

Evaluating Theories of Language: Evidence from Disordered Communication

**Edited by Barbara Dodd PhD, Ruth Campbell PhD
and Linda Worrall PhD**



**Whurr Publishers Ltd
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Preface

Language is a specifically human accomplishment. As individuals, we are judged by how we communicate: what we say, how we say it and how we respond to what other people say. It is hardly surprising, then, that scholars have sought to understand how the human animal communicates. One approach to the study of language has been to investigate people whose ability to communicate is impaired. Researchers have argued that it is possible to identify the component mental processes that contribute to the ability to communicate by describing the ways in which language can break down in aphasia, or develop anomalously. Such impairments are not random and the constraints on the varieties of impairment might indicate the structural faultlines of language itself. Other researchers have expressed doubts about the extent to which data from impairment reflect normal language function. However, within each discipline studying language breakdown, there are specific questions to be addressed. As the number of disciplines and methodologies, and the sheer volume of data concerning language impairment multiply, we sometimes lose sight of important issues.

At most conferences there are groups of people muttering about the need to sit down for two days with a small number of people from a range of disciplines and discuss a single issue in depth. Our frustration with a standard conference led to a plan to hold a 'workshop' somewhere remote and beautiful. The theme was whether the study of individuals with impairment of communication clarified theory of normal function, and the extent to which theory of normal function had clinical application. This controversial issue had been addressed before, but seemed worthy of multidisciplinary re-examination. There were representatives from the disciplines of psycholinguistics, linguistics, neurophysiology and speech-language pathology from Australia, Britain, Hong Kong and the United States of America. Our aim was to take time to examine our basic assumptions about the relationship between data on communication disorder and theory of normal language function.

The World Health Organization (1980), in its *International Classification of Impairment, Disability and Handicap*, defines three aspects of communication disorder:

1. *Impairment*, disturbance of structure or function, whether psychological, physiological or anatomical;
2. *Disability*, the consequences of impairment for an individual in terms of functional or everyday performance or activity;
3. *Handicap*, the disadvantage experienced by the individual due to impairment and disability, reflecting the value society attaches to disability.

The focus of the conference was at the level of impairment. Impairment includes the range of symptomatology that is associated with a disorder. As examples, people who have acquired brain injury may have deficits in language comprehension and production (aphasia); some children fail to acquire intelligible speech in the absence of any identified physical cause (developmental phonological disorder). While it is important to consider disability and handicap when planning intervention of a communication disorder, it is primarily data about impairment that is used to inform our understanding of normal communicative function.

This book presents a synthesis of a two day discussion where we explored the problems of constructing theory of how the normal brain deals with language using data from impaired individuals. The participants held different perspectives of impairment, influencing the questions they chose to address. Each of us presented a paper, which was discussed, rewritten, reviewed and modified. The end result appears here. The content includes theoretical reviews as well as new data. The foci of the participants' papers varied: critique of methodology; application of new technology; the study of bilingual people; and cross-linguistic studies. A range of language skills was discussed – phonology, prosody, syntax, semantics, reading and spelling. A range of developmental and acquired impairments was used as evidence – hearing impairment, cerebellar dysarthria, subcortical aphasia, cortical aphasia, phonological disorder, dyslexia. Initially some of us were a little bewildered by other participants' perspectives of areas we thought we understood clearly. Towards the end, what some had held as hard knowledge was transmuted to an assumption to be questioned.

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Introduction

Words and Nature

LEONARD L. LA POINTE

In the world of words, the imagination is one of the forces of nature.

Wallace Stevens

Introduction

In July 1995 an international group of scholars on human communication and its disorders gathered for a workshop in a unique and magical setting to present papers, to react, to imagine, to engage in spirited discourse, to dissect complexities, and to attempt a strengthening of our grasp of a curious and paradoxical topic. The theme was the usefulness of analysis of the interactive nature of normal and impaired communication processes. Specifically, questions addressed the notions, can we use the data and tenets of what we know about normal processing to inform us about impaired processing. Conversely, and equally as intriguing to some, can we use the data and canons of impaired processing to nurture explanation of normal processes? This is a tantalising and confounding reversible issue that has not been unexplored in the past. Cognitive scientists, neuropsychologists, linguists, computational experts, behavioural neurologists, and speech–language pathologists have turned over these mossy rocks before, and the state of cognitive–linguistic science assures that we are a long way from heuristic satiation. Past investment of effort, however, does not dissuade us from further pursuit of explanation and understanding of matters that are substantial and befitting. So these topics were considered anew, with the insight and benefit of an accumulating archive of research on the theme. Nature facilitates creativity. Ample evidence abounds in the worlds of science, the humanities, and the arts that a strange amalgam of natural phenomena and human imagination can result in tangible harvest. So a setting was chosen to bring together words and nature. Experts who would study weighty issues on the relationship of impaired to normal communication processes juxtaposed against a natural backdrop of exquisite beauty. The

setting was O'Reilly's Rainforest Guesthouse in the Green Mountains, surrounded by the Lamington National Park up a scenic, serpentine road from Canungra, Queensland in Australia.

