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Kees de Bot and Sinfree Makoni

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Preface

This book has a long history. The authors' interest in the topic dates from many years ago, and they have taken quite a lot of time to turn their ideas into something which became this book in the end. Over the years we have had long and intensive discussions with many colleagues in the field. One particularly important and stimulating event was the conference on Sociocultural Theory and Language Learning that took place at Penn State University in 2001. We are grateful to all those colleagues who were willing to share their views with us. We are also indebted to Margie Berns for inviting the first author to present a plenary lecture on language and aging at the 2002 Congress of the American Association of Applied Linguistics. This invitation gave us the inspiration to expand the topic and stimulated our attempts to develop an applied linguistic perspective on language and aging. The first author is also indebted to the Max Planck Institute for Psycholinguistics in Nijmegen for its hospitality during a sabbatical in 2002 during which a considerable part of this book was conceptualized. We would also like to thank the Africana Research Center at Pennsylvania State University for their support. Lorraine Obler helped us restructure the book in significant ways and we are indebted to her for her support.

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Kees de Bot
Groningen, November 2004

Sinfree Makoni
College Town, November 2004

Chapter 1

Introduction: Language, Aging and Multilingualism

While not all of us may be second language learners, or have participated in bilingual education or have lost a foreign language we once knew, we all become old, provided we don't die prematurely. And most of us at some stage in our life are confronted with the fact that our parents, or even our brothers and sisters, become old and with the fact that not all of our relatives and friends remain completely healthy mentally and physically until they die. In this book we want to focus on one aspect: language in aging.

Before going into the relation between language and aging, we need for a moment to stop and think what aging actually is. If we look at pictures of our own great-grandparents, we are likely to see pictures of very old people, the way they look, the way they dress. If we happen to have information on their real age, we will probably find out that those very old people are actually in their late 50s or early 60s. Even your own parents probably looked old when they were that age. In a sense they were older than we are, because in many ways, our healthcare system has led to increased life expectancies and more years in good health. Our attitudes towards aging have changed. There is still respect for old age, but we try to avoid being old, being seen as old or feeling old, as long as we can.

So what is aging? It is a generally accepted position in gerontology nowadays that age is an index variable that doesn't explain anything. It is probably best to define aging as a change on three interacting dimensions: biological, psychological and social. No one is denying that there are physical changes in our body over time, but they have their impact in different ways in different individuals. The risk of mental and physical decline increases more or less with age in the larger population, but strictly speaking grouping of individuals on the basis of age in order to learn more about aging is inappropriate. As we will argue later on, the effects of aging result from an interaction between these three dimensions, and only a part of the changes in one of these three dimensions can actually be compensated for by interventions in the other two dimensions.

Related to these issues is the problem of defining what constitutes normal healthy aging and pathological aging. As will be clarified in various chapters, no instrument is able to make a clear-cut distinction between the two. We take the position that pathology/non-pathology is a scale and that individuals have a position on that scale. As in most research on aging and dementia, we will look mainly at 'clear' cases and avoid the twilight zone in the middle up to a point. Maybe there is a place for language and assessment in that zone: maybe language can serve as an indicator of early dementia. We will present some research that suggests that this may be the case. A particularly difficult area is what has been called depressive dementia, i.e. syndromes that on the behavioral level are similar to degenerative dementia of the Alzheimer type but that are caused by depression and generally reversible. A treatment of that type is beyond the scope of the present book. An overview of research on language from this perspective can be found in Emery (1999).

There are other ways of looking at old age, not as a stage in life in which almost everything is worse than in earlier stages and the emphasis is on decline and on what is missing, but as a stage in its own right, just as childhood is not an incomplete version of adulthood. In this stage other matters become important; there is a different perception of time, work, maybe religion, certainly meaning of life. We can study this stage in itself and look at its inherent characteristics without reference to norms from an earlier stage. The two perspectives, aging as decline and aging as acceptance and fulfillment, lead to totally different questions we may want to answer in our research. While most of the research has been done from the decline perspective, we will argue for a perspective that looks at language and aging from the life-span development. In this perspective language development (or any development) does not stop at age 16 or 18 or whatever ages have been proposed for full language acquisition, but continues to develop over the life span. Due to changes in life, education, jobs, relationships or hobbies, people continue to learn new aspects of their languages. In such a perspective development includes not only growth, but also decline as part of the normal process.

