



# the resilience of language

what gesture creation in deaf children  
can tell us about how all children learn language

SUSAN GOLDIN-MEADOW

Essays in Developmental Psychology



Psychology Press

the resilience  
of language

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PSYCHOLOGY PRESS  
NEW YORK • HOVE

Reprinted in paperback in 2005

[www.developmentalpsychologyarena.com](http://www.developmentalpsychologyarena.com)

**Corrections** — On page 21, second paragraph, seventh line, transpose the words “before” and “after.” On page 174 in Figure 23, the key is reversed; the hatched box represents Chinese children and the black box represents American children.

Published in 2005 by  
Psychology Press  
Taylor & Francis Group  
270 Madison Avenue  
New York, NY 10016

Published in Great Britain by  
Psychology Press  
Taylor & Francis Group  
27 Church Road  
Hove, East Sussex BN3 2FA

© 2003 by Taylor & Francis Group, LLC  
Psychology Press is an imprint of Taylor & Francis Group

Printed in the United States of America on acid-free paper  
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-10: 1-84169-436-3 (Softcover)  
International Standard Book Number-13: 978-1-84169-436-8 (Softcover)

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#### Library of Congress Cataloging-in-Publication Data

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Catalog record is available from the Library of Congress

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Taylor & Francis Group  
is the Academic Division of T&F Informa plc.

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*I lovingly dedicate this book  
to the memory of my father, Benjamin J. Goldin,  
who was always very proud of me no matter what I did  
and to my mother, Mildred Goldin,  
for being my mom*

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# ACKNOWLEDGMENTS

I have always been fascinated by the structure of words—one of those kids who thinks grammar and Latin are fun. I'm not sure where the fascination came from but watching my daughter get hooked on Latin declensions and conjugations this summer (when she took high-school Latin as a middle school student just for fun) and knowing that my mother began her career as a Latin scholar makes me think that I've come by the interest honestly (and down the maternal line). I continued to cultivate the interest at Smith College when I spent my junior year abroad in Geneva at the Piagetian Institute working with Annette Karmiloff-Smith on a project on relative clauses under Mimi Sinclair's direction. Although our discoveries were hardly earth-shaking, this experience convinced me that I wanted to figure out how children learn language and I decided to go to the University of Pennsylvania to do it. I knew I'd find Lila Gleitman at Penn—she was one of the reasons I chose Penn for graduate school. But I didn't know I'd find Heidi Feldman. Heidi was a fellow graduate student in developmental psychology, also interested in language, and together with Lila we began our study of deaf children inventing their own gestures.

The Clark School for the Deaf, one of the best oral schools in the country, is down the road from Smith. I had heard, and observed, that deaf children who are not making progress in oral language nevertheless communicate and use their hands to do so, a titillating observation that resonated with the research program Lila and Henry Gleitman were just beginning. This program of research would result in some of the most interesting research done in the field of language acquisition. The basic idea was to vary the language learner and the language learning environment and observe the effects (or noneffects) of each on child outcomes (Gleitman & Newport, 1995). For example, do the natural variations in how mothers speak to their children result in differences in how those children learn language (Newport, Gleitman, & Gleitman, 1977)? Are children who lack access to vision able to align their sightless worlds with the linguistic inputs they receive so that they too can learn language (Landau & Gleitman, 1985)? Are children whose

mental development is delayed able to acquire language following the same trajectory as more cognitively able children (Fowler, Gelman, & Gleitman, 1994)? And our own project—are children lacking access to linguistic input able to develop language nonetheless (Feldman, Goldin-Meadow & Gleitman, 1978)? This was an intellectually exciting research program devoted to exploring *how* children learn language, not just documenting the stages children pass through as they learn language. And our work on the deaf children was a foundational part of the program.

