

Second Language Acquisition Research Series

SECOND LANGUAGE ACQUISITION AND THE **CRITICAL PERIOD HYPOTHESIS**

Edited by David Birdsong

Second Language Acquisition and the Critical Period Hypothesis

Edited by

David Birdsong
University of Texas



Routledge

Taylor & Francis Group
New York London

First published in paperback 2014
First edition published 1999
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

© 1999, 2014 Taylor & Francis

The right of David Birdsong to be identified as author of this work has been asserted by him in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data
Second language acquisition and the critical period hypothesis /
edited by David Birdsong.

p. cm. — (Second language acquisition research)
Chiefly papers presented at a conference held Aug. 1996,
Jyväskylä, Finland.

Includes bibliographical references and index.

1. Second language acquisition — Congresses. I. Series.
P118.2.S428 1998 401'93-dc21

ISBN: 978-0-8058-3084-2 (hbk)

ISBN: 978-0-415-74508-6 (pbk)

ISBN: 978-1-4106-0166-7 (ebk)

Typeset in ITC Stone Serif by
RefineCatch Limited, Bungay, Suffolk, UK

Printed and bound in Great Britain by TJ International Ltd, Padstow, Cornwall

Second Language Acquisition and the Critical Period Hypothesis

Second Language Acquisition Research: Theoretical and Methodological Issues

Susan Gass and Jacquelyn Schachter, Editors

- Tarone/Gass/Cohen • Research Methodology
in Second-Language Acquisition
- Schachter/Gass • Second Language Classroom
Research: Issues and Opportunities
- Birdsong • Second Language Acquisition
and the Critical Period Hypothesis

Monographs on Research Methodology

- Yule • Referential Communication Tasks
- Markee • Conversation Analysis

CREDITS

Figures 2.1, 2.2, 2.3, and 2.4 are reprinted from Christine M. Weber-Fox and Helen J. Neville, "Maturational Constraints on Functional Specializations for Language Processing: ERP and Behavioral Evidence in Bilingual Speakers," *Journal of Cognitive Neuroscience*, 8:3 (May, 1996), pp. 231-256. Copyright 1996 by the Massachusetts Institute of Technology. Reprinted with permission.

Tables 6.1 and 6.3 are adapted from Theo Bongaerts, Chantal van Summeren, Brigitte Planken, and Erik Schils, "Excellente tweede-taalleerders en uitspraakverwerving," *Gramma/TTT* 4 (1995), pp. 87-102. Copyright by ICG Publications. Adapted with permission.

Table 6.2 is reprinted from Theo Bongaerts, Chantal van Summeren, Brigitte Planken, and Erik Schils, "Age and Ultimate Attainment in the Pronunciation of a Foreign Language," *Studies in Second Language Acquisition*, 19:4, pp. 447-465. Copyright 1997 by Cambridge University Press. Reprinted with permission.

Table 6.3 is adapted from Theo Bongaerts, Chantal van Summeren, Brigitte Planken, and Erik Schils, "Age and Ultimate Attainment in the Pronunciation of a Foreign Language," *Studies in Second Language Acquisition*, 19:4, pp. 447-465. Copyright 1997 by Cambridge University Press. Adapted with permission.

Note: Versions of Table 6.3 appear in both *Gramma/TTT* and *Studies in Second Language Acquisition*.

Tables 6.4, 6.5, and 6.6 are adapted from Marie-José Palmen, Theo Bongaerts, and Erik Schils, "L'authenticité de la prononciation dans l'acquisition d'une langue étrangère au-delà de la période critique: les apprenants néerlandais parvenus à un niveau très avancé du français," *Acquisition et Interaction en Langue Étrangère*, 9 (1997), pp. 173-191. Adapted with permission.

PREFACE TO THE PAPERBACK EDITION

Since its publication in hardbound form in early 1999, *Second Language Acquisition and the Critical Period Hypothesis* has found its way into the hands of students and researchers around the world. As a measure of the book's impact, each of the six chapters has been cited dozens of times. According to Google Scholar, the average number of citations per chapter, as of September 2013, is more than 170, and the volume itself has received close to 400 cites.

In large part, continued scholarly interest in the book has derived from two factors. The first is its balanced representation with respect to the controversies surrounding the Critical Period Hypothesis for second language acquisition (CPH-L2A). Three chapters argue in favor of the hypothesis, and three against. Today, the battle lines of the dispute are still drawn, with many of the same combatants engaging one another, and others having entered the fray.

