CONSTRAINTS ON LANGUAGE
Aging, Grammar, and Memory

SUSAN KEMPER
REINHOLD KLIEGL

Constraints on Language:
Aging, Grammar, and Memory

This page intentionally left blank.

Constraints on Language:
Aging, Grammar, and Memory

edited by

Susan Kemper
University of Kansas

and

Reinhold Kliegl
University of Potsdam

Created in the United States of America

Visit Kluwer Online at: http://www.kluweronline.com
and Kluwer's eBookstore at: http://www.ebooks.kluweronline.com

CONTENTS

LIST OF CONTRIBUTORS

Dr. Amit Almor
Department of Psychology
University of Southern California
Los Angeles, Ca 90089
ALMOR@GIZMO.USC.EDU

Dr. Elaine S. Andersen
Department of Linguistics
University of Southern California
Los Angeles, Ca 90089
ELAINE@GIZMO.USC.EDU

Dr. Deborah M. Burke
Department of Psychology
Pomona College
Claremont, CA 91711
DBURKE@POMONA.EDU

Dr. David Caplan
Neuropsychology Laboratory
Department of Neurology
Massachusetts General Hospital
Boston, MA 021 14
CAPLAN@HELIZ.MGH.HARVARD.EDU

Dr. Gisbert Fanselow
Department of Linguistics and Innovationskolleg
  "Formal Models of Cognitive Complexity"
University of Potsdam
Potsdam D14469
Germany
FANSELOW@RZ.UNI-POTSDAM.DE

Dr. Angela Friederici
Max Planck Institute for Cognitive Neuroscience
Stephanstrasse la
Leipzig D-04103
Germany
ANGELAFR@CNS.MPG.DE

Dr. Lyn Frazier
Department of Linguistics
University of Massachusetts
Amherst, MA 01003
KAA@OITUNIZ.OIT.UMASS.EDU

Dr. Thomas C. Gunter
Max Planck Institute for Cognitive Neuroscience
Stephanstrasse la
Leipzig D-04103
Germany
GUNTER@CNS.MPG.DE

Martina Junker
Department of Psychology and Innovationskolleg
  "Formal Models of Cognitive Complexity"
University of Potsdam
Potsdam D14469
Germany
MJUNKER@RZ.UNI-POTSDAM.DE

Dr. Susan Kemper
Gerontology Center
4089 Dole
University of Kansas
Lawrence, KS 66045
SKEMPER@UKANS.EDU

Dr. Daniel Kempler
Department of Otolaryngology
School of Medicine and
  the Leonard Davis School of Gerontology
University of Southern California
Los Angeles, CA 90089
KEMPLER@HSC.USC.EDU

Dr. Karen Kemtes
Volen National Center for Complex Systems
Brandeis University
Waltham, MA 02254
KKEMTES@VOLEN.BRANDEIS.EDU

Dr. Reinhold Kliegl
Department of Psychology and Innovationskolleg
  "Formal Models of Cognitive Complexity"
University of Potsdam
Potsdam D14469
Germany
KLIEGL@RZ.UNI-POTSDAM.DE

Dr. Maryellen C. MacDonald
Departments of Psychology and
  Linguistics
University of Southern California
Los Angeles, CA 90089
MCM@GIZMO.USC.EDU

Dr. Ulrich Mayr
Department of Psychology and Innovationskolleg
  "Formal Models of Cognitive Complexity"
University of Potsdam
Potsdam D14469
Germany
MAYR@RZ.UNI-POTSDAM.DE

Dr. Lisa Soederberg Miller
Department of Psychology
Brandeis University
Waltham, MA 02254
LMILLER@BINAH.CC.BRANDEIS.EDU

Dr. Matthias Schlesewsky
Department of Linguistics and Innovationskolleg
  "Formal Models of Cognitive Complexity"
University of Potsdam
Potsdam D14469
Germany
SCHLESEL@RZ.UNI-POTSDAM.DE

Dr. Elizabeth Stine-Morrow
Department of Psychology
University of New Hampshire
Durham, NH 03824
Eals@Christa.Unh.Edu

Dr. Patricia A. Tun
Department of Psychology and
   Volen National Center for Complex Systems
Brandeis University
Waltham, MA 02454
Tun@Binah.Cc.Brandeis.Edu

Dr. Sandra H. Vos
Max Planck Institute for Cognitive Neuroscience
Stephanstrasse la
Leipzig D-04103
Germany
Vos@Cnd.Mpg.De

Dr. Gloria Waters
Department of Communication Disorders
Boston University
635 Commonwealth Ave.
Boston, MA 02215
Gwaters@Bu.Edu

Dr. Arthur Wingfield
Department of Psychology and
   Volen National Center for Complex Systems
Brandeis University
Waltham, MA 02254
Wingfield@Volen.Brandeis.Edu

PREFACE
Susan Kemper

A debate about the role of working memory in language processing has become center-most in psycholinguistics (Caplan & Waters, in press; Just & Carpenter, 1992; Just, Carpenter, & Keller, 1996; Waters & Caplan, 1996). This debate concerns which aspects of language processing are vulnerable to working memory limitations, how working memory is best measured, and whether compensatory processes can offset working memory limitations.