Equally fundamental questions can be asked with respect to what, in this specific context, 'language' is. There is little point in going into this deep philosophical question in the context of the present book, but one needs to take a position on a number of issues in order to discuss the relation between language and aging. Here, language use is seen as very advanced and complex skilled behavior. Skills develop with use, and decline with non-use. The basic skills may be quite resistant to decline, like our abilities to ride a bicycle or swim. Once we've learned them we don't forget the basics. But for doing more advanced things quickly and

properly, a lot of exercise is needed. In a way using language is like top sports: it is complex, extremely fast and calls for integration of many different skills. The complex parts of that skill need to be trained regularly to maintain them, otherwise they atrophy and fade, and are difficult to reactivate.

Language is not seen as a separate skill or capacity in our cognitive system. It is linked to and interacts with other subsystems, such as perception, memory and emotion. In the chapters that follow we will try to show how different components of language change over time with aging. Throughout this book, language will be presented as a complex dynamic system, and notions from dynamic systems theory will be used to show how language development across the life span fits in more general theories on development. The main thrust of this approach is that the language system is always changing and that it is always in interaction with other systems and dependent on input and use for maintenance.

The third main issue in the introductory chapters will be the role of memory in language use. Different types of memory play specific roles in language use. Many things have to be remembered in speaking and listening: the setting, the goal of the conversation, characteristics of the interlocutors, the topic, who said what and when. In the production and perception processes, there is temporary storage of outcomes of subprocesses. In particular working memory is crucial in language processing. The role of working memory is one of the most hotly debated issues in psycholinguistics at the moment, and though we will try to clarify the many functions of memory systems, a full treatment of this complex issue is beyond the scope of the present book.

The fourth issue has to do with multilingualism. As in the rest of the population, the majority of the world's elderly people are bilingual or multilingual. Multilingualism is defined here as being proficient to a certain degree in more than one language. In some definitions only people who grow up speaking more than one language qualify, but this definition has been discarded for a while now. There is no absolute measure for being bilingual. It does not amount to a given number of words or grammar rules in another language or the ability to carry out certain communicative activities in that language. In his definition of bilingual aphasia, Paradis (1987) takes 400 hours of formal instruction as the lower limit. How that translates to non-instructed acquisition is not really clear but participating in a foreign society and language for more than a few weeks should be enough. To what extent having more than one language is an asset or a problem in aging is unclear. On the one hand, the language system is more complex, and there are more languages that use mental resources; on the other hand, the other languages may be useful as an additional path or tool. Recent

work by Bialystok and her colleagues (Bialystok *et al.* 2004) suggests that cognitive functioning in later life may actually be affected by life-long experiences in handling two or more languages. Second language *learning* by elderly people has not been studied at all so far. This is remarkable since many multilingualism settings are settings in which migrants of different ages move to other countries where they have to deal with other languages. In many western-European countries there is now almost forced enculturation, including learning the national language for adult migrants irrespective of their age.

The structure of this book is as follows. In the first part we will discuss Dynamic Systems Theory briefly and show how it applies to language and language development. This leads us to a model of language and aging that appears to fit very well with general notions about development in general. We will discuss the state of the art with respect to language and aging from psycholinguistic and sociolinguistic perspectives. Historically, old age emerged as a distinct stage in life after the onset of industrialization when the continuous flow from adulthood to old age was institutionally disrupted by mandatory retirement. The notions of old age were reinforced by biomedicine which is one of the most powerful forces in framing notions about aging in contemporary society. Biomedicine, like psycholinguistics, tends to treat ageing as inherently problematic. Sociolinguistics tends to treat ageing as inherently unproblematic with the crisis in ageing being attributed to mediating factors like culture and language and the nature of the social cultural factors. The integrative approach we are adopting here tries to avoid the ageing as inherently problematic stance of psycholinguistics and the ageing as free from problems of sociolinguistics. The idea that ageing is inherently problematic is false positive, while the idea that ageing is free from problems is false negative. We will also discuss issues of language and dementia in multilingual settings. Both the assessment and treatment of dementia type disorders will be high on the agenda in many countries in the years to come, and few countries have made adequate provisions to take care of elderly multilinguals, both highly educated speakers of many foreign languages and lowly educated and illiterate speakers of many second languages in migrant settings. In the second part of the book we will discuss findings from ongoing studies on Afro-Americans, Hispanics and Chinese in the USA. Data from these projects will be related to the various theoretical notions discussed in the first part of the book.

