervisor. Her commitment to the speech pathology profession in Australia is quite remarkable, steadfast as it is substantial. Jan was one of the few people with the qualifications and skills to supervise PhD students as the development of research in this profession within Australia gained momentum. Consequently, Jan has made a significant impact on the advancement of research in this profession within Australia through her supervision of many PhD students. Her supervision of a large number of students has continued unabated and I have benefited enormously from her deep understanding of the profession and her accumulated wisdom. I am inestimably grateful to Jan for that support, along with her perceptive, insightful and incisive feedback along the journey that has consistently been situated within the broader context of the thesis and my profession of speech pathology.

Sharynne, too, has provided me with enthusiastic, unstinting support. Sharynne has more than capably fulfilled her role of assisting me with the child phonology
literature, reflecting her breadth and depth of knowledge. The remaining three people willingly agreed to become associate supervisors during my candidature, in list order. Toni Borowsky has provided me with invaluable support and guidance with theoretical phonology, as has Adrian Esterman in the area of statistics. Elise Baker has been a wonderful friend and colleague in discussing matters phonological over the time of my candidature and more recently as a supervisor.

My part-time, external (and interstate) status has made for a more complex candidature which has involved other staff from the School of Communication Sciences and Disorders in a way that might not have occurred had I been a local, full time (and much younger!) student. I particularly thank Kerrie Lee, the current head of school, for her support. I would also like to thank the various postgraduate co-ordinators over the period of my candidature, Vicki Reed, Jan van Doorn, Susan Balandin and Leanne Togher, for their support and interest. I also thank the staff in general for making me welcome within the School at the times I have been resident in or visiting Sydney.

There are also many other people I wish to acknowledge. The genesis of this thesis was in the late 1980s, in a discussion I had with the then chief speech pathologist of the (South Australian) Kindergarten Union, Althea Derrington, which furthered my interest in the assessment of children’s speech. This discussion culminated in my successfully applying to my employer, the then South Australian College of Advanced Education (now Flinders University), for a research grant to develop and trial a test to assess the speech skills of young children ranging in age from 3 to 7 years. Many people have been involved in the speech test endeavour and indirectly have contributed to this thesis. Thus, I wish to acknowledge their contribution and specify these contributions below.

The first stage in the test development was the creation and trial of the test prototype, which is described where relevant in Chapter 6 of this thesis. I designed the test prototype and it was illustrated by Colin Lambert with the support of his supervisor, Carl Dutton, from the publications section of the University of South Australia. I designed the trial study of the test, analysed the results and wrote up the study for a conference presentation (James, 1993) and two publications (James, 2001a, 2001c). The acknowledgments to the publications include Willem van Steenbrugge, a colleague, for his comments on the original research proposal, and the five children and their parents for allowing me to trial the first test prototype with them. Also acknowledged were the
school principal and staff and chief speech pathologist and staff of the local school and clinic who agreed to participate in the research and assisted with recruiting participants. The 99 children and their parents were also acknowledged for agreeing to and participating within the research. Also acknowledged were the three research assistants, Louise Hemmings, Heather Mollison and Susan Moore, for their involvement in collecting, transcribing and coding data. Elise Baker and the anonymous reviewers of these papers are also acknowledged for their comments on the two papers.

The second stage of the test development has many parts, some of which are ongoing. The first part was the revision of the prototype which was done by me (James, in preparation). The stimulus material and the accompanying instructions for the children were completed in 1996. Colin Lambert is acknowledged again for revising the illustrations. However, the accompanying manual is still being finalised, again being my own work. To date, Libby McMahon, Sharynne McLeod and Laura Dickenson have made constructive comments about the test and the manual. Also acknowledged are the students in my speech development and disorders classes at Flinders University, who have used the early versions of the manual for assignments and have made many valuable suggestions for changes.

Constructing the normative data for the test has been a major part in developing the final form of the test, and this part has involved many people. My colleagues, Andy Butcher, Keith Chiveralls, Paul McCormack and Alison Russell from the Department of Speech Pathology and Audiology at Flinders University and I received two grants to do this from the South Australian Channel 7 Children’s Research Foundation Inc. The first grant was received in 1994 and the second grant in 1996. I was the principal investigator for both applications and have supervised the entire project. Other colleagues provided advice on assessing for inclusion criteria and particular thanks got to Dr Judith Boswell, Dr Garry Childs and Mr Keith Chiveralls. The South Australian Channel 7 Children’s Research Foundation Inc. is also acknowledged for the funding as well as for granting me permission to use the database for my PhD project.

