COGNITIVE AGING PSYCHOLOGY: SIGNIFICANT ADVANCES, CHALLENGES, AND TRAINING ISSUES

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This study reports the results of a brief survey that focused on the past accomplishments and future challenges that face the specialized field of cognitive aging. The survey was mailed to 90 senior cognitive developmental psychologists. Respondents (N = 36) were asked to identify (a) significant advances in the field that have occurred in the past half-century, (b) challenges that face those working in the field, and (c) important content areas that should be addressed when training young researchers who plan to enter the field.

One hallmark of a mature scientific discipline is the extent to which it reflects on its own research endeavors in order to evaluate where it has been, and to anticipate where it is headed. This intradisciplinary form of research has been described as *reflexive*, in that methodologies used in the laboratory or the field are systematically applied to study those who conduct the scientific work (Barker, 1989; Hershey, Wilson, & Mitchell-Copeland, 1996; Shadish, Fuller, & Gorman, 1994). However, surprisingly few articles published in the area of psychology have focused on the past accomplishments and future directions of this field (Estes, 1993). The present study takes just such a focus by examining researchers' perceptions of the development of the field of cognitive aging psychology.

In order to establish the advances that have taken place in a field, it is important to establish when the field was founded. It is always a difficult task to pinpoint the beginning of a scientific discipline; however, cognitive development work was certainly being conducted

before the turn of the twentieth century. Galton had collected sensory and performance data from more than 9,000 adults by the late 1890s (Boring, 1950). In 1922, Hall published a text on adult develop- ment in which he characterized age differences in a variety of mental abilities. However, there are good reasons to set the founding of the field after the end of World War II given the occurrence of two land- mark events. The first was the founding of the laboratory on Aging and Performance at Cambridge University in 1946. According to Welford (1993), researchers in that lab had the applied goal of under- standing the practical limitations of adults' cognitive abilities in the workplace. That line of work, in turn, provided a boost to cognitive developmental work in general. In that same year, the American Psychological Association founded the division on Maturity and Old Age, which would later become known as the division on Adult Development and Aging (Birren & Birren, 1990). That event, perhaps more than any other, served to establish a significant organizing force that would focus and guide the research efforts of cognitive aging psychologists throughout the latter half of the 20th century. Therefore, for the purposes of the present study, we take the view that the field of cognitive aging has just turned the corner on its 50th birthday. The completion of five decades of research provides a suffi- cient window in time to reflect on the development of the field.

In the present study we surveyed a group of senior cognitive aging researchers to identify significant advances that have occurred since the mid-1940s, and significant challenges the field has yet to face. In addition, we asked the respondents to indicate what they felt were significant issues that should be addressed in training the next gener- ation of cognitive aging researchers.

METHOD

Participants and Sampling Procedures

Respondents were identified using the proceedings handbook of the 1996 Cognitive Aging Conference (Smith, 1996). Our sampling pro- cedure was admittedly biased. Our goal was to identify a set of well- known, established researchers who have made substantial contributions to the field of cognitive aging. We believed that such individuals would be more likely than most to have unique per- spectives or insights on how the field has developed, and where it was headed. A review of the list of attendees from that conference yielded

a set of 74 names, all of whom had published papers in the area of cognitive aging and possessed significant name recognition. The names of 16 additional researchers who had not attended the conference were added to the pool of survey recipients following review of a number of recent edited books and texts on cognitive aging psychology. This resulted in a final prospective sample of 90 individuals, all of whom held primary positions at universities or research institutions.

Surveys were sent via first class mail to researchers employed in the domestic United States ($N = 74$; 82%), and via e-mail to those individuals who resided outside the United States ($N = 16$; 18%).[1] Four surveys were returned as undeliverable, which reduced the potential pool of respondents to 86. Of those 86 individuals, 36 returned completed surveys yielding a 42% overall response rate, a figure that is within expected limits for a survey of this kind (Yu & Cooper, 1983).[2]

Materials and Scoring Procedures

Each survey packet contained a copy of the questionnaire, a self-addressed stamped envelope, and a cover letter. The cover letter explained that the survey was conducted as a student honors project for an upper division psychology course at a large Midwestern university. Participants were ensured that their responses would remain totally anonymous.