Chapter 2

Language and Aging: A Dynamic Perspective

In this chapter we want to present a general framework by linking research on language and aging with ideas on the development of complex systems. We will first discuss some of the basic notions in Dynamic Systems Theory (DST) and then show how these may be applied to language development. DST is primarily a branch of mathematics concerned with abstract structures. For this a whole range of concepts and tools have been developed that now find applications in a wide range of disciplines – from marine biology to demographics and aerodynamics. DST was adopted readily by the sciences, but it took a while for cognitive science to make the link. In the last decade major steps have been made in many aspects of cognition such as visual perception, sensorimotor activity and more recently also language and language development (see Port & van Gelder, 1995 for an overview). Over the years DST has emerged as a new perspective on development of systems. Its full mathematical application is problematic in many areas of research, primarily because there is simply not enough information for the formulation of the complex mathematical equations DST is based on, but in many areas ideas based on DST have been applied successfully to describe and explain development without the full mathematical modeling.

The most simple definition of a dynamic system is: *a system of interacting variables that is constantly changing due to interaction with its environment and self reorganization*. In such a system the variables it consists of interact with each other. Other variables that do not interact with all these variables are not part of the system, though they will be part of a larger system in which subsystems are the variables that make up the system. Dynamic systems are constantly changing but development is not typically linear, it goes in leaps and bounds and it tends to settle in what are called attractor states. These are states the system converges to in preference over other possible states. The definition of ‘environment’ is very broad: it entails everything from the physical environment to the social environment, including peer groups, teaching and so on.

For the implementation of Dynamic systems, connectionist network models have been found to work best. In such models there are nodes and connections between them. As a result of activation of connections by input and output, such connections get stronger. When connections are not strengthened regularly, they deteriorate. One of the consequences of the use of connectionist models is that traditional ideas on storage and retrieval come under attack.

The starting point of Dynamic Systems Theory is that a developing system is maintained by a flux of energy. Every developing cognitive system is constrained by limited resources, such as memory, attention, motivation and other aspects. The system is in constant complex interaction with its environment and internal sources. Its multiple interacting components produce one or many self-organized equilibrium points, whose form and stability depend on the system's constraints. Growth is conceived of as an iterative process, which means that the present level of development depends critically on the previous level of development (van Geert, 1994).

Several researchers have looked at language as a dynamic system (van Geert 1994, 1998; Elman, 1995; Larsen-Freeman, 1997; Herdina & Jessner, 2002; de Bot *et al.*, 2005). A full treatment of all the ins and outs of this are well beyond the scope of the present book. Therefore the main aspects of the DST approach as far as they are relevant for this book can be summarized here:

- The aim of DST is to describe and explain development over time of complex systems.
- Systems consist of subsystems that interact.
- Changes in one of the subsystems have an impact on all other subsystems.
- Systems never completely settle as long as there are sufficient resources.
- Systems show variation over time.
- Systems develop through input from the environment and self-reorganization and have no in-built goal.
- Development can be growth or decline, and it is typically non-linear.
- Systems tend to settle temporarily in attractor states while they avoid other states, but when and how the system will settle cannot be predicted.
- Complexity emerges as a result of the interaction of variables, and the development of complex systems is unpredictable.
- Development is an iterative process: in each next step all the information of the previous steps is included.

The Application of DST in Cognition and Language Development

Language shows all the characteristics of a dynamic system, and accordingly language development can be viewed from a DST perspective: it is a system consisting of many subprocesses (e.g. pragmatic, syntactic, lexical, phonological) that interact (e.g. the syntactic and the pragmatic level), it shows variation over time, it develops through interaction and self-reorganization, it depends on internal and external resources, it shows growth and decline depending on the setting it is in, and it never settles completely. In development the system will temporarily settle in some states and not others (e.g. developmental stages in L1 and L2 development, fossilization as attractor states). Language use in the form of overt language production, but also subvocal use and inner speech probably play a role on the self-reorganization of the system: through use of elements in production, the position of those elements in the networks is strengthened. It could also be argued that output also acts as input for the system and that output in that way has an impact on the system.

