

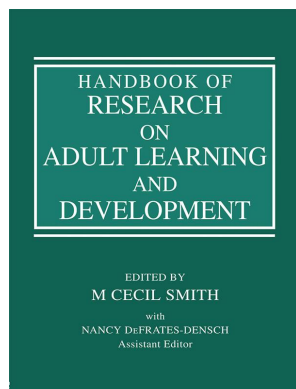
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AND
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Challenges for the Current Status of Adult Developmental Theories

A New Century of Progress

Fredda Blanchard-Fields and Antje Stange Kalinauskas

In order to understand learning in adulthood, we need to understand developmental changes across the latter half of the lifespan. The purpose of this chapter is to discuss a number of contemporary adult developmental theories that explain changes in different domains of functioning. For instance, strategies for dealing with a novel situation may be different for young and older adults as a function of changes in processing goals. When faced with a new situation, young adults may focus on developing and optimizing new strategies to adapt to the problem situation. Older adults, however, may draw upon an accumulated wealth of strategies in order to regain or maintain a viable solution. Adult development theories can provide us with explanations as to why and how individuals change such processing goals that impact the way they approach the problem.

The general framework for our chapter is a lifespan perspective on development. Baltes and his colleagues (Baltes, 1987, 1997; Baltes, Lindenberger, & Staudinger, 2006) have outlined general theoretical tenets of life-span development characterized by multidirectional, multidimensional, and multifunctional processes that involve the constant interplay of gains and losses within each life period. Applied to a learning situation this means that the learning of a certain skill can involve growth, but this may be at the expense of another skill, therefore implying loss.

By examining contemporary theories through the lens of a lifespan developmental perspective, we hope to illustrate that the core constructs listed above are more fully realized than in earlier thinking. For instance, research focusing on multidirectionality of development has been further enhanced by implementing statistical techniques assessing intraindividual variability. In this case, developmental growth can be distinguished from fluctuations in performance as later described in this chapter. Research focusing on multidimensionality of development has been enhanced with recent attempts to examine developmental linkages in different domains of functioning, such as emotion and cognition or health and cognition.

The lifespan approach takes a functionalist perspective on development. According to this view, the ultimate goal of development is to increase adaptation of the organism to its environment which is achieved through learning. Plasticity and intra-individual variability are key concepts within this perspective because they set the boundaries for the organism's ability to learn and as such adapt to its environment. One of the central questions of adult developmental theory is to understand the boundaries of plasticity. For instance, in the oldest old, the functional reserve capacity of the individual is declining and developmental gains are become increasingly more difficult to achieve. The dynamic of gains and losses, biology and culture need to be investigated within different stages of life to understand the full cycle of adult development.

Another common life-span-related thread that runs through contemporary adult developmental theories discussed in this chapter is that behavior and development are

multiply determined. At the simplest level, age is not the best predictor of behavior. Instead, behavior across the lifespan is determined by multiple forces, some of which are age-related (such as biological changes), differing opportunity structures in society, and changes in motivational orientations and emotional functioning. For example, researchers now acknowledge that cognitive change in older adulthood is influenced at multiple levels of analysis including declines in brain volume and density, the positive and negative effects of stereotyping, and deploying attention away from negative stimuli. Furthermore, investigation of these multiple forces on development has become more tractable as new technologies and research methods have evolved, such as brain imaging techniques and extensive multiple-burst micro-longitudinal studies.

This chapter provides an overview of contemporary theories and recent empirical findings of adult development while at the same time outlining future challenges that need to be addressed by these theories. We begin by discussing three factors that influence the development of theories, the availability of new methods of measurement and analysis, the emergence of new phenomena, such as the fourth age, and changes in the science-political agendas that influence the investment of resources into research. Next, several contemporary theories of adult development are described. Whereas we place some theories in their historical context to highlight how they have extended previous thinking in their respective areas, other theories are shown to reflect new and emerging perspectives on adult development and change. We discuss these contemporary theories and provide empirical examples of how they have been tested. Finally, in elucidating each of the newer theories, we suggest how new methods and empirical phenomena can provide challenges for theories of adult development.