Heidi and I traipsed all over Philadelphia looking for just the right children to study—and we found them. We then spent hours together trying to figure out what we should be looking at and how to write it down. It seems clear in retrospect what we ought to have been focusing on, but it was not at all clear at the time. Heidi was the perfect person for me to work with—we complemented each other beautifully. I continued to observe many of the children long after Heidi and I both graduated (indeed, thanks to NSF, long after I had moved away from Philadelphia). But the seeds of the project were sown in Philadelphia and this book owes its very existence to Lila and to Heidi—and, needless to say, to the deaf children themselves. I am very grateful to the many families who welcomed us and our video equipment into their homes and shared their children and their stories with us.

When I moved to the University of Chicago in 1976, it was an excellent opportunity to ask whether deaf children in the Midwest invent gesture systems that resemble those invented by their East Coast peers. The move also gave me the opportunity to begin new collaborations, the most important of which has been with Carolyn Mylander. Carolyn has run my lab in Chicago for over 20 years. She has a feel for how to code gesture and how to get things done carefully and with just the right attention to detail. Her contributions to this research program are incalculable and, happily, promise to continue—she is currently orchestrating our new studies of deaf children of hearing parents in four cultures (American, Chinese, Spanish, Turkish) with the excellence that is her trademark. I thank her for always making it work.

I also thank Martha Scott who has ably assisted Carolyn in running the lab for as long as I can remember. In addition to making everything in the lab run smoothly, Carolyn and Martha work hard to make sure that people respect one another and have fun together. The healthy attitude in the lab is maintained, in large part, by these two very important people. The weekly meetings that we hold in the lab are to me the heart of the research and educational process. I thank all of the students and colleagues who attend for the hard and constructive thinking they do every Wednesday afternoon. I have learned much from these meetings.

I have been fortunate over the years to have had wonderful collaborations with many students (undergraduate, graduate, and postdoctoral) and

colleagues. All of the studies described in this book have been collaborations and much of the credit belongs to my partners: Heidi Feldman, Lila Gleitman, Carolyn Mylander, David McNeill, Peggy Miller, Susan Gelman, Rachel Mayberry, Jenny Singleton, Lisa Gershkoff-Stowe, Jill Morford, Ming-yu Zheng, Xiao-lei Wang, Asli Ozyurek, Cynthia Butcher, Mark Dodge, Jody Saltzman, Sarah Van Deusen Phillips, Elif Yalabik, Amy Hammond, Amy Franklin, and Bari Wieselmann Schulman. In addition, my ideas about innateness have developed over the years under the nurturing influence of Martha McClintock and Bill Wimsatt. We have taught the Mind course in the Social Sciences Core at the University of Chicago together since 1977 and have found that our views are strikingly similar despite the vast differences in our fields (Goldin-Meadow, McClintock, & Wimsatt, 2003).

Gesture coding is remarkably labor intensive. We generally spend at least 40 hours coding every hour of videotape, and I have been fortunate to have had a great deal of help over the years. I thank all the many people who spent days and nights coding videotapes, first in Judd Hall and later in Kelly-Beecher-Green, and those who helped collect data in Philadelphia, Chicago, and Taiwan: Tomoko Asano, Ralph Bloom, Sara Broaders, Keeshawna Brooks, Te Chang Chao, Peter Chen, Ruth Breckinridge Church, Susan Duncan, Ellen Eichen, Emily Hammer, Jeff Harlig, Margie Hartfield, Janna Hicks, Monica Ho, Julia (Sae) Kim, Lorraine Kubicek, Tricia Leaky, Simon Li, Lisa Liu, Shuhong Lim, Alexander Meadow, Marolyn Morford, Miriam Rabban, Veronica Sansing, Lisette Tefo, Kristie Wang, Xiao-ping Wang, Rhonda Wodlinger Cohen, and Mitch (Ming Che) Yeh.