The survey consisted of three brief, open-ended questions: (1) What do you consider to be the two most *significant advances* seen in the field of cognitive aging in the past fifty years?; (2) What are the two most *significant challenges* facing the field of cognitive aging in the foreseeable future?; and (3) What do you see as the most significant issues to be addressed in *training young researchers* entering the field of cognitive aging? Following each question were six blank response lines; however, some participants required additional space to formulate their responses.

Response categories were developed for each question based on question-specific patterns seen across the full set of responses. In all but a small number of cases, subjects reported two significant advances, two challenges which the field has yet to face, and two

[1] Response rates did not differ appreciably for the two different mailing techniques (regular mail, 44%; E-mail, 33%).

[2] In a study of response rates for different types of surveys, Yu and Cooper (1983) found that the mean response rate to a mail survey of this type was 47% ($SD = 19.6$).

significant training issues. This resulted in a total of 72 responses for
the *advances* and *challenges* questions and 66 responses for the *train-
ing* item.[3] In a small number of cases, a response appeared to fit into
more than one category. In these situations the most appropriate
response category was selected based on a consensus among the four
investigators. For each question, separate categories were created for
responses that totaled greater than 5% of all answers submitted.
Responses that failed to yield more than this minimum criterion were
combined into a miscellaneous or other category.

RESULTS AND DISCUSSION

Significant Advances

Nine different coding categories were created to accommodate
responses to the significant advances question, which read as follows:
''What do you consider to be the two most significant advances seen
in the field of cognitive aging in the past fifty years?'' In descending
order of responses, the coding categories included (a) advances in
research on cognitive slowing, (b) statistical and methodological
advances, (c) neurological advances, (d) advances in theoretical
issues, (e) advances in specific theoretical constructs, (f) advances in
the inter-relations between and distinctions among cognitive pro-
cesses, (g) advances in the distinction between normal and pathologi-
cal development, (h) advances in research and communication, and (i)
an ''other'' category. Figure 1 contains a chart that indicates the per-
centage of responses for each of the above coding categories. Sample
responses from each category are shown in Table 1 in order to
provide the reader with a general sense of the nature of the replies
submitted.

Somewhat surprisingly, the most often suggested advance involved
what is known about age-related changes in speed of processing.[4]

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[3] Two individuals provided more than the requested two answers to the significant
advances question, and seven respondents provided more than two answers to the sig-
nificant training issues question. In order to prevent any one individual from differen-
tially influencing the outcome of the survey, in all nine cases these additional answers
were eliminated from the pool of responses. Moreover, six other individuals provided
only one response to the training question, resulting in a reduced set of 66 responses
for that item.

[4] Normally, responses to the cognitive slowing category would have been included
as part of the ''specific constructs'' category. However, so many individuals indicated
that the theory of cognitive slowing was itself a significant advance that it was
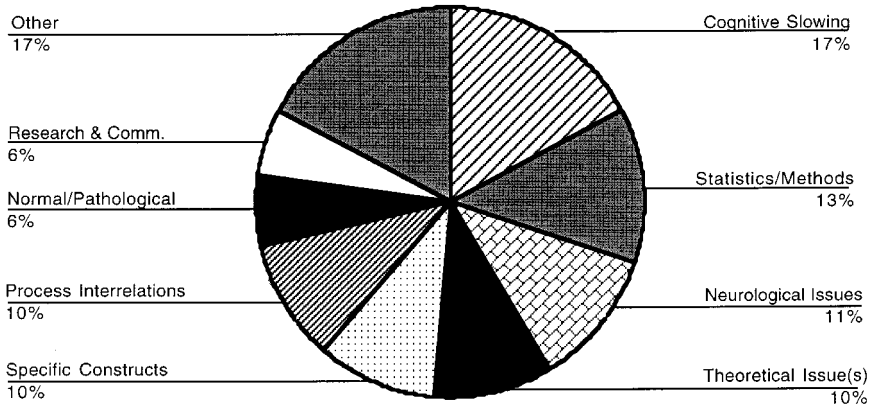separated into its own category.

FIGURE 1 Percentage of responses associated with each of the eight signifi-
cant advances in the field of cognitive aging in the last fifty years.