Recent Scientific Trends Influencing Theory Development

Psychological theories are advanced when theory-inconsistent findings require the elaboration and refinement of older theories or sometimes the development of completely new theories (Kuhn, 1962). However, there are other factors that influence theoretical development including (1) the development and use of new methods of measurement and analysis that allow the investigation of both recurrent and emerging research questions, (2) the emergence of new phenomena, and (3) science-political agendas that influence the investment of resources into research.

In this section we focus on several noteworthy examples of how these factors have influenced current thinking in human development. First, we focus on neuroimaging as an example of a recent technology that allows the non-invasive investigation of brain functions. Second, we use the sample case of intra-individual variability to illustrate how new methods of data analysis can shape our understanding of developmental processes. Third, we discuss the impact of measures of everyday functioning, such as time-sampling studies that enable us to more closely examine psychological processes as they occur in everyday life. Fourth, we discuss the theoretical implications of the emergence of the fourth age as a likely extended phase of aging for most people. Fifth, we briefly describe how putting aging on the science-political agenda advances the field of adult development.

The Century of the Brain: Observing the Brain Working

The 21st century has been called the century of the brain. Recent technological advances, such as the development of functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI), allow us to study brain structure and functions using non-invasive

technologies. Neuronal correlates of behavior can be studied in living individuals. Neuroscientific approaches have been widely applied to research questions that deal with cognitive aging. However, recently researchers have used this technique to investigate processing preferences for emotional compared to neutral information in older adults (Mather, Canli, English et al., 2004). Research in the emerging field of social cognitive neuroscience has shown associations between neural structures and a variety of social cognitive tasks such as person perception, stereotypes, and theory of mind (Amodio & Frith, 2006; Ochsner & Lieberman, 2001). One of the challenges for adult development theories will be to incorporate these models and techniques into their thinking. Finally, the neuroscience approach has taken intervention research to new heights. Now, we cannot only observe change as a result of intervention at the behavioral level but also at the neurological level (Colcombe, Erickson, Raz et al., 2003).

Three approaches to the neuroscience of aging can be distinguished: The neuropsychological, the correlational, and the activation imaging approach (Cabeza, 2004). The majority of work in this area has focused on cognitive aging rather than including the entirety of adulthood. Therefore, we will focus in our discussion on this aspect of adult development. The neuropsychological approach compares the neuropsychological functioning of healthy older adults with adults showing certain pathological patterns. A good example is Parkinson's disease which is accompanied by dopaminergic deficits that affect the frontostriatal system and reduce, for instance, speed of processing. The primary objective of this approach is to identify neural mechanisms that are associated with both normal and pathological decline in cognitive functions. These findings stimulate theoretical development by describing influential factors that warrant theoretical explanation as to how and why these factors may cause cognitive decline as we age.

The correlational approach, on the other hand, tries to link cognitive and cerebral aging. It focuses on the correlation of cognitive behavioral data, such as executive functioning, with neural structural measures, such as white matter deterioration or brain volume. Data from this approach focus on the role of brain structure in explaining cognitive decline (Raz, 2000).

Finally, the activation imaging approach, tries to directly link functional brain data with cognitive behavioral data. This approach allows the *in vivo* investigation of changes in brain function as they relate to cognitive performance within individuals. For example, studies using this approach found that younger adults' brains show unilateral activation in their brains when they work on cognitive tasks whereas older adults' brains tend to show increased activation in both brain hemispheres (Cabeza, 2002).

Overall, as the sample case of research on cognitive aging demonstrates, theoretical development within the field of adulthood is enriched by neuroscientific methods in several ways. First, theories can be tested using neuropsychological approaches. For instance, the idea of selective allocation of attention can be tested by relating event-related potentials to behavioral data (Wood & Kisley, 2006). Second, changes in performance can be associated with both functional and structural brain variables to explain how the brain influences performance. This is not only applicable to change processes in older adults' brains, but could be also investigated in the maturing brains of adolescents and children. Third, research methods that focus on the architecture and functioning of the brain can help to explain why certain cognitive functions, such as well-practiced tasks, vocabulary, and wisdom can be preserved into old age while other functions, such as processing speed, decline rapidly as people age.