My research has flourished under the generous support and attentive eye of Paul Chapin at the National Science Foundation (BNS 8810769 from 1977 to 1992), Tom James at the Spencer Foundation (from 1980 to 1983), and Judith Cooper at the National Institute of Deafness and other Communication Disorders (RO1 DC00491 from 1988 to 2006), and I thank them for their help over the last 25 years. I would also like to thank Irving B. Harris, whose chair I currently hold in the Department of Psychology and Committee on Human Development at the University of Chicago. He has done much over his long career to better the lives of children in our society, and I am grateful for his support and honored to hold a professorship bearing his name.

The book itself got its first breath of life when Henry Wellman convinced me that it would be a good idea to bring all of the studies on the deaf children's gesture systems together in one place and to do it in the *Essays in Developmental Psychology* series that he was editing with Janet Werker. Having read and greatly enjoyed Carol Dweck's excellent book serving the same function for her research program and published in the *Essays in Social Psychology* series, I became convinced that this was indeed the right step to take. But it took a sabbatical year funded by a John Simon Guggenheim Fellowship and a James McKeen Cattell Fellowship to get me writing.

The manuscript improved immensely as a result of careful reads from many colleagues and friends. I thank them all for their comments and suggestions: Martha Alibali, Danny Povinelli, Jill Morford, Lila Gleitman, Dan Slobin, Elissa Newport, John Lantos, and Mildred Goldin. I particularly thank my editors, Henry Wellman and Janet Werker, and my reviewer, Virginia Valian, for the detailed and very thoughtful comments they gave me on how to make the book better. I thank Linda Huff for turning videotapes of gestures into lovely line drawings that make it much easier to imagine what an invented gestural language looks like. I thank Amanda Woodward and the students in the graduate and undergraduate courses on language acquisition we taught together in 2002 for reading the book and commenting on how it can (and should) be used in a course. I thank Dedre Gentner for always listening and helping me decide where to publish the book and how to make it useful to teachers and readers. I thank Kathy and Kevin Clougherty for lending me their car phone for several hours so that I could get comments from my readers while working on the revisions on Washington Island. The serenity and peacefulness of the Gibson's cabin on the island (and their hospitality and friendship) made revising the manuscript infinitely easier and greatly improved the final product. I heartily recommend an island for book writing.

And most of all I thank my family, my favorite language learners, Alexander ("Xander"), Nathaniel ("Shmug"), and Jacqueline ("Beanie") whose linguistic accomplishments I chose to revel in rather than document. I am also grateful to my favorite language teacher, my mother, Mildred Goldin, whose attention to language form stemming from her own interest in Latin and Greek sowed the seeds of my curiosity about words. And, of course, I must mention the family dogs, Rugeleh, Knish, Kugel (there's a theme here), and Metro Goldin-Meadow, none of whom came close to inventing a language despite hours of some of the best "motherese" I could muster. Finally, I thank my husband, Bill Meadow, who has read every word of this book several times over, and improved on most of them. He has been totally supportive of me and my interests since our early days together in undergraduate and graduate school. Our marriage has been my most productive and deeply satisfying collaboration. I cannot thank him enough.

Susan Goldin-Meadow  
Chicago  
November 2002

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# ACCOMPANYING WEBSITE OF VIDEO CLIPS

In order to bring the gestures that are described in this book to life, there is an accompanying website of video clips gathered from the tapes that Heidi Feldman, Lila Gleitman, and I collected many years ago (which explains their blurriness). If the book is used as part of a course (see *How the Book Can Be Used in a Course on Language Acquisition*, page xix in the Introduction), the clips will be particularly important in making the phenomenon of gesture creation real. I thank Zachary Johnson and Carolyn Mylander for their help in preparing the clips. And I thank the children and their families for sharing their lives first with us and now with the readers of this book. The video clips, which are listed in the table below, can be viewed at:

**[www.psypress.com/goldinmeadow](http://www.psypress.com/goldinmeadow)**

Page in Book	Short Name	Description
59	Shovels	Combining gestures into sentences to talk about shovels
73	Dad-Sleep	Pointing at a chair in the room to indicate dad who is sleeping in another room (Figure 1 in book)
75	Break	An emblem meaning “break” (Figure 2A in book)
75	Give	An emblem meaning “give” (Figure 2B in book)
77	Flutter-Fall	Communicating about manner (snow flutters) and path (snow falls) in two separate gestures (Figure 3 in book)
79	Headshakes & Nods	Incorporating headshakes and headnods into a gesture sentence to negate (“Lisa is not eating”) and affirm (“but I am eating”)
79	Wait	A modulating gesture “wait” used to signal the immediate future (Figure 4A in book)



81	Away	A modulating gesture “away” used to signal displacement in time and space (Figure 4B in book)
81	Away Embedded	The “away” gesture embedded in a string of gestures describing an event displaced in time and space (Figure 4B in book)
83	Round-Put Down	Breaking one gesture (an O handshape incorporated into a SHORT ARC motion) into two gestures: (1) an O handshape (with NO motion) followed by (2) a SHORT ARC motion (made with a PALM handshape)
85, 92	To&Fro + Fist	Using a TO&FRO motion with a FIST handshape to mean “move knife” (Figure 5A in book).
85, 92	To&Fro + Palm	Using a TO&FRO motion with a PALM handshape to mean “knife moves” (Figure 5B in book)
92	Fist + Linear Path	Using a FIST handshape with a LINEAR PATH motion to mean “move a long, skinny object forward” (Figure 6A in book)
92	Fist + Circle	Using a FIST handshape with a CIRCLE motion to mean “move a long, skinny object in a circle” (Figure 6 B in book)
108	Snack-Eat-Susan	Combining gestures into sentences in a particular order: Snack-Eat-Susan (Patient-Act-Actor) (Figure 11 in book)
144	Rabbit Story	Using gestures to tell a story about a rabbit escaping from its cage and finding something to eat
148	Talking to Self	Using gesture to ask oneself where an object is



# INTRODUCTION

## ☐ **The Goal of the Book**

With each of my three children, I waited with some amount of trepidation for the first signs of language—the first word, the first sentence, the first story. Being a nervous sort, I was concerned that maybe they wouldn't be able to do it—that they wouldn't be able to master the complex and intricate system that we use effortlessly and without thinking.

I needn't have worried. Language-learning is a remarkably robust and resilient process, one that comes naturally to the vast majority of children (including my own). This book explores the resilience of the language-learning process.

For the last 25 years, I have been studying children who are growing up in language-learning circumstances that are not typical. The children are deaf with hearing losses so severe that they cannot acquire the spoken language that surrounds them. In addition, they are born to hearing parents who have not exposed them to a conventional sign language (e.g., American Sign Language). The children thus lack access to a usable model of language. Under such inopportune circumstances, these deaf children might be expected to fail to communicate.

Yet the children do communicate. Not surprisingly, they use their hands to do so—they gesture. What is surprising, however, is that the gestures the deaf children use to communicate are structured in language-like ways. The children are inventing their own, simple language. My goal in this book is to situate the study of deaf children who invent a gesture system within the phenomenon of language-learning—to make it clear why a study of deaf children who do not have access to a usable model for language is important, and what such a study can tell us about how all children learn language.

## ☐ **The Organization of the Book**

The book is divided into three sections. The first section, "The Problem of Language-Learning," lays out the challenges language-learning presents both

to the child trying to figure out how language works and to the experimenter trying to figure out how the child is figuring out how language works. In these five chapters, I provide an overview of what we know about the steps children take as they acquire language, a description of current attempts to explain language-learning, and a brief summary of what we've learned from studying language-learning under varying circumstances—in children exposed to different languages in various cultures across the globe, in children exposed to conventional sign language, and in children exposed to varying amounts of linguistic input within a single culture.