However, looking across the responses included in Table 1, it is clear
that different individuals conceptualize the value of research on cog-
nitive slowing differently. Some see the theory of cognitive slowing
as a "model" theory of adult development, whereas others view it as a
default hypothesis for age-related changes in cognitive processing.
Other respondents commented on the nature of advances in the sta-
tistical and methodological techniques used to quantify age-related
changes. Often cited examples of advances in this category were
developments in multivariate techniques, particularly structural
equation modeling. In the area of neurological advances, most
respondents pointed to recent and emerging linkages between cogni-
tive theory and research in the areas of neuropsychology and neuro-
physiology.

Three other categories each captured 10% of the responses: theo-
retical issues, specific constructs, and the inter-relations between and
distinctions among cognitive processes. In some respects, responses
to all three categories are similar in that they highlight advances in
theory. The theoretical issues category includes responses that focus
on theoretical advances in the absence of a particular content area,
whereas in the specific content category, responses include advances
in a particular content domain (e.g., implicit/explicit memory). A
number of respondents highlighted the inter-relations between theo-
retically defined constructs, such as the interdependency between

TABLE 1 Sample Responses to the Question: ''What Do You Consider to Be the Two Most Significant Advances Seen in the Field of Cognitive Aging in the Past Fifty Years?''

Cognitive slowing
- Identification of generalized slowing as a major component of age-related losses.
- Using models of slowing and processing speed as default hypotheses for assessing age-related changes in specific types of memory or cognitive function.
- The speed-of-processing and general slowing theories (both as theories and as targets to be shot at).
- Recognition of the illusions of ''normal aging'' that are created by Brinley plots and other nonsense.
- The concept of speed of processing—a simple but powerful variable accounting for much of performance variance.

Statistical and methodological advances
- Use of more sophisticated statistical techniques that permit multivariate approaches to research (e.g., LISREL).
- Improving methods (regression designs; structural models).
- Better overall research methodologies (sampling, tasks, analyses, designs).
- The emergence and use of multivariate statistical techniques.

Neurological advances
- Development of an understanding of neural change.
- Integration of traditional cognitive methods with neuropsychological methods.
- Identification in the brain of certain cognitive aging substrates.
- Technological advances in brain imaging, and so on.
- Links between cognition and neurophysiology.

Theoretical issues
- Move away from a pure decline model of cognitive aging to a gain/loss model.
- Development of positive models of cognitive aging.
- Move toward theories which go beyond mere description.
- Understanding of contextual contributions to cognition and old age.
- Focus on practical or contextual approach to the study of everyday cognition.

Specific constructs
- The use of inhibition as a theoretical mechanism to explain age-related deficits.
- Appreciation (by at least some researchers) of the distinction between performance and competence (i.e., plasticity).
- Isolated but important demonstrations of compensation.
- The implicit/explicit memory distinction.

TABLE 1 Continued

Inter-relations between and distinctions among cognitive processes
- Increased sensitivity to the issue of process dissociations.
- Understanding the distinctions between different kinds of cognitive capabilities. The differences in age-related curves has been a principle contribution to cognitive science from the adult development field.
- Acknowledgment of the fact that general and "modular" effects of aging need to be distinguished by adequate experimental and psychometric methods.
- Differentiation of knowledge-based and information processing-based aging trajectories (e.g., fluid/crystallized, expertise, skill acquisition).
- The finding that there is an apparent "cognitive" cascade in which slower processing leads to working memory deficits which, in turn, lead to fluid IQ deficits as we age.

Normal/pathological distinction
- Distinction between aging and diseases associated with aging.
- Better diagnosis and treatment of pathologies associated with aging.
- Separation of normal and non-normal changes.

Research and communication
- Advent of specialized conferences (Cognitive Aging Conference) and journals (*Aging & Cognition*).
- The establishment of the National Institute on Aging.

Other
- Increasing number of longitudinal studies.
- Development of a knowledge base of normal aging data.
- Large increase in the number of cognitive aging researchers.
- Technology has allowed us to study the aging process at a more molecular level.
- The melding of individual differences and experimental approaches to understanding cognition (this reflects the nature of "age" as a variable in our research).

knowledge-based and process-oriented abilities, or fluid and crystallized abilities.