However, neuroscientific methods also have their limits. For instance, documenting activities in different brain regions does not necessarily imply that different psychological

processes are involved (i.e., decline in sensory motor functioning, vision and hearing may be similar processes but different regions of the brain). Nevertheless, advances in the field of neuroscience have major impacts on the development of theories of cognitive age because they reveal new findings for which psychological theories have to account and with which they must be consistent.

Statistical Innovations: A New Focus on Intra-individual Change

Past methodological debates have revolved around criticisms of cross-sectional designs comparing young and older persons as adequate tools for studying developmental change. It has been demonstrated that inter-individual differences between young and older adults cannot necessarily be attributed to changes that accompany age. For instance, many human phenomena are non-ergodic. Non-ergodicity refers to the fact that variations between persons (inter-individual variability) and variations within persons (intra-individual variability) are not equivalent (Molenaar, 2004). For example, if we would find that older adults prefer to learn in a face-to-face context, whereas younger adults prefer a computer-based instructional tool, this may reflect generational differences rather than aging-related effects. In this scenario, we would not expect young adults to change their preference as they get older. In other words, the inter-individual difference (i.e., between younger and older adults) would not translate into intra-individual differences.

Furthermore, adult developmental theories are informed by observed behavioral differences between age groups. Thus historically, intra-individual variability has often been considered measurement error or noise (Luszcz, 2004). There are two major problems associated with the cross-sectional approach. First, it is unclear whether behavior measured at a specific point in time is representative of the person's typical behavior. Second, it is questionable whether the differences found between people of different ages are equivalent to the changes that occur within people.

Recently, researchers have turned their attention back to studying the individual as the unit for the observation of developmental change by investigating intra-individual variability. This approach has also been referred to as the person-centered or idiographic approach (Baltes, Reese, & Nesselroade, 1977; Magnusson, 2001; Molenaar, 2004; Nesselroade, 2001, 2004). Again, we will use cognitive aging as an example field in which these ideas have been applied most radically. Here, variability that is due to non-reversible changes, e.g., development due to either learning or cognitive decline, needs to be distinguished from reversible short-term intra-individual variability that reflects fluctuation and reversible changes within individuals, e.g., moods and temporary states (Nesselroade, 2001).

Non-reversible changes are exemplified in developmental changes in cognitive performance over time (see Schaie, 1996). For instance, cross-sectional studies of change often overestimate the amount of change that occurs with age because they reflect inter-individual differences and perhaps cohort effects between age-groups rather than intra-individual change. Also, predictors of cognitive change in old age may differ depending on whether cross-sectional or longitudinal approaches are taken (Sliwinski & Buschke, 1999). Recently new statistical analytical procedures are available to analyze longitudinal data, such as Latent Growth Modeling (LGM) and Multi-Level Models (MLM) (Ghisletta & Lindenberger, 2004; Holt, chapter 5, this volume).

The second form of intra-individual variability is referred to as short-term intra-individual variability. It reflects a person's instability or fluctuation around the individual's mean score. This form of variability has received considerable attention in the

psychological literature in the past decade because it has been shown that short-term variability may be an important predictor of different outcomes over and above mean levels of performance (Hultsch, MacDonald, & Dixon, 2002; Li, Aggen, Nesselrode, & Baltes, 2001; Nesselrode & Salthouse, 2004; Ram, Rabbitt, Stollery, & Nesselrode, 2005; Salthouse, Nesselrode, & Berish, 2006). Moreover, measuring any performance using just single assessments becomes questionable as considerable short-term variation and inter-individual differences in short term variation are found even for highly reliable cognitive measures (Salthouse et al., 2006). A life-span perspective is necessary to interpret such variability: Early in the life span, a high amount of intra-individual variability may reflect plasticity and the potential to grow and advance (e.g., Baltes et al., 2006). However, increased intra-individual variability—that is fluctuation—in older adulthood may reflect a decrease in the integrity of the system (Hultsch & MacDonald, 2004; Li & Lindenberger, 1999). As such the intra-individual variability that is associated with temporary states is of high significance to understanding age-related changes that occur across the life span (Hultsch & MacDonald, 2004).