Another dimension of the book's persistent appeal is its focus on two types of evidence that remain at the core of CPH-L2A debate. One major variety of evidence is the degree and frequency of nativelikeness versus non-nativelikeness among late learners at the L2A end state. In one fashion or another, every one of the six chapters examines L2 ultimate attainment in terms of (non-)nativelikeness.

Under the CPH-L2A, the possibility of nativelike ultimate attainment in L2 decreases with age of acquisition (AoA) because of maturationally conditioned deficiencies in the mechanisms responsible for language acquisition. Long (1990) stipulates that the CPH-L2A can be falsified by evidence of across-the-board nativelikeness (i.e., nativelikeness with respect to the knowledge, production, and processing of all features of the L2) in a single late L2 learner. This evidence, be it behavioral or brain-based, must be obtained by microscopic scrutiny; it does not suffice for a late L2 learner to be mistaken for a native speaker under casual observation or under simple task demands. Thus, falsification of the hypothesis would require "scrutinized nativelikeness" over all imaginable comparisons of late L2 learners with natives (Abrahamsson and Hyttenstam, 2009).

On the other side of the issue are researchers who point out that the two languages of a bilingual are constantly interacting with, and influencing, one another. By virtue of this natural feature of bilingualism—and not because of maturationally based learning deficits—comprehensive monolingual nativelikeness cannot reasonably be expected in either the first language (L1) or the L2 (Ortega, 2009; 2013). Consequently, among users of two languages, the CPH-L2A is effectively insulated from falsification. Taking the logic a step farther, extreme L1 attriters, who have completely “lost” their L1 and have no ongoing contact with, or use of, their L1, would arguably not be subject to L1-L2 mutual influence. If nativelikeness were observed in this population, the putative maturational basis of AoA effects would be questioned; conversely, non-nativelikeness would be consistent with the CPH-L2A. To date, evidence for nativelikeness among extreme L1 attriters, in particular international adoptees, is mixed (Pallier et al., 2003; Hyltenstam et al., 2009). From an orthogonal perspective, the incidence of nativelikeness among these—and any other—L2 learners may hinge on motivation to be taken for a native speaker by true natives, and on social-psychological factors such as degree of identification with native speakers of the L2. For contrasting positions taken on the nativelikeness issue, see Abrahamsson and Hyltenstam (2009); Birdsong and Gertken (in press).

The other principal type of evidence underlying the CPH-L2A debate concerns the geometric and temporal characteristics of the function that relates AoA to measures of proficiency or other learning outcomes. This consideration is taken up in the chapters by Bialystok and Hakuta; Eubank and Gregg; Flege; and Hurford and Kirby.

Non-linearities or changes of slope in the AoA/L2 proficiency function are suggestive of qualitative changes in the nature or effectiveness of the system(s) responsible for L2 learning. If maturation is responsible for the geometry of the function, then slope deflections should line up temporally with known developmental milestones. Conversely, in the absence of such features (i.e., if the decline in L2 proficiency across the range of AoA is roughly linear), it is difficult to make a case for maturational effects. Those interested in pairs of studies on either side of the issue may wish to look at Hakuta et al. (2003) and Stevens (2005); DeKeyser et al. (2010) and Vanhove (2013).

To get a more general sense of researchers' stances in the CPH/L2A debate, readers may consult the following representative exchanges: DeKeyser (2000) and the response by Bialystok (2002); Marinova-Todd et al. (2000), the response by Hyltenstam and Abrahamsson (2001), and the subsequent reply by Marinova-Todd et al. (2001). Diverging views on evidence are expressed by Long (2005) and Rothman (2008). For an experimental study that looks at nativelikeness and critical period geometry, as well as the moderating variable of language-learning aptitude (a factor that is also considered by DeKeyser, 2000, and DeKeyser et al.,

2010), see Granea and Long (2013). Up-to-date critical reviews of age-related issues include DeKeyser (2013) and Muñoz and Singleton (2011).

As I noted in the Preface to the 1999 volume, "this is not the first time the CPH-L2A has been visited, nor will it be the last." The manifest accuracy of this prediction makes all the more significant the fact that the book's chapters haven't been forgotten over the intervening fifteen years of prolific research on the topic—nor, I wager, will they be forgotten fifteen years from now. And so the continuing success of *Second Language Acquisition and the Critical Period Hypothesis* is a testament to its contributors: Ellen Bialystok, Theo Bongaerts, Lynn Eubank, Jim Flege, Kevin Gregg, Kenji Hakuta, Jim Hurford, Simon Kirby, Helen Neville, and Chris Weber-Fox. To each of them, my admiration and my thanks.