Some aspects of language as a dynamic system are not generally accepted in linguistics: the idea that development has no goal but develops through incidental interactions between subsystems goes against ideas on universal grammar (UG) that argue that there is an in-built developmental path. Also the idea of continuing development goes against ideas of 'endstates' of development that are commonplace in UG thinking. The issue that places a DST approach to language in sharpest contrast with ideas on innateness is that complexity can develop through iteration (repeated application) of fairly simple operations. So the idea that complexity needs to be innate because it cannot come from input (the 'poverty of input' argument), does not hold.

The application of DST leads to a new approach to cognition and language. As Port and van Gelder argue in their introduction to *Mind as Motion. Exploration in the Dynamics of Cognition* (1995), the main problem is *time*. Most models of cognition and language processing, including such well-known models as the Levelt model for language production (1993), are steady state models, that is, models that try to capture the cognitive system as it is at a given moment in time. Development over time is presented as sequences of pictures of static states over time, like movies that suggest changes over time through rapid sequences of fixed pictures.

Cognitive processes and their context unfold continuously and simultaneously in real time . . . The cognitive system is not a discrete sequential manipulator of static representational structures: rather, it

is a structure of mutually and simultaneously influencing change. Its processes do not take place in the arbitrary, discrete time of computer steps: rather, they unfold in the real time of ongoing change in the environment, the body, and the nervous system. The cognitive system does not interact with other aspects of the world by passing messages and commands: rather, it continuously coevolves with them. (Port & van Gelder, 1995: 3)

This means that static models lose their relevance and even their validity for the study development and that we have to look for other models that can deal with both the main findings on static systems and developing ones.

The Role of Resources in Language Development

For language development a distinction can be made between *internal resources*, resources within the developing individual: the capacity to develop, time to develop, internal informational resources such as conceptual knowledge and motivational resources, and *external resources*, resources outside the individual: spatial environments to explore, time invested by the environment to support development, external informational resources such as the language used by the environment, motivational resources such as reinforcement by the environment, and material resources. Memory capacity, perceptual and production skills, and aptitude to learn are all resources.

Resources in growth systems have two main characteristics: they are limited and they are interlinked in a dynamical system. The limitations hold for all internal resources: memory capacity is limited, as in the time available to spend on learning, the available knowledge and the amount of motivation to learn. The same goes for external resources: the variation of environments and their willingness to invest time and energy in learning support are limited as are the material resources. The fact that resources are limited has important consequences for language learning and language use: Van Geert (1994) argues that the development of the L1 lexicon shows leaps and bounds that can be related to changes outside the lexicon: e.g. the emergence of the multi-word sentence leads to a deceleration of the lexical growth in the one-word phase: while in the latter all resources could be used to develop the lexicon through the linking of different types of sensory information, in the next phase more resources are needed to develop the grammatical system needed for the functional distribution of information in multiple-word utterances. The resources must have some limited value for learning to take place: without memory, input or internal informational resources or motivation there will be no learning. At the

same time there are compensatory relations between different types of resources: effort can compensate lack of time, motivation can compensate limited input from the environment. So resources are part of an interlinked dynamic structure. This holds for the interaction between internal and external resources as well: a growth in the child's informational resources will lead to a change in the interaction with the environment through a demand for more demanding tasks and environments. Also, a decline in language skills will lead to differences in language use with the environment and to a change of input.

The interlinked structure of resources is referred to as the 'cognitive ecosystem': 'each person has his or her own particular cognitive ecosystem consisting of internal as well as external or environment aspects' (van Geert 1994: 314). In DST terms, the resources define the state phase of the system. To give an example: the number of words an L2 learner has acquired is the resultant of the combined and interacting effects of the internal and external resources of time, input, motivation and attention.

Some Unresolved Issues: Attention and Intentionality

In research and models based on DST, it is obvious that DST has its roots in the hard sciences in which the agents looked at have complex but definable properties. When applying notions of DST in human cognition and language development, and learning and teaching, some issues come up that have not been dealt with adequately in DST models so far. The most obvious are the role of attention and intentionality. Weather systems and solar systems and even economic systems, which have figured prominently in the history of DST, are systems in which notions like attention and intentionality play no role. Such systems have no built-in direction they 'want' to go: they just develop. For human systems (and probably some animal systems) we have to deal with these other forces that are difficult to model but all important for behavior. It is not clear how in a dynamic system intentionality can be included, and how this variable in itself is related to other variables. In the list of internal resources for human learning we have simply included 'motivational resources' but in fact we know little about how that variable should be implemented. Something similar applies for various aspects of processing, but here the issues are slightly different: as indicated above, the addition of time as a variable has an enormous impact on the workings of processing models, as has the implementation along connectionist lines, which to a certain extent forces us to give up ideas on storage and retrieval in the traditional sense, while no real alternatives are available at the moment.