Normal processes, impaired processes, models

As we shall see, and as others have indicated (Barsalou, 1992), the interplay between data collection and theory development is often complex and multivariate. Cognitive psychologists and others interested in human communication and its disorders often disagree on the best ways for studying cognition and language. We should not be surprised by this disagreement, since the study of human cognitive–linguistic processes is such a diverse and enigmatic theme.

Additionally, cognitive and communicative science is still quite embryonic, or at best is in its infancy, relative to many other disciplines. We have not been around since the days of Hippocrates, Descartes, Flourens or Galen with subsequent centuries to bury our leeches and mistakes and cover our misdirection. Instead, our uncertainty and backtracking, in the context of improved techno-availability of the archive of our art and science, is nearly immediately available for probing and dissection. Those who have studied the philosophy of science have commented regularly that revolution of scientific discovery appears to be much less common as an outcome than does cumulative evolution (Kuhn, 1970; McCauley, 1986; Bechtel, 1988; Barsalou, 1992). This flies in the face of popular wisdom and stereotype which appear to indicate that science develops in a logical, plodding, organised manner, and that each new discovery fits nicely into the puzzle of what has been previously concluded. Common sense seems to indicate that scientists have a road map, and they know where they are going. Though Jay Rosenbek, (1995, personal communication) reminds us that 'common sense' is that sense that for centuries told us the world was flat.

Particularly in a new science, such as cognitive–communicative disorders, this view of the non-chaotic march of science is particularly fictional. Instead we pause, redo, reinvent, false start, explore redundantly, and occasionally break new ground. This is especially apparent in disciplines that do not have a clear general outline of a theory that will guide future research and that will persist for future theorists to articulate in greater detail (Barsalou, 1992). So we struggle to see what we can learn. We grasp at insights. We view impairments to see if this suggests anything new about intact processes, and we wonder if a thorough explanation of normal processes will inform us about impairment or even better, guide us to a theory of therapy or intervention.

In aphasia, the aspect of cognitive and communicative impairment most familiar to me, the struggle over models, theory and treatment has intensified in recent years. Caramazza and his colleagues have written

fairly extensively about what we can learn about normal cognitive structure from impaired performance as well as about theories of remediation of cognitive deficits (Rapp and Caramazza, 1991; Caramazza and Hillis, 1991). They remind us that inference about the structure of cognitive mechanisms from data derived from impaired subjects is problematic. One of the major problems centres on the complexity of inference in neuropsychology. As Rapp and Caramazza (1991) indicate, inferences about cognitive structure or psychological mechanisms is usually based upon sets of assumptions about the data that drive the inference.

It is very difficult to make one's assumptions explicit and even when the inter-nested assumptions are made explicit, researchers rarely seek independent confirmation of their validity. Conclusions, then, frequently are resting uncomfortably on a house of cards rather than a firm foundation. Rapp and Caramazza (1991) present several illustrative examples from the literature in neuropsychology that, in their opinion, rest on weak or unproven assumptions. If questions are raised about unreasonable conclusions from observed patterns of impairment, this clearly impacts on the interpretation of the relation of patterns of impaired or unimpaired performance.

Nevertheless, Caramazza and colleagues and others (Caramazza and Hillis, 1991; Gonzalez-Rothi and Moss, 1992; Byng, 1994; Hillis, 1993) have advocated or provided examples of model-based intervention strategies. Despite the problems involved in developing a science of model driven therapy, some writers appear optimistic that these obstacles can be worked through or around (Rapp and Caramazza, 1991). They point out that the considerable work in cognitive-communicative model building has had some concrete results. Firstly, and not unimportantly, especially in aphasia, models of processing in neuropsychology have increased our understanding of the disorders that occur as a result of brain damage. We are now able to specify more aptly and with greater confidence those mechanisms or processes that create the more global impairments. For example, instead of simply stating that an individual has impaired writing, Rapp and Caramazza (1991) indicate that now we may be able to explain further that the impaired writing is caused by inability to hold an orthographic representation in memory while motor commands for arm and hand movement are being assembled. These advances in understanding the nature of a deficit have also been apparent in the study of the reading process, with significant contributions by members of this conference. Testing empirically based architectural models of the normal language-processing system by careful exploration of whether or not damage to one of the components of these models could account for different disorders of language is the foundation of modern cognitive neuropsychology.