David Birdsong

REFERENCES

- Abrahamsson, N., & Hyltenstam, K. (2009). Age of onset and nativelikeness in a second language: Listener perception versus linguistic scrutiny. *Language Learning*, 59, 249–306.
- Bialystok, E. (2002). On the reliability of robustness: A reply to DeKeyser. *Studies in Second Language Acquisition*, 24, 481–488.
- Birdsong, D., & Gertken, L. M. (in press). In faint praise of folly: A critical review of native/non-native comparisons, with examples from native and bilingual processing of French complex syntax. *Language, Interaction and Acquisition*.
- DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition*, 22, 499–533.
- DeKeyser, R. M. (2013). Age effects in second language learning: Stepping stones toward better understanding. *Language Learning Issue Supplement*, s1, 52–67.
- DeKeyser, R., Alfi-Shabtay, I., & Ravid, D. (2010). Cross-linguistic evidence for the nature of age effects in second language acquisition. *Applied Psycholinguistics*, 31, 413–438.
- Granea, G., & Long, M. H. (2013). Age of onset, length of residence, language aptitude, and ultimate L2 attainment in three linguistic domains. *Second Language Research*, 29, 311–343.
- Hakuta, K., Bialystok, E., & Wiley, E. (2003). Critical evidence: A test of the critical-period hypothesis for second-language acquisition. *Psychological Science*, 14, 31–38.
- Hyltenstam, K., & Abrahamsson, N. (2001). Comments on Stefka H. Marinova-Todd, D. Bradford Marshall, and Catherine E. Snow's "Three misconceptions about age and L2 learning." Age and L2 learning: The hazards of matching practical "implications" with theoretical "facts." *TESOL Quarterly*, 35, 151–170.

- Hyltenstam, K., Bylund, E., Abrahamsson, N., & Park, H.-S. (2009). Dominant-language replacement: The case of international adoptees. *Bilingualism: Language and Cognition*, 12, 121–140.
- Long, M. (1990). Maturation constraints on language development. *Studies in Second Language Acquisition*, 12, 251–285.
- Long, M. (2005). Problems with supposed counter-evidence to the Critical Period Hypothesis. *International Review of Applied Linguistics in Language Teaching*, 43, 287–317.
- Marinova-Todd, S. F., Marshall, D. B., & Snow, C. E. (2000). Three misconceptions about age and L2 learning. *TESOL Quarterly*, 34, 9–34.
- Marinova-Todd, S. F., Marshall, D. B., & Snow, C. E. (2001). Missing the point: A response to Hyltenstam and Abrahamsson. *TESOL Quarterly*, 35, 171–176.
- Muñoz, C., & Singleton, D. (2011). A critical review of age-related research on L2 ultimate attainment. *Language Teaching*, 44, 1–35.
- Ortega, L. (2009). *Understanding second language acquisition*. London: Hodder.
- Ortega, L. (2013). SLA for the 21st century: Disciplinary progress, transdisciplinary relevance, and the bi-multilingual turn. *Language Learning*, 63, 1–24.
- Pallier, C., Dehaene, S., Poline, J.-B., LeBihan, D., Argenti, A.-M., Dupoux, E., & Mehler, J. (2003). Brain imaging of language plasticity in adopted adults: Can a second language replace the first? *Cerebral Cortex*, 13, 155–161.
- Rothman, J. (2008). Why all counter-evidence to the Critical Period Hypothesis in second language acquisition is not equal or problematic. *Language and Linguistics Compass*, 2, 1063–1088.
- Stevens, G. (2005). Using census data to test the critical-period hypothesis for second-language acquisition. *Psychological Science*, 16, 341–343.
- Vanhove, J. (2013). The critical period hypothesis in second language acquisition: A statistical critique and a reanalysis. *PLoS ONE* 8(7): e69172. doi:10.1371/journal.pone.0069172