Several people within the Australian Bureau of Statistics advised on the sampling, and particular thanks go to Mr Tenniel Guiver. Since that time, other people have provided advice on the statistical analyses. Emeritus Professor John Keeves from the School of Education at Flinders University, Associate Professor Adrian Esterman, Senior Research Fellow, Flinders Centre for Epidemiology and Biostatistics, Flinders
University (and now Professor of Biostatistics at the University of South Australia) and Mr Graeme Tucker, Head, Health Statistics Unit, Department of Health, Government of South Australia have all provided invaluable advice on the statistical analyses.

Also acknowledged are the principals of the 65 schools and the directors of the 29 preschools who were prepared to discuss the research proposal with me and their school communities. Without their support, the project would have faltered. Also acknowledged are all the other school personnel who selected children and then implemented and followed up all the necessary paperwork to involve the children. The commitment and attention to detail that school staff extended to the research project were outstanding and meant the project was achieved. Without their support, the project would have foundered. Staff worked tirelessly to ensure that children were available. All members of the research team were made to feel very welcome in all the schools and preschool and on behalf of the research team, I wish to acknowledge the extensive support offered by all the schools. The level of support for the project is demonstrated in the following episode. One day, a staff member was aware that two children were ill on the day of testing and organised replacement children. This meant that they had contacted other parents and arranged copies of all the relevant papers for the parents to complete.

The parents are also acknowledged and thanked for agreeing to involve their children in the project. Many of them volunteered their younger children for the second phase of the project, some of whom participated. Most importantly, the children who participated are also acknowledged.

I wish to acknowledge the assistance of Sue Horton, Deborah Hersch and Lisa Corigliano in locating the 3-year-old participants. The first two were associated within my department at the time of data collection and the third was the director of a Child Care Centre.

Wendy Ferguson was the principal research assistant with the project and co-ordinated the data collection phase of the study. Wendy collected most of the data with the assistance of Paul McCormack, Jenny Chapman and me. Wendy was an outstanding research assistant and I am greatly in her debt. The complexity of handling all the participants, their parents, the schools and their staff was nothing short of stupendous, and she exhibited great talent and skill in co-ordinating and managing the project. Her skills in creating the database, along with her meticulous attention to detail in all the
appropriate documentation, resulted in an excellent database that will continue, as planned, to be the source of more projects in the future.

Wendy and my colleague Paul McCormack conducted the inter-rater reliability checks on the transcriptions that I performed.

Dr. Steven Long from Marquette University (formerly from Cape Western University) has provided unstinting support in modifying the software package, *Computerized Profiling*, that he originally developed and has subsequently published with Marc Fey and Ron Channell for linguistic analyses.

Two events were critical in my decision to undertake a PhD investigating children’s productions of polysyllabic words (PSWs). Firstly, when I was transcribing the data, I became increasingly intrigued with the way the children were saying PSWs, fostering my curiosity in the area. This culminated in the presentation of a paper at the 1996 national conference of the then *Australian Association of Speech and Hearing* in conjunction with the *New Zealand Association of Speech Therapists*, held in Auckland, New Zealand. I am again indebted to Wendy Ferguson who agreed to present that paper on my behalf. Secondly, I was aware that the output files from the phonology module *PROPH+* of *Computerized Profiling* were saturated with valuable information about typically developing children’s speech. Lincoln Turner had an important role here because he recognised the need for and developed a computer programme for extracting the detail from the output files constructed by PROPH+. Also acknowledged are the efforts of Beno Rice, who extended Lincoln’s work, permitting extraction of the data according to syllable numbers, a function that has subsequently been built into PROPH+.

I would also like to acknowledge Abby Bean for her meticulous and scrupulous work in data transfer.

I would also like to acknowledge the support I received from colleagues in my department, and, in particular, from the people who were head of department over that time. These people include Linnett Sanchez, Andy Butcher, Colin Carati and Paul McCormack. I would particularly like to acknowledge the support of Paul in marshalling resources to provide me with teaching relief in the final stages of the PhD and more latterly Colin Carati. I also acknowledge Andy Butcher and Willem van Steenbrugge for their support and friendship throughout the time of my candidature.
Staff within and outside my department have been generous in lending me books and journals. Particular thanks are offered to Andy Butcher, Paul McCormack, Andy McDowell, Alison Russell, Willem van Steenbrugge and Robyn Young. I would also like to acknowledge the staff in the Gus Frankel Medical Library at Flinders University for their extensive assistance in locating and retrieving resources for me. In particular, I wish to acknowledge Miranda Morfey and Jess Tyndall. Other people have also been generous in assisting me with literature, and special mention goes to Caroline Bowen.