Six percent of respondents indicated that significant advances have come in the form of the distinction between normal and pathological aging, and another 6% pointed out that the infrastructure and support within the field has changed, given the founding of the National Institute on Aging, increased funding for studies of adult development, and specialized journals that focus on cognitive aging. The "other" category included a wide variety of responses that

ranged from improvements in research technology to an increase in the number of researchers in the field.

Significant Challenges

Of the 72 responses to the question, "What are the two most significant challenges facing the field of cognitive aging in the forseeable future," roughly two-thirds focused on theoretical challenges, approximately one-quarter focused on applied challenges, and the remaining 15% of the responses were varied. Each of these three response categories are represented in Figure 2.

Responses that took the form of theoretical challenges were further subdivided into a set of five discrete categories: (a) metatheoretical challenges, (b) challenges that involve the understanding of individual differences, (c) integrative research challenges, (d) biological and/or neurological challenges, and (e) challenges which involve research on cognitive slowing. Together, responses to these five categories shown in Figure 2 sum to 100% of the theoretical challenges dimension. Descriptions of responses to the non-theoretical
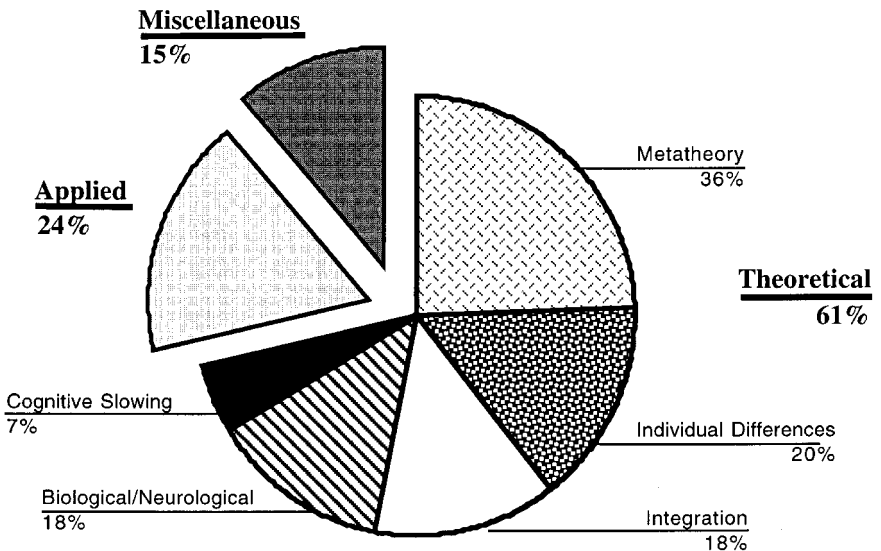

FIGURE 2 Percentage of responses associated with each of the three significant challenges that face the field of cognitive aging. The theoretical, applied, and miscellaneous dimensions sum to 100%, as do the five categories within the theoretical dimension.

TABLE 2 Sample Responses to the Question: ''What Are the Two Most Significant Challenges Facing the Field of Cognitive Aging in the Forseeable Future?''

Theoretical issues
Metatheoretical issues
- Find a simple mechanism that underlies decline in cognitive functioning.
- Synthesizing or pulling together the seemingly disparate lines of research in our field to come up with a unifying theory.
- To develop and formalize a small number to theories that have a wider range of explanatory power.
- Moving away from an information-processing orientation of cognitive aging toward a more ecologically oriented one.
- Search for a common cause.

Individual differences
- Recognition of the wide range of individual differences in the aging of cognition.
- Understanding factors that contribute to individual differences in cognitive development and decline over adulthood.
- The ''biological-challenge'': What are the biological factors that ultimately lead to general and specific age effects, and to what degree are these modulated through experiential factors?
- Understanding between *and* within individual variation.

Integrative research
- Integration of data from a variety of domains to produce a coherent picture of aging.
- Coupling neurological data with behavioral data.
- Linking observed cognitive changes with underlying neurological processes.
- Integrating knowledge of cognitive/behavioral issues in aging with knowledge of physiological/biological/neuropsychological aging.

Biological/Neurological issues
- Determining biological correlates and neural substrates of normative age-related declines.
- Mapping the cognitive modularity of the aging mind with the physiological modularity of the aging brain.
- Developing parameter estimates for physiological processes.
- Understanding age-related differences and changes in brain-behavior relationships.