CONTENTS

Credits	vii
Preface to the Paperback Edition	ix
Chapter 1: Introduction: Whys and Why Nots of the Critical Period Hypothesis for Second Language Acquisition David Birdsong	1
Chapter 2: Functional Neural Subsystems Are Differentially Affected by Delays in Second Language Immersion: ERP and Behavioral Evidence in Bilinguals Christine M. Weber-Fox and Helen J. Neville	23
Chapter 3: Co-Evolution of Language Size and the Critical Period James R. Hurford and Simon Kirby	39
Chapter 4: Critical Periods and (Second) Language Acquisition: Divide et Impera Lynn Eubank and Kevin R. Gregg	65
Chapter 5: Age of Learning and Second Language Speech James E. Flege	101
Chapter 6: Ultimate Attainment in L2 Pronunciation: The Case of Very Advanced Late L2 Learners Theo Bongaerts	133
Chapter 7: Confounded Age: Linguistic and Cognitive Factors in Age Differences for Second Language Acquisition Ellen Bialystok and Kenji Hakuta	161
Author Index	183
Subject Index	189

CHAPTER ONE

Introduction: Whys and Why Not of the Critical Period Hypothesis for Second Language Acquisition

David Birdsong
University of Texas

The facts of adult second language acquisition (L2A) contrast sharply with those of first language acquisition (L1A). Whereas the attainment of full linguistic competence is the birthright of all normal children, adults vary widely in their ultimate level of attainment, and linguistic competence comparable to that of natives is seldom attested. A reasonable explanation for the facts of L1A and L2A is given by the Critical Period Hypothesis (CPH). In its most succinct and theory-neutral formulation, the CPH states that there is a limited developmental period during which it is possible to acquire a language, be it L1 or L2, to normal, nativelike levels. Once this window of opportunity is passed, however, the ability to learn language declines. Consistent with the CPH are the morphological and syntactic deficits of Genie, who was largely deprived of linguistic input and interaction until age 13 (Curtiss, 1977), as well as the desultory linguistic achievements of most adult L2 learners.

With a focus primarily on L2A, the present volume explores reasons why humans might be subject to a critical period for language learning. It also examines the adequacy of the CPH as an explanatory construct, the "fit" of the hypothesis with the facts.

To both of these dimensions, the contributors offer cutting-edge thought and experimentation. In examining the possible causes of a

critical period for L2A, the researchers bring the CPH into line with specifics of recent linguistic theory (Eubank & Gregg, chap. 4), discern neurofunctional differences between early- and late-learned language (Weber-Fox & Neville, chap. 2), and suggest sources of limits to language learning that are accommodated in modern evolutionary thinking (Hurford & Kirby, chap. 3). In questioning the explanatory suitability of the CPH-L2A, contributors bring new empirical data and argumentation to bear on matters once thought to be settled, such as the heuristic utility of the CPH-L2A (Flege, chap. 5), the shape of the age function, in theory and in fact (Bialystok & Hakuta, chap. 7), and the possibility of nativelike attainment in L2 pronunciation (Bongaerts, chap. 6).

These two approaches—one that ponders the etiology of a critical period for L2A and the other that disputes the adequacy of the CPH-L2A—are representative of current intellectual discourse. In according equal time to each of the approaches, this volume aims at a balance of scholarship pro and contra the CPH in the L2A context.

As a prolegomenon to these chapters, it is instructive to examine a few of the more prevalent formulations of the CPH-L2A, looking in particular at the proposed mechanisms of age-related effects. The introduction will also situate this book within the current intellectual climate of questioning the received wisdom relating to the CPH-L2A.

THE WHYS: VIEWS ON THE ONTOGENY OF TIME-BOUNDED SUCCESS IN L2A

Earlier references to "the" CPH are somewhat misleading, for there is no single CPH.¹ Rather, there are varied formulations, each of which takes a different ontogenetic tack on the limits of language acquisition. It is customary, however, to refer to them collectively, because, manifestly, they share the common denominator of determinism. That is, they assume a nonnativelike end state for late language acquisition and seek explanations for this outcome in developmental factors that inevitably affect all members of the species.

In this volume, each of the chapters addresses at least one of several critical period hypotheses as they apply to adult L2A. As a preview of these varied formulations of the CPH—and as an introduction to other,

¹Similarly, the present use of the term *critical period* is meant to encompass formulations of a weaker *sensitive period* as well. The latter is thought to be more gradual in offset, and to allow for more variations in end-state attainment, than the former (see Long, 1990). However, the present discussion applies equally to the strong and weak formulations, hence the use of a single label. For further distinctions between sensitive and critical periods, see Eubank and Gregg (chap. 4, this volume).

kindred proposals not mentioned in the chapters—this section offers sketches of some of the mechanisms that researchers have proposed as underlying age-related declines in language learning ability.