The second section of the book, "Language Development Without a Language Model," explores in depth a situation in which children are lacking input from a language model yet in all other respects are experiencing normal social environments—deaf children inventing their own gesture systems. In these ten chapters, I first provide background on deafness and language-learning, background that is crucial for understanding the unique circumstances in which deaf children of hearing parents find themselves. I then describe properties of the deaf children's gesture systems—how gestures function as words, how they are combined to form sentences, and how they are used to describe situations beyond the here-and-now. Finally, I consider where the deaf children's gesture systems might come from. I first entertain the most obvious hypothesis, that the children's hearing parents provide a gesture model which the deaf children adopt. I explore this hypothesis by examining the gestures of hearing parents of American deaf children, and also by studying the invented gesture systems of deaf children of hearing parents in another culture (a Chinese culture). The striking finding is that the American deaf children's gestures do not resemble those of their mothers—indeed they look much more like the gestures of the Chinese deaf children halfway across the globe than the gestures of their hearing parents in their own living room. The gestures that the hearing parents produce do not appear to serve as a model for the deaf children's gestures.

The properties that appear in the deaf children's gesture systems are resilient—they appear in the children's communications even though the children do not have a usable conventional language to guide their development. If these properties are so fundamental to human communication, why then do they not appear in the gestures of the deaf children's hearing parents? What is it about either the circumstances of acquisition, or the nature of the acquirer, that seems to lead inevitably to this type of structured communication system in the child?

I tackle these questions in the final section, "The Conditions That Foster Language and Language-Learning." I begin by considering what the phenomenon of gesture-creation in deaf children can tell us about language-learning in all children—how do the resilient properties of language help children, deaf or hearing, learn language? I then explore the conditions under which gesture becomes language using an experimental approach with hear-

ing adults. We put hearing adults in situations that simulate some of the conditions under which the deaf children find themselves, and ask whether those conditions lead adults to develop a gesture system that has some of the resilient properties of language. In the third chapter in this section, I consider what we learn from the deaf children about the age-old question: Is language innate? I suggest that, although tired and worn, the word “innate” has not yet outlived its usefulness. What it needs is to be freed from genetics and tied to developmental resilience. I end by reviewing the resilient properties of language with an eye toward what we learn from them about how all children learn language.

## **How the Book Can Be Used in a Course on Language Acquisition**

This book is not a stand-alone textbook, that is, it was not intended to be used as the sole text in a course on language acquisition. However, I did write it with students of language in mind. I believe that the phenomenon of children creating language can be used as an excellent teaching device to get students to think hard about what communication is and what “counts” as language. Ask your students to imagine what it would be like if there were no language to learn and they wanted to make their wants, desires, and thoughts known to others. What would they do? It’s an exercise that forces students to think about what is essential to human language.

Because the phenomenon of language creation is so compelling, the book can be used as an extended case study that supplements a traditional text in both upper level undergraduate courses and introductory graduate courses. I have used it along with readings from primary sources, each week supplementing the readings on how children learn a piece of conventional language, say syntax, with the chapters of this book describing what children can do in the syntactic domain without a conventional language—and it has worked remarkably well.

I realize, however, that there may not be time in a course to read the whole book. As a result, I have tried to write the book so that pieces can be assigned on their own. And I have some recommendations for how the book can best be used in this way.

The first five chapters offer an overview of the problem of language-learning and can be used for this purpose. Because my focus is on the properties of language that are resilient, I have reviewed literature and highlighted topics that are often treated peripherally in traditional texts. For example, to my knowledge, no text on language acquisition has a chapter on how children learn different languages across the globe—traditionally, cross-linguistic facts are scattered throughout the text where relevant. But I think something very important can be learned by thinking about the learning

problems children face when acquiring different languages—and, of course, by figuring out what's resilient across these variations and what's not. As another example, learning sign language in most texts is relegated to a chapter near the end of the book on atypical language-learning. Its lessons are rarely integrated into the main story of how children learn language. My focus on resilience makes a chapter of this sort central to the enterprise. So the first five chapters provide a short introduction to language acquisition taking a perspective that is slightly different from, but clearly complementary to, the perspective typically taken in textbooks on how children learn language.