Cognitive slowing
- Taking into account overall processing speed differences.
- Specify the mechanism behind general slowing.
- How to localize specific cognitive changes amongst the backdrop of general cognitive slowing.

TABLE 2 Continued

Applied issues
- Applying the findings from basic research and doing the appropriate research to evaluate applications.
- To make findings accessible to the lay public—to actually affect the lives of aging people.
- Getting out of the lab and into the real world with some applications to the health and quality of the lives of older adults.
- The challenge has to do with the fact that the resources designed to support aging research are insufficient in the face of the graying population.
- Link basic research to real world problems.
- Applying research to non-lab settings.
- Understanding how to maximize cognitive functioning in the years following retirement.

Miscellaneous issues
- Need for increased federal funding for basic research.
- Develop an increased database on cognitive aging with respect to diverse ethnic populations.
- Training researchers to be well informed not only in the cognitive aging literature, but also in current research and theory in cognitive psychology, statistics and methods, and neuropsychology and neuroscience.
- Finding jobs in nonacademic settings for graduates; limited tenure track openings in academia.
- Differentiation of normal and pathological cognitive aging as the proportion of 80+ year-old individuals increases.

(applied and miscellaneous) challenges are discussed below. Sample responses for each of the significant challenge categories are contained in Table 2.

Somewhat more than one-third of all respondents who suggested that the field will face theoretical challenges in the coming years indicated that those challenges will be metatheoretical in nature. There was a lack of consensus, however, regarding the nature of those challenges. Some indicated that researchers should attempt to synthesize and refine existing theory into a simpler set of principles, whereas others suggested that we need to develop more comprehensive models of adult cognitive development. It was also suggested that existing theoretical models need to be made stronger by moving beyond descriptive research efforts in the direction of more explanatory models of cognitive aging phenomena.

A substantial number of responses, nearly 20%, indicated that the study of individual differences will represent a significant theoretical challenge. In this regard it was suggested that researchers need to address the "vast degree of individual differences" and "identify the causal factors which lead to individual differences." An additional

20% of responses indicated that researchers will face integrative challenges. In this category, however, there was a striking degree of consensus as to what needs to be integrated. Nearly all responses suggested that a primary task would be to integrate behavioral data with neurological, neuropsychological, and/or physiological research findings. In a related vein, nearly 20% of responses indicated that the field of cognitive aging will face primarily biological and neurological challenges. Specifically, it was suggested that researchers will need to better understand the physiological basis of age-related changes, and use new techniques (such as functional magnetic resonance imaging) to ''help unravel the puzzle of how cognition changes in adulthood.'' Finally, 7% of responses suggested that the further development of theory in the area of cognitive slowing would present a significant research challenge.[5]

Beyond the theoretical research dimension, nearly one-quarter of responses identified the need to conduct applied research as a major challenge. Nearly half of the responses in this category indicated a need for interventions that support the elderly, and research activities aimed at improving the quality of late life. The majority of remaining responses in the applied category indicated that researchers should work to apply established psychological principles to address significant, real-world developmental problems that occur over the adult life course.

Finally, nearly 15% of responses to the significant challenges question were classified as miscellaneous. Responses in this category ran the gamut from a need for information on ethnic diversity as it relates to cognitive functioning, to ensuring that jobs and funding will be available for cognitive aging researchers.

Significant Training Issues

There were 66 responses to the question: ''What do you see as the most significant issues to be addressed in training young researchers entering the field of cognitive aging?'' Replies to this question were classified into seven different categories: (a) breadth and multidisciplinary training issues, (b) issues related to the training of quantitative and research methods, (c) issues related to training in the neurosciences, (d) applied and real-world issues, (e) lifespan developmental issues, (f) training in grantsmanship, and (g) other training

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[5] Responses within this ''theoretical'' dimension only sum to 99% due to rounding error.

issues. Each of these response categories are represented in Figure 3. Sample responses for each category are contained in Table 3.

Nearly 30% of responses indicated that those who will enter the field of cognitive aging should be trained in both a broad-based and multidisciplinary fashion. Beyond a strong grounding in basic science, respondents indicated that students should be exposed to research in psychology, sociology, biology, computer sciences, neuro-psychology and neurophysiology. A number of responses within this category indicated that graduate students should not only be trained in a multidisciplinary fashion, but they also should be indoctrinated with an interdisciplinary research perspective that will allow them to think about their science in an integrative fashion.