Byng (1994) reviews this approach and its influence or lack of influence in clinical aphasiology. These models offer a logical, sometimes

even coherent, architectural framework for viewing language impairment, though the perils of oversimplified box-and-arrow diagrams are sometimes reminiscent of Radio Shack hard-wired diagrams of simple electronic devices rather than the multilevel, multiconnected, parallel-distributed reality of the complexity of the human nervous system.

Despite productivity in the arena of how cognitive neuropsychological models can advance our understanding of thinking about language as a number of processes and components, some of which can even be identified reliably across patients, some scholars in aphasia express reservations about the contributions of theory-driven therapy. Audrey Holland (1994), for example, states that the contributions that theory-driven therapy can make in the treatment of aphasia are limited in both number and scope. She suggests that most theories of cognitive processing are not theories about how to fix deficits; rather, they are theories about how and why the deficits occur.

Both Byng (1994) and Holland (1994) decry our lack of a coherent theory of therapy in aphasia (and this lament might well be raised in many other disorder areas of human cognitive–communicative dysfunction), and call for a focus of effort on the development of a such a theory of treatment. Byng (1994) gives several examples of how a theory of deficit is necessary for the development of a theory of therapy. She proposes that deficit analysis by itself is not enough to suggest formulation of specific therapeutic procedures. However, she advocates that analysis of the nature of the language impairment, rooted to a relationship of normal language processing, is a more informative way to construct therapeutic objectives and select remediation strategies.

Holland (1991), while being mindful of the limitations of cognitive neuropsychological theory to treatment in aphasia, is not unequivocal about the need to develop a richer conceptualisation of a theory of therapy. She states,

If we are to serve aphasic patients better ... and turn clinical art into clinical science, then we must begin to develop explicit and falsifiable theories of treatment, to test their assumptions and contrast various theoretically-driven forms of treatment.
(Holland, 1991)

Golper (1994), Byng (1994) and others echo these sentiments. Certainly we have not progressed to the point where a coherent theory of intervention or therapy can be assembled for all of the deficits seen in aphasia or in many of the other cognitive–communicative impairments, but it is clear that we can ill afford to be adrift on the clinical ocean without benefit of navigational guides. The navigational guides we possess at the moment might appear to be only stars and sextant, but nevertheless it would behove us to continue the voyage of trying to find out what we

can learn from impairment about normal processing, as well as how normal processing can inform better understanding and management not only of impairment, but of the psychosocial aspects of disability and handicap created by cognitive–communicative disorders.

Contributions at O'Reilly's

The impetus for this conference and subsequent book was generated in Brisbane at the University of Queensland, but subsequent contributions to the project were generated by scholars from London, Newcastle-upon-Tyne, Perth, Sydney, Adelaide, Brisbane, Hong Kong, Houston, and Tempe. As expected from consideration of a topic on which the universals have yet to be firmly entrenched, these contributions and the subsequent discussion generate a range of opinion. Strong support for the thesis that impairment can inform models of normal communication processes (and the converse) is apparent in some papers and healthy scepticism is conspicuous in others. Diversity in the pursuit of clarity is no vice.

Max Coltheart and his co-authors Robyn Langdon and Michael Haller advocate the contributions to models of language that are possible from the perspective of computational cognitive neuropsychology and acquired dyslexia. Coltheart and colleagues trace the rebirth some 40 years ago of flow-chart or box-and-arrow diagrams of cognitive psychology. While these authors give ample credit to other researchers for the 'rebirth' of cognitive psychology or the birth of cognitive neuropsychology, the contributions of Coltheart and a variety of colleagues certainly have had a presence in this birthing process as well. Coltheart's seminal contributions to the study of acquired dyslexia have a distinguished history in the development of how impaired language can inform aphasia theory and models of normal language. Now Coltheart and colleagues argue that it is time to evaluate critically the utility of computational cognitive neuropsychology in the development of models of language processing that can be artificially lesioned to test hypotheses about how people recognise printed words and read them aloud.