Age-comparative studies are particularly relevant to this debate for several reasons: difficulties with language and communication are frequently mentioned by older adults and signal the onset of Alzheimer's dementia and other pathologies associated with age; older adults commonly experience working memory limitations that affect their ability to perform everyday activities; the rapid aging of the United States population has forced psychologists and gerontologists to examine the effects of aging on cognition, drawing many investigators to the study of cognitive aging. Older adults constitute ideal population for studying how working memory limitations affect cognitive performance, particularly language and communication. Age-comparative studies of cognitive processes have advanced our understanding of the temporal dynamics of cognition as well as the working memory demands of many types of tasks (Kliegl, Mayr, & Krampe, 1994; Mayr & Kliegl, 1993).

The research findings reviewed in this volume have clear implications - for addressing the practical problems of older adults as consumers of leisure time-reading, radio and television broadcasts, as targets of medical, legal, and financial documents, and as participants in a web of service agencies and volunteer activities. Older adults are often the recipients of "elderspeak," an insulting and patronizing form of address which is intended to enhance older adults' comprehension (Kemper, 1992; Kemper, Finter-Urczyk, Ferrell, Harden, & Billington, in press); yet elderspeak, by conveying a sense of disrespect, may offend older adults, reducing intergenerational contact and thereby indirectly contributing to older adults' cognitive and social decline (Ryan, Giles, Bartolucci, & Henwood, 1986). Effective strategies for enhancing older adults' comprehension must be developed

which will minimize processing demands without relying on "baby talk." Broadcasts and texts targeted at older adults must be adapted to slower information processing rates and reduced working memory capacity if older adults are to continue to be informed and engaged. The chapters in this volume examine what is known about memory, aging, and grammar in order to better understand how such constraints affect language and communication.

PLAN OF THE BOOK

The contributors to this volume fall into three clusters: (1) Leading cognitive aging researchers with special expertise in language production and comprehension (Kemper, Burke, Kliegl, Stine-Morrow, Waters, Wingfield); (2) Syntacticians concerned with developing performance-based models of language (Frazier and Fanselow); (3) Neuroscientists studying language processing (Gunter, Caplan, Kempler). These researchers adopt a variety of methodological approaches to the study of language processing including psycholinguistic investigations of comprehension and production, psychometric studies of the component processes of reading and of individual differences, neuroimaging studies of linguistic function, and neurolinguistic investigations of pathologies of language. Research populations including young and older adults, older adults with dementia and other age-related diseases, and speakers of English and German.

The first set of chapters draws upon recent research in cognitive aging to consider how language production and comprehension are constrained by aging. Studies of normal aging adults offer a unique opportunity to study the role of working memory in language processes. Each chapter focuses on a different aspect of language processing and explores how the architecure of cognition affects language processing. In Chapter 1, Burke draws upon Node Structure Theory in order to consider how asymmetries in language production and perception can arise from limitations of phonological access. She presents new evidence from experimental and naturalistic studies of verbal fluency, word finding, name retrieval, and spelling that highlight how constrains on phonological access can affect older adults. In Chapter 2, Wingfield and Tun focus on studies of spoken language perception to consider the role of working memory and the role of compensatory mechanisms in language processing. In Chapter 3, Stine-Morrow and Soederberg Miller consider how time as a limited resource can affect older adults' reading comprehension. They use regression techniques to decompose the reading process, discovering how some components may be disadvantaged by slower processing whereas other components of reading may be advantaged by slower processing.

The chapters in Section 2 focus on syntactic processing. Kemper and Kemtes in Chapter 4 review recent research on the effects of working memory limitations on language processing with an emphasis on syntactic processing. In Chapter 5, Waters and Caplan consider whether there are significant individual differences in working memory, how they best might be measured, and the extent to which such individual differences affect on-line language processing. In Chapter 6, Kliegl and his colleagues investigate how syntactic factors interact to affect older adults' processing of complex constructions. Like the other contributors to this section, they argue that

some aspects of language processing are age-invariant whereas others are age-varying. Kliegl et al. also provide a detailed tutorial on alternative experimental paradigms for investigating age invariance in language processing. The contributors in Section 2 identify a mosaic of age-spared versus age-impaired language processes at lexical - sentence - and discourse levels of analysis; age-spared processes appear to be buffered from working memory whereas age-varying processes are dependent on working memory.