Language Development Across the Life Span

One of the most important outcomes of the DST approach is that language development as a process has no endpoint. If language is a dynamic system, it will continue to develop as long as the resources last. Most research has focused on the early stages of L1 and L2 development, and more on the growth side than on the decline side of development. There is a general tendency to view the end of puberty also as the end of L1 development. Language as a dynamic system, however, will continue to develop: there is constant interaction with the environment and the system is constantly reorganizing itself. There are many factors that may play a role in post-puberty language development: education, job requirements, relationships, parenthood and new hobbies are just a few of them. Different settings of language use will lead to differences in input and adaptations of the language system. While the differences in the first language in monolinguals may be relatively small (though no research has really looked at this so far in any detail), the acquisition and use of additional languages will have a major impact on the language system. Different languages can be viewed as subsystems within the larger language system (de Bot, 2004). The languages have an impact on each other. There is now substantial evidence that the first language, which for a long time was considered to be more or less immune to change after puberty, is influenced by the use of other languages (e.g. Kecskes & Papp, 2000; Dussias, 2001). Here, resources are the crucial issue. Following connectionist principles, linguistic elements as part of networks need to be used to be maintained. How much use is needed for maintenance we don't know, but research on migrants who have stopped using their mother tongue has shown that decline is the normal pattern (Schmid, 2003; Hulsen *et al.*, 2002). Apparently, not enough resources (in terms of amount of time of use) are invested or available to keep the language at the same level. While complete non-use is an obvious case for attrition, more subtle processes seem to be taking place in multilinguals: while monolinguals invest all their language-related resources to one language, multilinguals have to divide them over all their languages. Accordingly, the total of resources available has to be spread over these languages, and that will have an effect on the level of activation (as defined by speed of processing and retrievability of elements) of each language. This is also the gist of Grosjean's (1998) argument of the bilingual who is not two monolinguals in one person: the multilinguality changes the system and makes it different from a monolingual one. To what extent resources can be augmented for a specific task or subsystem and be taken from the resources for other systems is not clear.

Language development in aging

Apart from research on language attrition, research on non-pathological development in the age group between roughly speaking 18 and 55 is very scarce. There is some research on adult literacy development, but for spoken language the assumption seems to be that there is nothing of interest happening during that period. As the following chapters will show, there is considerable interest in language development in aging, with an emphasis on decline as the normal outcome. In the remainder of this chapter we want to show how a DST perspective on language development can be applied in an aging population.

When we go back to the basics of dynamic systems, three factors appear to be crucial for development: availability of resources, use of the language, and self-reorganization, though the latter factor is probably more a result of changes in the first two factors than a factor of its own. Because self-reorganization is not open to inspection, we will consider only availability of resources and use of the language as factors. So we could look at how changes in language proficiency are related to resources and use, but in the true DST spirit, it would be better to look at how language proficiency, language resources and language use interact. Each of these variables can be dissected into smaller variables that in themselves can be viewed as dynamic systems at a lower level. Also, like all other parts of the cognitive system, resources and language skills are both embodied and situated. This means that they function as part of a physical body, and changes in that physical system interact with cognitive variables. The situatedness of cognition means that characteristics of the setting also interact with the cognitive variables. Here the aging factor comes in: there are age-related physical changes that have an impact on cognitive functioning and accordingly language processing. But again, the relations are reciprocal: cognitive changes and changes in resources and language use have an impact on the physical system, as we hope to show later on. So we have a complex system with four interacting variables: the physical condition, the life setting, cognitive resources and language use. This system develops through the interaction of these variables. We will now discuss some of the core parameters of each of the variables.

Physical Changes

There is an enormous amount of research on various aspects of physical changes with aging on about every single subsystem in the body: the brains, the respiratory system, the metabolistic system, the muscular system, the blood system and so on. This is not a book on the physiology of aging, and we will not even try to summarize the main findings in the field.