How then can the rest of the book be used in a course on language acquisition? I suggest to prospective teachers that Chapter 6 be used to introduce the communication problem that faces these deaf children and that the other chapters in Part 2 be assigned according to the particular emphasis of the course. For example, if it's methods and the problems of description that you'd like to emphasize, Chapter 7 describes how to go about analyzing an unknown system that may not even be there, and thus presents the "how to" problem in an unusual and instructive light. If you'd like to focus on words and their composition, Chapters 8 and 9 form the basics, supplemented by Chapter 12 which is where nouns and verbs are discussed and Chapter 13 which is where you'll find a discussion of generics. If the focus of the course is syntax, Chapters 10 and 11 describe the structures children impose on the sentences they create and Chapter 12 describes how this system develops over time. If you'd like to focus on the functions of language, Chapter 13 describes the uses that the children's invented language serve, uses that go well beyond making requests in the here-and-now—to talking about past, future, and hypothetical events; to making generic statements about classes of objects; to telling stories; to talking to oneself; and even to talking about talk. Finally, if you'd like to focus on the role that environmental input plays in language-learning, Chapter 14 describes the unconventional input that these language-creating children receive from their parents and Chapter 15 takes a different approach to the same problem by looking at language-creating across the globe (on the assumption, which turns out to be correct, that the children are doing their creating in very different worlds).

Another possibility is to skip Part 2 entirely and assign Chapter 16 which summarizes the resilient properties of language described in Part 2 and speculates about how these properties help children learn conventional languages. Chapter 16 is the heart of the book and indeed provides a roadmap of Part 2. Chapter 17 explores what happens when adults who already have language are forced to create a gesture language, and again encourages students to think about what language is and why it looks the way it does. Chapter 18 is a discussion of innateness and language-learning and therefore can be assigned along with Chapters 14 and 15 to continue the discussion of the importance (and nonimportance) of linguistic input in language-learning (it can even be used to foster discussions of innateness independent of lan-

guage acquisition in the context of a broader course on developmental psychology). Chapter 19 is a brief summary of what the phenomenon of gesture creation tells us about how all children learn language.

Because I think the phenomenon of gesture creation is instructive not only for experts in the field, but also for people who do not routinely think about language, I have tried to make the book accessible to readers who have no knowledge of language or linguistics. However, in order to make a convincing case that the deaf children in our studies really have invented a system that looks like language, I have to show you that their gestures can be described in the terms that work so well to describe natural languages. So I do have to use some linguistic terminology. But I've described the children's structural patterns minimizing linguistic jargon whenever possible and explaining technical terms when it has not been possible to avoid them. My goal has been to give you a feel for language as it comes out the hands of a child.

Throughout the book, I use the term "we." It is not the royal "we" to which I refer, but rather the collaborative "we." All of the studies on the deaf children, from the earliest studies with Lila Gleitman and Heidi Feldman to the latest with Susan Gelman, Carolyn Mylander, Ming-yu Zheng, and Lisa Gershkoff-Stowe, were done working closely with others. It is my good fortune that I have had so many smart and insightful colleagues and students with whom to think. Whatever insights about language-learning have been gained by studying deaf children of hearing parents were achieved through endless hours of watching and thinking with others. I offer this book as another step in the process of collaboration, in the hope that others will find the questions raised here worthy of continued probing and thinking.

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PART

# I

## THE PROBLEM OF LANGUAGE-LEARNING



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# 1

## CHAPTER

# Out of the Mouths of Babes

The fact that children learn language so effortlessly at a time when tying their shoes is a real hurdle makes language-learning appear miraculous. Children are faced with the seemingly difficult task of learning a complex symbolic system, one that varies from culture to culture in seemingly arbitrary ways. We have all had the experience of listening to a foreign language fluently spoken by a native speaker—it feels to us, although not to the speaker, that there are no breaks in the flow. Where are the words? Where do the sentences stop and start? This is the first task that faces young children, discovering the units of the language they are to learn.