Theories of adult development need to incorporate both mean levels and variability in performance to account for age-associated developmental phenomena. However, it should be noted that there are limitations to the applicability of these designs in some domains of research. For instance, it has to be assumed that repeated exposure to the same material will not influence performance (i.e., practice effects). Basically, studies on intra-individual variability face similar criticisms as within-subjects designs in general (such as longitudinal studies).

Getting Back to “Real Life”: Studying Behavior Embedded in Social Context

There is a long history of research in adult development and aging that has embraced the importance of social context by translating behavior from the lab into daily life. Current research trends and methods have enhanced the way we incorporate social context into research designs. Recent advances in the stress and coping as well as the everyday problem solving literature are good examples of this. Both of these areas have utilized interviews and questionnaires to assess retrospective accounts of individuals’ actual behavior in handling stress or solving daily hassles and problems. With this approach, we have learned about changes in the way older adults cope with stress, regulate their emotions, and solve problems (Folkman & Lazarus, 1988; Blanchard-Fields, Jahnke, & Camp, 1995). However, these approaches suffer from inherent problems in retrospective accounts that rely on one’s memory and one’s conceptualization and image of the self.

As opposed to obtaining information retrospectively (e.g., how one handled an emotional situation or assessing perceived stress in life events) a growing trend is to take into consideration the fact that socio-emotional functioning, everyday problem solving, and decision making occur over an extended time frame. Such processes draw upon cognitive, physiological, emotional, and social resources in a time-related fashion. Thus, researchers are now paying particular attention to broadening the assessment of retrospective accounts of successful or unsuccessful outcomes, to solving problems or dealing with stress, to assessing age-related differences in day to day variability in handling ongoing stressful situations or problems. Thus, everyday functioning is related to adaptation to everyday environments by a) examining processes such as problem solving or coping with stress as they naturally occur in daily living and b) relating them to relevant and well-known adaptive outcomes in everyday functioning, both psychological and physiological.

For example, Almeida (2005) examines the measurement of daily stressors in older adults' lives using study designs that allow for the direct examination of how different stressors affect well-being and how personal characteristics influence the daily-stress process. Recent daily assessment methods include responding over the telephone, using personal digital assistants, and Internet reporting. Collecting information about ongoing daily activities circumvents problems with retrospective recall or interviews that can perpetuate memory distortions (Bolger, Davis, & Rafaeli, 2003). Most importantly, Almeida (2005) aptly points out that this methodology assesses within-person processes that chart the day-to-day fluctuations in processes such as stress and well-being, as well as to identify predictors, correlates, and consequences of these fluctuations. In this way, Almeida's research more precisely established the short-term effects of concrete daily experiences.

In sum, a strength of these approaches is that they fully embrace the life-span developmental tenet that behavior is multiply determined. For example, current research not only assesses outcomes of problem solving and coping with stress in terms of psychological well-being, but assesses outcomes at various levels of analysis such as biology in the form of cortisol patterns or allostatic load (Ryff, Singer, & Love, 2004). As indicated above, another strength of these approaches is that it moves beyond a snap-shot of behavior to examining behavior in process across time. There are of course limitations to examining behavior in the natural environment including lack of control over variables, technological limitations in the use of instruments such as PDAs, as well as the degree to which participants comply with procedural instructions. However, in concert with laboratory studies, the future of research in these everyday domains is quite promising.

Emerging Phenomena: Discovering the Fourth Age

Besides the development of new scientific methods, theory development in the field of human development is influenced by the emergence of new phenomena. One example of a relatively new phenomenon is the emergence of the fourth age as a normative condition for most people in our society. The fourth age starts roughly at age 80 or 85 (Baltes, 1997; Laslett, 1991; Neugarten, 1974; Suzman, Willis, & Manton, 1992).