The second largest response category highlighted researchers' concern that students receive strong training in quantitative and research methods. Respondents suggested that today's students need stronger training in mathematics, statistics, methodology and measurement. Another common response was that researchers-in-training need to be taught to use both correlational techniques *and* more traditional experimental methodologies.

Together, responses to the first two categories (breadth and quantitative/research methods) accounted for more than half of all responses submitted. However, five other smaller categories were identified. Respondents stressed the need for training in the neurosciences, with a particular emphasis on neurophysiology. They also indicated the need to train students to think about applied issues, so that they will have an appreciation for the practical relevance of laboratory research. Respondents suggested that graduate training should include a life-span focus on cognitive abilities, in order to
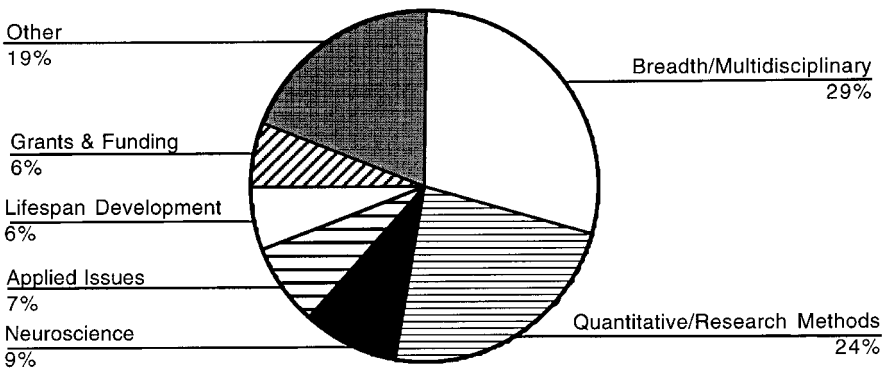

FIGURE 3 Percentage of responses associated with each of the seven issues that are important in training future cognitive aging researchers.

TABLE 3 Sample Responses to the Question: ''What Do You See as the Most Significant Issues to be Addressed in Training Young Researchers Entering the Field of Cognitive Aging?''

Breadth of learning; Multidisciplinary perspectives
- Broad exposure to biology, sociology, and psychology of aging.
- Ensure a broad, interdisciplinary training regimen.
- Development of a multidisciplinary perspective which encourages collaboration across professions (cognitive aging types must work with physicians, neuropsychologists, etc.).
- Strong grounding in basic science.
- Students today need to have excellent training in methodology, both univariate and multivariate statistics, and a thorough understanding of basic cognitive psychology. The major issue is the ''breadth–depth'' tension. Breadth is needed because of the nature of cognition and the understanding of what age differences mean in cognition. Depth is needed because to contribute in a productive way to the science, one must be at the cutting edge of an area.

Quantitative and research methods
- Ensuring they will be well grounded in a variety of methodological skills (both statistics and research design).
- Solid training in methodology and the limitations of methodology, especially non-experimental methods.
- Training at the PhD level in a multivariate approach and structural modeling.
- Training in both psychometric (correlational) and experimental methods.

Neuroscience
- Understanding of neurophysiological basis of cognition.
- Good training in cognitive theory and neurosciences.
- Provide young researchers with a more thorough understanding of neuroscience and aging.

Applied and real world issues
- Better training on obtaining data that speaks to real-world phenomena.
- Be able to communicate what you know to non-research oriented practitioners.
- They should understand the unique socio-cultural context of aging, and how that may interact with cognitive abilities.
- Educating students about the practical relevance of laboratory research.

Life-span and developmental perspectives
- Training them to think about cognitive aging as a life-span process.
- Focus on *developmental* perspectives of cognition, not just experimental.
- Ensuring they have a solid understanding of developmental theories as well as basic theories of cognition.

TABLE 3 Continued

Grants and funding opportunities
- To ensure that they are trained in grantsmanship. The ability to attract extramural funds is becoming increasingly important.
- Students need better training on how to qualify for funding.
- Need to learn how to establish a productive research program in an era of diminishing support.