The wonderful or perhaps illusive world of prosody is visited by Paul McCormack, who queries 'Why are prosodic disorders so rare?' McCormack argues that the evidence is far from convincing that particular areas of the enchanted loom are responsible for specific aspects of prosodic functioning. The paper reviews data from studies of apraxia of speech, the dysarthrias, right hemisphere syndrome, and reports of 'foreign accent syndrome' and points out instances of obscured interpretation and conclusions regarding prosodic functioning and organisation.

Andrew Butcher takes a different tack in arguing against a model of gradual development and automatising of motor programmes based

on forms from the input lexicon. He asks 'how many lexicons?', and presents results from 'before and after' speech with postoperative cleft palate speakers and children with 'glue ear' after grommet insertion to show rapidity of acquisition of appropriate and consistent pronunciations. This, Butcher maintains, appears to be incompatible with the notion of gradual development of a separate output lexicon.

Ruth Campbell draws from another unique population to shed light on normal language and cognitive development. Campbell outlines some of the ways in which profound prelingual deafness impacts on language and cognition, particularly with the interactive variables of the role of Sign and lipreading. Campbell signifies the dynamic nature of deafness research, particularly regarding the influence of deaf culture on research agendas, and identifies several areas of study that may be fruitful in advancing our understanding of mechanisms and substrates of language. She indicates that careful exploration of the language and cognition of people who have been born deaf offers unrivalled opportunities for advancing theories of neural plasticity of cognitive-linguistic systems.

Professor Randi Martin discusses the issue of normal variation in cognitive architecture and the implications of these individual differences for neuropsychology. Martin argues that performance differences across normal subjects are entirely consistent with an analysis of a cognitive domain into components, and suggests that such differences make documentation of impairment more difficult though not impossible.

Barbara Dodd, Lydia H.K. So and Li Wei examine symptoms and signs of disorder in bilingual subjects who have atypical language learning experience but no specific type of impairment. From two experiments, one of phonological awareness in bilingual Chinese and English speaking university students and the second of phonological acquisitional errors in young bilingual speakers, Dodd, So and Wei argue that a particular language learning experience can lead to language behaviour in normal people that mimics impairment. Their findings support the view that differences in language behaviour may not necessarily reflect impairment of cognitive functions.

Bruce Murdoch traces the faint and hallowed steps of investigators and writers such as Luria as well as Penfield and Roberts when he visits the role of subcortical structures as a participant in language. Although the cerebral cortex has been regarded as the czar of language for generations, Murdoch points out that over the past two decades a proliferating number of clinico-neuroradiological studies have challenged the traditional view of the cerebral cortex as the sole neural province of language. Murdoch contends that advances in neuro-imaging and other windows to the brain, particularly the dynamic functional methods such as positron emission tomography (PET) and single photon emission computed tomography (SPECT), may be useful in drawing back the veil

of uncertainty about the role of subcortical structures in language processing. Murdoch suggests that language compromise in subjects with lesions to the thalamus or striatum further lend evidence to models of subcortical participation in language.

Current research methodology in cognitive neuropsychology and aphasia is critically evaluated in the chapter by Meredith Kennedy. Kennedy holds that if the cognitive neuropsychological approach is to deal adequately with the intricacies of aphasia, replete with its complexity and variability, it may be appropriate to consider the extent to which other approaches to understanding aphasia either complement or supplant the cognitive neuropsychological approach. Kennedy raises questions about the sufficiency of double dissociations to contribute all we need to know about the nature of aphasic language impairment or models of single word processing in normal adults.

Edwin Yiu and Linda Worrall question the explanatory foundation of models of normal language processing and indicate that most studies of both normal and abnormal language processing are relatively Eurocentric. These authors point to cross-linguistic studies of sentence processing, particularly Cantonese, as instructive in testing the universality of language processing. Yiu and Worrall further highlight the existence of compensatory language functioning in aphasia as a complicating variable which must be considered in any model of impaired language processing that purports to inform normal language models.

Dusk

Some issues and questions are arduous. Some phenomena blend and do not lend themselves to being dichotic or invariant. When, during twilight, does it become dark? Some propositions must be turned, considered and evaluated from varying perspectives and with accumulating evidence. Such may be the perplexity of the theme of this conference and book. These papers would suggest, however, that although the topic is fraught with complexity, we are developing paths of analysis that mark progress and occasional traces of consensus.

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