The distinction between the third and fourth age of adulthood is important because most of the positive aspects of aging are found only for the third age. Adults in the third age (aged 65 to 80 years) demonstrate stability in some aspects of intellectual functioning, such as knowledge and expertise (Ackerman, 2000; Baltes & Staudinger, 2000; Schaie, 1996; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003), sustained functional reserve capacity and plasticity (e.g., Baltes & Willis, 1982), desirable levels of social-psychological functioning (Smith & Baltes, 1997), and implementing adaptive goals in daily life (e.g., Riediger, Freund, & Baltes, 2005). The third age is full of positive news.

However, recent empirical evidence has shown that the news for the old-old and oldest-old may not be as promising, i.e., the maintenance of high levels of psychological functioning is more difficult in the fourth age (Gerstorf, Smith, & Baltes, 2006; Smith & Baltes, 1999). Older adults in the fourth age are more likely to be multi-morbid, depressed, and demented (Baltes & Mayer, 1999), show lower levels of cognitive plasticity (Singer, Lindenberger, & Baltes, 2003), as well as decreases in happiness and meaning of life (Smith & Baltes, 1993). The vulnerabilities of very old age provide a challenge for theories of adult development. There may be an increasing need for adult developmental theories to capture the behavioral and psychological dynamics of losses in various domains of life.

Science, Politics, and Social Policy: Furthering the Aging Agenda

Policy makers and researchers alike have noted that the changing population (i.e., the graying of America) focuses us on questions regarding aging at a societal level such as, what effect does an aging workforce have on our economy? To answer this question we need to have a better understanding of the conditions in which the older population functions effectively and under what conditions they are challenged. Thus, for example, the National Institute on Aging has emphasized research that takes into consideration the dynamic interplay between changing biomedical, social, and physical environments. The underlying mission is to establish a knowledge base for maximizing active life and health expectancy with advancing age. Interdisciplinary research is central to establish this kind of knowledge base such as the integration of biology and genetics with behavioral and social sciences. Thus, the newly publicized NIH Roadmap Initiatives sees research teams of the future to be interdisciplinary bringing together biological, behavioral and social sciences to tackle the most pressing health problems. Subsequently, we have seen advances in cognitive neuroscience and aging, genetics, behavior, and aging, and multilevel interactions among psychological, physiological, social, and cultural factors.

For example, the National Institute on Aging has commissioned the National Academy of Sciences to create research agendas for future aging research. Two prominent books have resulted, one focusing on the aging mind (Stern & Carstensen, 2000), the other focusing on social psychology and aging (Carstensen & Hartel, 2006). Each of these research agendas emphasizes an interdisciplinary perspective, which removes the artificial barriers of separate disciplines. This has had far-reaching effects on forging new interdisciplinary research teams with a particular emphasis on the dynamics between a neuroscience approach and other disciplines such as neuro-economics, social neuroscience, and biodemography, among others.

Some Illustrations of Contemporary Theories of Adult Development

In this section we examine a number of areas of adult developmental research that are illustrative of the emerging and new developments in theories of adult development and aging discussed in the first section of the chapter. We focus mainly on areas that have recently benefited from methodological advances and/or have received considerable attention in the literature both in publication proliferation as well as from granting agencies. For each of the following areas, we describe the state of the art, as well as future directions based on the emerging trends.

As indicated above, there are numerous domains covered by adult developmental theories and it is beyond the scope of this chapter to cover them all. We selected theories from a few domains of functioning based on the following criteria: We tried to incorporate “hot topics,” areas that receive considerable attention in the literature, such as the relation between cognition and aging and neuroscientific underpinnings of cognitive change. This area is particularly illustrative of how methodological advances have enhanced our understanding of “cognitive aging.” Second, we incorporated areas of practical significance, such as the relation between health, cognition, and aging. This exemplifies how the granting agencies putting emphasis on research enhancing the quality of life of older adults has pushed the field forward. Similarly, research on the role of emotion in information processing in older adulthood is also a recent outcome of quality of life issues in older adulthood. Similarly, we describe self-regulation as an area characterized by substantive theoretical elaboration. Finally, we discuss social cognition

as a field with a new and growing status in the adult development and aging field. A number of these areas also illustrate how method, empirical findings, and theories work together in enhancing our understanding of adult development.