Many people have provided me with unconditional friendship and support over the time of my candidature. I wish to thank my sister, Madeleine, for her unfailing, extensive support and more recently her husband, Bruce. Other South Australian people I particularly want to mention and thank are Rose Boucaut, Jenny Jenkinson and Libby McMahon. I also want to acknowledge and thank all the people in Sydney who befriended me on my numerous visits. Beyond their friendship, their kindness extended to accommodating, feeding and watering me as well as showing great interest in my project. Particular thanks go to the extended Marr family as well as the Britten, Jaffray and Patterson families. I am indebted to you all.
ETHICS STATEMENT AND DECLARATION

I, Deborah James, certify that the work contained within this thesis is original and my own, except where acknowledged in the text. The material has not been submitted, either in whole or in part, to this or any other university or institution for any degree.

The research reported in this thesis was based on a pre-existing database developed by me in conjunction with my colleagues, as described within the acknowledgements. The original research proposal for which the database was developed was approved by the (Flinders Medical Centre/Flinders University) Flinders Clinical Research Ethics Committee (Protocol number 2000.098). The Channel 7 Children’s Research Foundation of South Australia Inc. funded the development of the database and granted permission for it to be used in the research reported within this thesis. Confirmation of that permission was provided on 29th October, 1997. The research was conducted in accordance with the National Health and Medical Research Committee’s guidelines on human experimentation. Participant confidentiality was ensured. No data that identified any participant was placed on any computer system.

__________________________________________________________

Candidate’s signature                                      Date
DEDICATION

I dedicate this thesis to:

Althea Derrington, whose inspiration was instrumental in my taking this journey

Madeleine Stocks, my sister, for her unconditional support

The memory of Anne Louise Pennington, my cousin, 2/10/1951–24/12/2004
PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS THESIS

Book Chapters


Journal articles


Conference presentations; published proceedings


Conference presentations: published abstracts


**Seminars/lectures**

James, D. G. H. (2004). *Productions of polysyllabic words by children aged 3 to 7 years.* Seminar presented to staff and students in the Department of Speech Pathology and Audiology, Flinders University, Adelaide, SA (November 15).

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\(^1\)This poster was awarded the poster prize for the paediatric section at the International Clinical Phonetics and Linguistic Association Conference, Edinburgh, August, 2000
Forums where data generated for this thesis (but not presented within this thesis) have been published

Honours theses supervised by Debbie James


Other honours theses


Conference presentations


NOTES ON STYLE

*Speech pathologist* is used in this thesis rather than *speech-language pathologist*, in keeping with common usage in Australia.

The term *polysyllabic words* (PSWs) is used to denote words of three or more syllables. Terms to differentiate words of different syllable numbers include:

- *monosyllabic words* (MSWs) to denote words of one syllable.
- *disyllabic words* (DSWs) to denote words of two syllables.
- 4-, 5- or 6-syllables are used where greater specificity is required.

Collective terms used are:

- *multisyllabic words* (XSWs) to denote words of two or more syllables.
- *short words* to denote words of one and two syllables.
- *long words* to denote words three or more syllables.

Use of acronyms is variable. Where perceived large gaps of text occur between their use, they are used in full again.

The word *used* is employed when noting that patterns are present in children’s speech, exemplified in “The participants used weak syllable deletion”. This convention was adopted for the brevity in expression but does not imply that the participants’ use of these patterns was conscious or deliberate.

To exemplify syllable prominence, the orthographic spelling of the word is used with the prominent syllable indicated by capitalisation.

Syllable shapes are denoted with the use of the following convention: V denotes a vowel and C a consonant. Thus, a sequence such as CCVC denotes a closed syllable with a cluster onset.

The term *non-final weak syllables* is used as a collective term, denoting initial or within-word weak syllables. When more specificity is required, the terms *initial weak syllable* or *within-word weak syllable* are used.

A period is inserted in sound sequences to denote the syllable boundary.