Loss of Neural Plasticity in the Brain

Because of progressive lateralization of cerebral functions and ongoing myelination in Broca's area and throughout the cortex, the neural substrate that is required for language learning is not fully available after the closure of the critical period. This formulation was originally proposed by Penfield and Roberts (1959), and later popularized by Lenneberg (1967), who postulated that the end of the critical period was marked by "termination of a state of organizational plasticity linked with lateralization of function" (p. 176). Variations on this line of thinking have been advanced for the L2A context (e.g. Long, 1990; Patkowski, 1980; Pulvermüller & Schumann, 1994; Scovel, 1988).

Lenneberg (1967) directed most of his argumentation to primary language acquisition. However, he made a brief foray into L2A and pointed to learners' progress as well as their shortcomings. Here, Lenneberg moved from brain-based to mind-based commentary, alluding to an appendix in his book—written by Chomsky—that outlines Universal Grammar (UG)-based formal similarities among natural languages. For adults learning an L2, Lenneberg (1967) invoked the presence of this mental "matrix for language skills" to square the facts of (partial) L2A success with closure of the critical period:

Most individuals of average intelligence are able to learn a second language after the beginning of their second decade. . . . A person *can* learn to communicate in a foreign language at the age of forty. This does not trouble our basic hypothesis on age limitations because we may assume that the cerebral organization for language learning as such has taken place during childhood, and since natural languages tend to resemble one another in many fundamental aspects (see Appendix [A]), the matrix for language skills is present. (p. 176)

For related thinking about the linkage of neurological development and the mental representation of UG, see Eubank and Gregg (chap. 4, this volume) and Jacobs (1988).

Loss of (Access to) the Language Learning Faculty

The closure of the critical period entails a loss of UG, a mental faculty consisting of innately specified constraints on the possible forms that natural language grammars may take. A weaker version of this approach suggests that UG continues to be mentally represented but for various reasons is no longer available or accessible to the language learner. It should be noted that, because the L1 grammar is an

instantiation of UG (see previous section), one can plausibly account for at least some of the headway that learners do make in L2A.

With the offset of the critical period, there may also be a loss of innate learning strategies presumed specific to the learning of language. These include the Subset Principle, which guides the learner to posit the most conservative grammar consistent with the linguistic input. By hypothesis, these epistemological components are the *sine qua non* of language acquisition; their absence essentially guarantees failure to attain nativelike competence. Thus the Fundamental Difference Hypothesis (Bley-Vroman, 1989) attributes the divergent end states of early L1A and late L2A to loss of, or lack of access to, UG and associated learning principles.

Principled inquiry concerning the role of UG in both the initial and end states of adult L2A comes in many forms (for a recent selection, see Flynn, Martohardjono, & O'Neil, 1997). One prominent line of thinking holds that invariant principles of UG are not lost in adult L2A; rather, what is problematic is the acquisition of L2 parameters: "Parameter values become progressively resistant to resetting with age, following the critical period" (Towell & Hawkins, 1994, p. 126). Simplistically, the difficulty in resetting parameters resides in having to "unlearn," in the sense of relinquishing the representation of a parameter having a unique, L1-based setting, and establishing in its stead a biunique setting compatible with both the L1 and the L2 (for elaboration on parameter resetting, see Eubank and Gregg, chap. 4, this volume). In a later section, I summarize a contrasting approach to unlearning under the connectionist model of acquisition.

Maladaptive Gain of Processing Capacity with Maturation

As children develop, they are increasingly capable of processing linguistic input. However, Newport (1990, 1991) argued that cognitive immaturity, not cognitive maturity, is advantageous for language learning. Young children's short-term memory capacity allows them initially to extract only a few morphemes from the linguistic input. Working within these processing limits, children are more successful than adults, whose greater available memory allows for extracting more of the input, but who then are "faced with a more difficult problem of analyzing everything at once" (Newport, 1991, p. 126). The benefits of starting small have been demonstrated in simulations of the acquisition of English morphology (Goldowsky & Newport, 1993). Similarly, Elman's (1993) connectionist model starts with limited memory, then undergoes *maturational changes* (incremental increases in memory capacity). Training of networks under this condition succeeds in processing complex sentences. If the starting point is a fully formed

adult-like memory, however, the complex sentences are not successfully processed by the network.