The third set of chapters offer insights from contemporary models of syntax. Both contributors seek to define which aspects of language are subject to working memory constraints and which are buffered from working memory limitations. In Chapter 7, Fanselow and his colleagues, working from a Minimalist perspective, consider parallels between formal grammatical theory and the operation of the human syntactic parser. They argue that grammars avoid postulating movement operations in the same way that human parsers do. Drawing upon linguistic arguments as well as experimental studies, they consider the costs of movement operations in both German and English. In Chapter 8, Frazier also draws upon linguistic arguments as well as experimental studies of reading to examine how sentence complexity as well as discourse factors can affect comprehension.

The final set of chapters draws on neuroscience studies of language processing to examine how working memory may be affected by aging and, in turn, affect language processing. In Chapter 9, Kempler and his colleagues draw on comparative studies of healthy older adults and adults with probable Alzheimer's dementia. They show how Alzheimer's dementia selectively impairs semantic processes, including word retrieval and word comprehension, while sparing basic syntactic processes. In Chapter 10, Gunter and his colleagues from the MPI in Cognitive Neurosciences present evidence for age-related working memory limitations on syntactic processing from a study of event-related potentials (ERPs) measured during a sentence reading task. The effects of syntactic complexity on the pattern of ERPs varied with age and working memory capacity, providing further insight into the role of working memory in syntactic parsing. In Chapter 11, Caplan and Waters look at how the use of positron emission tomography (PET) can help to resolve questions concerning the neurological localization of language processing. They suggest that aging may affect language processing at the level of neurological organization and localization. Kliegl and Kemper provide a summary discussion of issues raised by these chapters in their Conclusion.

ORIGINS OF THE BOOK

REFERENCES

Caplan, D., & Waters, G. S. (in press).   Verbal working memory and sentence comprehension. *Behavioral and Brain Sciences.*

Just, M. A., & Carpenter, P. A. (1992). A capacity theory of comprehension: Individual differences in working   memory. *Psychological Review, 99,* 122-149.

Just, M. A., Carpenter, P. A., & Keller, T. A. (1996). The capacity theory of comprehension: New frontiers of evidence and arguments. *Psychological Review, 103,* 773-780.

Kemper, S. (1994). Elderspeak: Speech Accommodations to older adults. *Aging and Cognition, 1,* 17-28.

Kemper, S., Finter-Urczyk, A., Ferrell, P., Harden, T., & Billington, C. (in press). Using Elderspeak with Older Adults. *Discourse Processes.*

Kliegl, R., Mayr, U., & Krampe, R. Th. (1994).   Time-accuracy functions for determining process and person differences: An application to cognitive aging. *Cognitive Psychology, 26,* 134-164.

Mayr, U., & Kliegl, R. (1993). Sequential and coordinative complexity: Age-based processing limitations in figural transformations. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1297-1320.

Ryan, E. B., Giles, H., Bartolucci, G., & Henwood, K. (1986). Psycholinguistic and social psychological components of communication by and with the elderly. *Language and Communication, 6,* 1-24.

Waters, G. S., & Caplan, D. (1996). The capacity theory of sentence comprehension: Critique of Just and Carpenter (1992). *Psychological Review, 103,* 761-772.

This page intentionally left blank.

Part 1

CONSTRAINTS ON LANGUAGE: AGING

This page intentionally left blank.

1 LANGUAGE PRODUCTION AND AGING
Deborah M. Burke

When older adults are asked to identify problems in their daily cognitive functioning, certain aspects of language production are at the top of their list. They rate word finding failures and tip of the tongue experiences (TOTs) as their most severe cognitive problems, and the ones most affected by aging (Rabbitt, Maylor, McInnes, Bent & Moore, 1995; Ryan, See, Meneer & Trovato, 1994; Sunderland, Watts, Baddeley, & Harris, 1986). Although older adults' complaints focus on word retrieval failures, younger adults believe that older adults suffer general declines in their ability to produce effective language (Giles, Coupland & Wiemann, 1992; Ryan & Laurie, 1990). In this chapter, we investigate whether aging affects language production in only specific functions, or across the board. This question is important for evaluating two different types of theories of cognitive aging: *information-universal* and *information-specific* theories. We focus on word retrieval, reviewing empirical evidence that sheds light on the nature of age-related changes in production processes during adulthood. This evidence suggests an asymmetric effect of aging on different aspects of production, and we discuss the implications of this pattern for the two classes of theory.

Changes in language production in old age carry practical as well as theoretical significance, because language production is a critical component of interpersonal communication. If aging impairs production, this may disrupt interpersonal communication, contributing to social isolation. Moreover, people use language production in their everyday interactions as an index of intellectual functioning. Impaired word production, for example, may negatively affect both self-evaluation of cognitive ability and evaluation by others (e.g., Ryan et al., 1994). Negative self-appraisal may promote withdrawal from social interaction, and negative appraisal by others may promote the use of simplified speech to older adults, which appears to further erode their self-evaluation of cognitive functioning (Cohen, 1994; Kemper, Othick, Warren, Gubarchuk, & Gerhing, 1996; Hummert, 1994; Ryan et al., 1994). This downward spiral linked to impaired production highlights the practical