In addition, children must learn how the units of their language are combined. When children produce utterances that they have never heard before, and that follow the patterns of the language they are witnessing, we know that they have learned something about the underlying regularities that make English English, Swahili Swahili, or American Sign Language American Sign Language. Children hear particular sentences, yet they acquire rules. Moreover, every child hears a different set of particular sentences, yet they all acquire the same rules and in approximately the same sequence. This is the wonder of language acquisition.

To begin to understand this miraculous process, we will take a brief tour through the steps children follow in acquiring language, beginning with their discovery of the sounds of language.

### ☐ **Discovering the Units of Sound**

When we speak, we run words together without reliable pauses between them, which is what gives listeners who don't know the language the feeling

that there are no breaks in the stream. How then do native language-users parse the language they hear into recognizable units? Adult listeners use their knowledge of regularities in the sound structure of the language to predict the boundaries of units like words. Since sound structure differs across language, knowledge of regularities in one language may not be useful in identifying boundaries in another language. Infants thus need to learn the particular features of the sound structure of *their* native language in order to be able to find words in the stream of talk that is addressed to them. When do they accomplish this feat?

Much to everyone's surprise, infants know something about the language they are to learn on the day they are born. Newborn babies born to French-speaking mothers listened to tapes of French and Russian speech and sucked on a wired nipple while doing so. The babies sucked more—and, by inference, were more aroused—when they listened to the French tapes than when they listened to the Russian tapes. Babies who had not heard French during their prenatal months showed no such effect (Mehler, Jusczyk, Lambertz, Halsted, Bertoncini, & Amiel-Tison, 1988). What the babies appear to have learned about French during those months in the womb was its prosodic structure (its intonation contours, or “music”); when the speech samples were filtered so that *only* the prosodic cues remained, the findings were unchanged. Thus, babies are already attuned to the music of their mother's tongue on day 1.

However, babies do not become sensitive to the particular sounds of their native language until the second half of their first year. Babies start out ready to learn any language—an essential characteristic since, in principle, they could be exposed to any of the world's languages, present or future. Babies are able to make essentially all the discriminations in sound contrasts that languages across the globe require. But sometime during the latter part of the first year, the ability to discriminate between contrasts *not* found in the infant's native language fades. (Adults are only able to hear those contrasts used in their particular language and can no longer hear the rest.) For example, Hindi and Salish have consonant contrasts not found in English. Surprising those who believe that adults always know more than children, infants learning English are able to make these Hindi and Salish discriminations, adult English-speakers are not. However, the infants are only able to do so during their first year—by 12 months the ability fades and they begin to listen like adult English-speakers. Importantly, the ability to discriminate these contrasts does *not* fade if the infant is exposed to input that makes use of the contrasts—infants learning Hindi or Salish are still able to make the discriminations in their respective languages at 12 months (Werker & Tees, 1984). Babies start to fail to make discriminations among vowels (as opposed to consonants) that are not found in their language even earlier (perhaps as early as 6 months; Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992).

By 9 months, infants can recognize words in their language independent of prosodic cues. English and Dutch have very similar prosodic characteristics. They differ, however, in phonetic and phonotactic structure (that is, in which sounds are produced in the language and how those sounds combine). For example, the [r] in English words is very different from the [r] found in Dutch words (a phonetic difference). English allows [d] to occur at the end of a syllable while Dutch doesn't, and Dutch allows [kn] or [zw] to begin syllables while English doesn't (phonotactic differences). When presented with a spoken list of English and Dutch words, 9-month-old English-learners listen longer to the English than the Dutch words. In contrast, 6-month-old English-learners show no preferences (Jusczyk, 1993). By 9 months, babies have learned enough about the sound structure of their language to prefer their own language to others, even those that have the same "music."