This "less is more" formulation of the CPH is apparently not confined to the domain of language acquisition: "The more limited abilities of children may provide an advantage *for tasks (like language learning)* which involve componential analysis" (Newport, 1990, p. 24; italics added). Nor is any loss of an innate language learning faculty implied: "the language acquisition capacity remains intact, but as children mature beyond the ages of four or five its function is impeded by the child's increasingly sophisticated cognitive abilities" (Meier, 1995, p. 613). In a similar vein of thought that specifically targets L2A, Felix's Competition Model (e.g., Felix, 1985) posits the coexistence of an intact UG and advanced domain-general cognition, and maintains that competition between the two systems results in victory for the latter. Mature domain-general cognition is thought to be ill-suited to the narrow, modularized task of acquiring language, hence the lack of success typically associated with adult L2A. The inappropriateness of certain mature cognitive mechanisms in the L2A context was explored by Birdsong (1994) and Bley-Vroman (1989).

Rosansky (1975) appealed to a Piagetian developmental model of cognition and argued that the emergence of Formal Operations during adolescence might forestall language learning. Although Rosansky's theoretical constructs differ from those of Newport, the reasoning of the two researchers is remarkably similar. For Rosansky (1975),

initial language acquisition takes place when the child is highly centered [i.e., in stages prior to Formal Operations]. He is not only egocentric at this time, but when faced with a problem he can focus (and then only fleetingly) on one dimension at a time. This lack of flexibility and lack of decentration may well be a necessity for language acquisition. (p. 96)

Use It Then Lose It

After childhood, unneeded neural circuitry and the language learning faculty it underlies are "dismantled" because the relevant neural tissue incurs metabolic costs (Pinker, 1994). This reasoning, whereby early language learning is biologically favored over later learning, is rooted in modern evolutionary thinking. Early learning of language is preferred in order that we may reap the benefits of linguistic communication over a longer stretch of our lifetime. So whereas our use of language continues through adulthood, the language learning faculty has served its purpose early on. To retain it would be uneconomical.

The evolution of our species has taken account of this one-shot utility. As Pinker (1994) argued:

Language-acquisition circuitry is not needed once it has been used; it should be dismantled if keeping it around incurs any costs. And it probably does incur costs. Metabolically, the brain is a pig. It consumes a fifth of the body's oxygen and similarly large portions of its calories and phospholipids. Greedy neural tissue lying around beyond its point of usefulness is a good candidate for the recycling bin. (pp. 294-295)

Hurford (1991) similarly accommodated the "use it then lose it" version of the language learning faculty within an evolutionary model: "The end of the critical period at around puberty is . . . a point where the selection pressure in favour of facilitating factors ceases to operate, because of success at earlier lifestages. . . . The 'light' goes out for lack of pressure to keep it 'on'" (p. 193).

Pinker (1994) speculated that the critical period for language acquisition is evolutionarily rooted in the more general phenomenon of senescence. Natural selection asymmetrically favors young organisms over older ones, assigning to youth the emergence of the lion's share of genetic features, which deteriorate at differing rates with increasing age. Using the example of lightning striking and killing a 40-year-old, Pinker noted that if a bodily feature had been designed to emerge after the age of 40, it would have gone to waste:

Genes that strengthen young organisms at the expense of old organisms have the odds in their favor and will tend to accumulate over evolutionary timespans, whatever the bodily system, and the result is overall senescence. Thus language acquisition might be like other biological functions. The linguistic clumsiness of tourists and students might be the price we pay for the linguistic genius we displayed as babies, just as the decrepitude of age is the price we pay for the vigor of youth. (p. 296)

Use It or Lose It

On the mental muscle metaphor, the language learning faculty atrophies with lack of use over time. Paltry progress in postadolescent L2A is clearly compatible with this view. Further, deriving from "use or lose" the inference that if the language learning faculty is used it will not be lost, this "exercise hypothesis" can also accommodate anecdotal accounts of individuals who start L2 acquisition early and continue to acquire foreign languages successfully into adulthood.

The exercise hypothesis was elaborated in greatest detail by Bever (1981). Under Bever's view, for acquisition of a given linguistic structure to take place, the systems of speech production and speech perception should work in tandem. In the absence of ongoing language learning activity, however, the two systems become progressively independent (with perceptive abilities outstripping productive abilities), because the *psychogrammar*, which normally mediates production and reception, ceases to function. (Bever's psychogrammar may be likened to a combination of UG, plus an organizer of acquired