Other
- Development of sensitivity in assessment of older adults.
- How to create cognitive interventions based on good theory.
- Teach a better foundation in individual differences.
- Reinforcing critical thinking and analytical reasoning in research and scholarship.
- Clear understanding of cohort differences and sampling problems.
- How to find jobs in applied and nonacademic settings.

fully appreciate the notion of psychological gains, peak performance, and decline. And finally, a number of individuals indicated that graduate students should be well trained to attract extramural funding in a climate of diminishing support for research in the behavioral sciences.

There were a number of responses which did not neatly fit into any of the above categories that were coded as "other." Among those were the suggestions that graduate students should be taught to ask good insightful questions, become exceedingly familiar with the (current and past) research literature on cognitive aging, and work to develop collaborative research relationships. Respondents also wrote that graduate students should be trained to think analytically (i.e., in terms of causes and effects), and they should be trained in interviewing and job search strategies in order to improve the odds of obtaining employment.

The comments of one respondent touched upon a number of the points made by others, when he suggested the following:

> Students today need to have excellent training in methodology, both univariate and multivariate statistics, and a thorough understanding of basic cognitive psychology. The major issue is the "breadth—depth" tension. Breadth is needed because of the nature of cognition and the understanding of what age differences mean in cognition. Depth is needed because to contribute in a productive way to the science, one must be at the cutting edge of an area.

Perhaps it is too ambitious a goal to believe that most students can be trained to possess both breadth and depth perspectives, in addition

to finely honed quantitative and methodological skills. Nonetheless, the respondents to this survey indicate that these are all worthwhile and important training goals that should be incorporated into the educational curriculum of future generations of cognitive aging researchers.

SUMMARY

Birren and Birren (1990) suggested that the growth of the field of adult development has been, to a great extent, empirically driven. These authors suggested that this developmental profile is more common in the field of gerontology than it is in the related field of child development. They went on to point out that "the emergence of integrative theory in the psychology of aging has been slow, perhaps because of the inherent complexity of the subject matter" (1990, p. 16). Responses to our survey, however, indicate that substantial theoretical development has occurred in the past half-century in the area of adult *cognitive* development. Despite that fact, respondents acknowledged that the development of metatheories and theoretical integration will serve as major objectives in the future, along with the goal of establishing research paradigms that link theory and application. Central to the success of these two goals will be the development and maintenance of training programs that teach young researchers two things: the skills necessary to produce quality science, and the insight and perspective required to select their research topics wisely.

REFERENCES

Barker, P. (1989). The reflexivity problem in the psychology of science. In B. Gholson, W. R. Shadish, R. A. Neimeyer, & A. C. Houts (Eds.), *Psychology of science : Contributions to metascience* (pp. 92–114). New York : Cambridge University Press.

Birren, J. E., & Birren, B. A. (1990). The concepts, models, and history of the psychology of aging. In J. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (3rd ed. ; pp. 3–20). New York : Academic Press.

Boring, E. G. (1950). *A history of experimental psychology* (2nd ed.). New York : Appleton-Century-Croft.

Estes, W. K. (1993). Concepts, categories, and psychological science. *Psychological Science*, *4*, 143–153.

Hall, G. S. (1922). *Senescence : The second half of life*. New York : Appleton.

Hershey, D. A., Wilson, T. L., & Mitchell-Copeland, J. (1996). Conceptions of the psychological research process : Script variation as a function of training and experience. *Current Psychology*, *14*, 293–312.

Shadish, W. R., Fuller, S., & Gorman, M. E. (1994). Overview. In W. R. Shadish & S. Fuller (Eds.), *The social psychology of science* (pp. 3–123). New York: Guilford Press.

Smith, A. D. (April, 1996). *Conference proceedings of the 6th biennial Cognitive Aging Conference*, Atlanta, GA.

Welford, A. (1993). The gerontological balance sheet. In J. Cerella, J. Rybash, W. Hoyer, & M. L. Commons (Eds.), *Adult information processing: Limits on loss* (pp. 3–10). New York: Academic Press.

Yu, J., & Cooper, H. (1983). A quantitative review of research design effects on response rates to questionnaires. *Journal of Marketing Research*, *20*, 36–44.