While learning to listen to sounds, infants are also learning to produce them. Infants do not produce what we might recognize as words until they are approximately 1 year old. However, long before then they use their voices in changing ways. They begin by using their voices to cry reflexively and to make vegetative sounds; they then coo, laugh, and begin to play with sound. Sometime around 6 to 9 months, infants begin to babble (Oller & Lynch, 1992)—they produce true syllables, often in a reduplicated series of the same consonant-vowel combination, for example, [dada] or [mamama]. Later still, infants begin to produce variegated babbling in which the range of consonants and vowels expands and sounds no longer need to be reduplicated (Stark, 1986). The child is now adding prosody to strings of babbles and, as a result, begins to sound like a native speaker (as long as you're not listening too closely).

Indeed, it is at this point (around 8 months) that native listeners can begin to identify an infant as one who is learning their language. For example, when they heard tapes of 8-month-old babbling, French speakers were able to tell the difference between French babies' babbling and Arabic or Chinese babies' babbling (deBoysson-Bardies, Sagart, & Durand, 1984). When the infants' babbles were closely examined by trained linguists, the French babies were found to display lengthenings and softer modulations than the Arabic and Chinese babies, who exhibited other characteristics that were found in the languages they had been hearing for 8 months (deBoysson-Bardies, 1999). Thus, by the end of the first year, children are beginning to speak, and listen, like native users of their language.

## Starting With the Word

All natural languages, spoken or signed, are structured at many levels. Meaningless units (phonemes) combine to create morphemes, the smallest

meaningful units of a language, which in turn combine to form words, phrases, and sentences. Having made significant progress in learning the sound system underlying their language in the first several months of life, children are then free to tackle larger units. Regardless of the language learned, children tend to enter the system of larger units at the level of the word, rather than the morpheme or sentence. Between 10 and 15 months, children produce their first words, typically using each word as an isolated unit. Children then proceed in two directions, learning (1) that the word can be composed of smaller, meaningful parts (morphology), and (2) that the word is a building block for larger, meaningful phrases and sentences (syntax).

What is a word? Consider a child who wants a jar opened and whines while attempting to do the deed herself. This child has conveyed her desires to those around her, but has she produced a word? A word does more than communicate information—it stands for something; it’s a symbol. Moreover, the mapping between a word and what it stands for is arbitrary—“dog” is the term we use in English for furry four-legged canines, but the term is “chien” in French and “perro” in Spanish. There is nothing about the form of each of these three words that makes it a good label for a furry creature—the word works to refer to the creature only because speakers of each language act as though they agree that this is what it stands for.

At the earliest stages of development, children may use a sequence of sounds consistently for a particular meaning, but the sequence bears no resemblance to the sound of any word in their language. These “proto-words” (Bates, 1976) are transitional forms that are often tied to particular contexts. For example, a child uses the sound sequence “brmm-brmm” every time he plays with or sees his toy truck. In fact, a child’s proto-word need not be verbal at all—gesture works quite well. For example, a child smacks her lips every time she feeds her fish, or flaps her arms when she sees a picture of a butterfly (Acredolo & Goodwyn, 1985, 1988; Iverson, Capirci, & Caselli, 1994). Indeed, some children rely heavily on gestural “words” to communicate with others at the early stages.

Sometime around 18 months, children’s vocabularies reach 50 words (Nelson, 1973), and they continue to add an average of nine words a day throughout the preschool years (Carey, 1978). Children’s most common words are names for people and pets (“mama,” “Metro”), objects (“bottle”), and substances (“milk”). These nominal terms are among the earliest terms children learn, along with social words (“want,” “no,” “bye-bye”). Adjectives (“hot”) and verbs (“go,” “up”) are part of a young child’s repertoire, but tend to be rare relative to nouns (Gentner, 1982; Goldin-Meadow, Seligman, & Gelman, 1976; although children learning languages other than English may show the noun bias less than English-learners, e.g., Korean; Gopnik & Choi, 1995; Mandarin; Tardif, 1996).

It is, of course, not trivial for the child to figure out exactly what adults mean when they use a word like “dog” or “run” (let alone abstract terms