INTERFERENCE

Interference is a generic term used to describe the disruptive effects of three sources of irrelevant information: concurrent distractors, currently irrelevant memories, and strong but situationally inappropriate responses. All three sources tend to slow correct responding and reduce accuracy. In general, older adults are more susceptible than young adults to each source of interference (Hasher, Zacks, & May, 1999; McDowd, Oseas-Kreger, & Filion, 1995).

Older adults' vulnerability to interference from environmental *distraction* can be seen in visual search, categorization, problem-solving, and reading tasks. When searching for a target in a visual display, the presence of distractors impairs older adults more than it does young adults (e.g., LePage, Stuss, & Richer, 1999). Age differences in errors or slowing will increase with the number of distractors (e.g., Scialfa, Esau, & Joffe, 1998), unless targets and distractors are easily distinguished (e.g., Zeef, Sonke, Kok, Buiten, & Kenemans, 1996) or occur in predictable locations (see Madden & Plude, 1993, for sparing factors).

Age differences in distractor interference are particularly large if the distractors are related to the targets. For example, older adults' reading times are slowed more than those of young adults by distracting words scattered throughout a passage of text (Dywan & Murphy, 1996), and older but not younger adults are further slowed if distractors have meanings related to the passage. In some cases, distractors strongly related to the target can lead to age differences even if they appear in predictable locations. For example, older adults are more affected than younger adults by the nature of distractors in the Remote Associations Test, which asks participants to find the connection between three words (e.g., ship, outer, crawl: SPACE). Distractor words congruent with the solution (e.g., rocket, atmosphere, attic) result in greater benefits for older adults than for young adults, and incongruent distractors (e.g., ocean, inner, floor) result in greater costs (May, 1999). Both younger and older adults are slower to identify the category a word belongs to if that word is flanked by distractors from a different category than if it is flanked by distractors from the same category, but this difference is especially large for older adults (Shaw, 1991). In short, interference from distractors will have a greater impact on older adults' ability to identify and use target information than on that of younger adults. Exceptions occur only when distractors are very distinct from targets.

Interference from distractors (here, irrelevant material that is similar to the target) will also differentially impair the ability of older adults to retrieve a target memory. The irrelevant information may have been learned before (*proactive interference* [PI]) or after (*retroactive interference* [RI]) the targeted information. For example, if a friend moves and changes phone numbers, it may be difficult at first to remember the correct phone number because the memory for the old number gets in the way. Conversely, after the new phone number is well learned, it may be more difficult to remember the previous number.

Interference in *memory* is traditionally studied by using lists of unrelated word pairs in which one element arbitrarily serves as the cue (stimulus) for recall of the other (response). At test, participants are given one of these words (the stimulus word) and asked to remember the other (the response word). Interference can be created by pairing the

stimulus word with additional response words in a list presented either before (PI) or after (RI) the to-be-remembered list.

A review of earlier work using this methodology confirms that older adults are more susceptible than young adults to both PI and RI (see Kane & Hasher, 1995). The few exceptions can generally be explained by differences in materials or methodology. These differences include floor effects and the use of list lengths, numbers of lists, or memory measures insensitive to age differences or "young" samples that were actually middle-aged. Proactive interference has also been studied by using other procedures (e.g., Brown-Peterson, release from PI). Here the findings are more mixed, with some investigations finding greater decrements for older adults, and others finding no age differences. Again, the lack of age differences in some studies may be due to methodology: Kane and Hasher (1995) found that those studies that did not show age differences used, on average, many more lists (25.1 lists) than studies that did (7.0 lists). They suggest that the use of many lists may have caused PI to build up for both young and older adults, making age differences difficult to discern.

Although few recent studies have directly addressed the issue of age differences in either PI or RI, they generally support the idea that older adults are more susceptible to both (e.g., LePage, Stuss, & Richer, 1999; May, Hasher, & Kane, 1999). Other studies have found age differences in the major mechanism underlying interference, competition between to-be-remembered information and similar but incorrect information. This type of competition can be investigated by varying the number of items associated with a memory cue. Increasing the number of items associated with a cue makes retrieval of any one of those items slower and more error-prone (Anderson, 1983). For example, learning three facts about an object (e.g., "The potted palm is in the lobby," "The potted palm is in the laundromat," "The potted palm is in the stairwell") makes retrieval of any one fact about that object more difficult than if only one fact is learned about an object (e.g., "The pay phone is in the hall"). The increase in difficulty as more facts "fan off" a single cue and compete with each other at retrieval is referred to as the fan effect. Older adults show larger fan effects than do young adults (Radvansky, Zacks, & Hasher, 1996). However, presenting multiple pieces of information in a way that allows their integration into a single scene (e.g., "The potted palm is in the hotel lobby," "The pay phone is in the hotel lobby," "The wastebasket is in the hotel lobby") eliminates competition and thus fan effects for both younger and older adults.

Older adults show greater competition from irrelevant information even when explicitly instructed to forget such information, as in directed forgetting studies. Successful directed forgetting is demonstrated by lower memory for "forget" items and greater memory for "remember" items, compared to conditions in which all studied items are to be remembered. Relative to younger adults, older adults remember more "forget" items as a proportion of the total number of items recalled and are more likely to intrude "forget" items when trying to recall "remember" words (Zacks, Radvansky, & Hasher, 1996).

Older adults are also more vulnerable to interference from previously learned behaviors. Interference of this sort is often assessed by the Stroop Test or the Wisconsin Card Sort Test (WCST). Interference in Stroop is measured by comparing the time needed to name the ink color of incompatible color words (e.g., green ink used to spell the word *red*) to that needed to name the ink color of simple stimuli (e.g., colored blocks). Participants must overcome a strong word-reading tendency in order to name the color; interference from the word information results in slower and more inaccurate naming than in the simple condition. Stroop interference is typically greater for older adults than for young adults (e.g., Comalli, Wapner, & Werner, 1962). In the WCST, participants match response cards to key cards on the basis of one of three dimensions (color, shape, or number); the dimension to be sorted on changes without warning after 10 correct trials. Older adults are more likely than young adults to persist in a previously correct but now incorrect response rule (e.g., Kramer, Humphrey, Larish, Logan, & Strayer, 1994). Similarly, older adults have difficulty withholding a category decision when, on rare occasion, a signal sounds to do so (May & Hasher, 1998).

In general, then, older adults are more vulnerable than young adults to interference from concurrent distractors, from currently irrelevant memories, and from strong but inappropriate habitual responses. Age differences in interference proneness may con-

tribute to age differences on many tasks, including those measuring working memory (May, Hasher, & Kane, 1999; McDowd, Oseas-Kreger, & Filion, 1995). In some cases, reducing the role of interference in a task can reduce or even eliminate age differences in performance (e.g., May et al., 1999; Radvansky, Zacks, & Hasher, 1996). Finally, recent work has shown that some age differences in interference can be exaggerated when participants are tested in the afternoon, rather than the morning, a finding tied to age differences in circadian arousal (May, 1999).

CINDY LUSTIG
LYNN HASHER

See also
Cognitive Processes
Learning
Memory and Memory Theory

The Encyclopedia of Aging

A Comprehensive Resource in Gerontology and Geriatrics

Third Edition

GEORGE L. MADDOX, PhD
EDITOR-IN-CHIEF

Robert C. Atchley, PhD, **J. Grimley Evans,** MD,
Robert B. Hudson, PhD, **Rosalie A. Kane,** DSW,
Edward J. Masoro, PhD, **Mathy D. Mezey,** RN, EdD, FAAN,
Leonard W. Poon, PhD, and **Ilene C. Siegler,** PhD
ASSOCIATE EDITORS

Sheri W. Sussman
MANAGING EDITOR

SPRINGER PUBLISHING COMPANY • NEW YORK

Springer Publishing Company, Inc.
536 Broadway
New York, NY 10012-3955

Cover design by Susan Hauley
Acquisitions Editor: Sheri W. Sussman
Production Editor: Helen Song/Elizabeth Keech

01 02 03 04 05 / 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

The encyclopedia of aging: a comprehensive resource in gerontology and geriatrics / George L. Maddox, editor-in-chief.—3rd ed.
p. cm.
Includes bibliographical references and index.
ISBN 0-8261-4842-5 (set)
1. Gerontology—Encyclopedias. 2. Aged—Encyclopedias. I. Maddox, George L. II. Title.
HQ1061 .E53 2001
305.26'03—dc21

00-049663
CIP

Printed in the United States of America by Maple-Vail Book Manufacturing Group