Emotion and Cognition

As witnessed in various chapters in this book, there is a pervasive and rich history of theory and research examining changes in cognition as we grow older and the extent to which age-related changes in cognition influence the effective functioning of the individual. However, until fairly recently there has been relatively less research on the role emotion plays in cognitive functioning in adulthood and aging. In the past, the focal emotion-related question was whether age differences in performance-inhibiting emotional states (e.g., test anxiety) accounted for age differences in cognitive performance. For example, classic studies by Eisdorfer (1968) argued that age differences in paired associate learning could be an artifact of “overarousal” of older persons in test situations. Historically, for most gerontologists interested in cognitive processes, emotional constructs were really little more than nuisance factors representing possible confounding influences on studies designed to measure age changes in cognition.

This was followed by a line of thinking that treated emotion and affect as a completely separate domain of psychological constructs relevant to aging (Schulz, 1985). This perspective generated a number of emotion-related theoretical questions. For example, researchers questioned whether emotional intensity dampened with increasing age (Diener, Sandvik, & Larsen, 1985; Levenson, Carstensen, Friesen, & Ekman, 1991).

New theoretical trends in research on emotion, cognition, and the aging mind have examined the role of emotions in terms of motivational goals, neurological changes, emotional complexity, and emotion regulation efficacy in cognitive and social cognitive functioning (Blanchard-Fields, 1998; Carstensen, Isaacowitz, & Charles, 1999; Labouvie-Vief, 2003). For example, researchers find that the regulation of emotions improves with age, which has stimulated interest in what accounts for this positive developmental trajectory (Blanchard-Fields et al., 1995; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Lawton, Kleban, Rajagopal, & Dean, 1992). The important conclusion coming out of many of these various lines of thinking is that emotion and emotion-related behavior show a positive developmental trajectory in contrast to the well-documented areas of cognitive decline (e.g., in executive processes, working memory).

Most recently, researchers are interested in how this positive developmental trajectory in emotion regulation translates into age-related differences in the way individuals process emotionally-laden information. This interface is reciprocal in that emotion and affect influence cognitive processes (i.e., memory, decision making, social judgments, learning) and cognitions also influence emotions (i.e., mood induction, cognitive appraisal, causal attributions). For example, the emotion-cognitive processing relationship has its roots in cognitive research advocating that when an emotion is experienced, information associated with it is primed and more likely to be recalled (e.g., Bower, 1991; Mandler, 1984; Ortony, Clore, & Collins, 1988). Research in the area of social cognition suggests that when, in a negative mood, individuals may become more critical and search for information to explain their negative feelings (for a review see Forgas, 1995). They tend to engage in more careful and deliberate information processing which leads them to more accurate judgment and decision making. These findings are consistent with the mood-as-input model of affect (Martin, 2001) which proposes that positive moods create a false sense of overconfidence, reducing a participant’s willingness to invest additional

resources to a task (i.e., increasing more heuristic processing). On the other hand, negative moods create a sense of insecurity within the participant, evoking a state of protective vigilance and a willingness to invest more effort to a task (i.e., a state of more systematic, detail-oriented processing).

It is important to note that the last six years have witnessed a mushrooming of theories and research on the interplay of cognition and emotion from an adult developmental perspective. As evidence, one only has to list current theories on cognition and emotion (e.g., Socioemotional Selectivity Theory and the positivity effect, Dynamic Integration Theory), or peruse the latest handbooks and overview chapters (e.g., Birren & Schaie, 2006; Hoare, 2006), recent trends in grant proposals, scientific presentations, and recent publications such as the special section on cognition and emotion in *Psychology and Aging* (Blanchard-Fields, 2005). Whereas emotion was once thought of as a confounding variable, it now commands attention in the cognitive aging and neuroscience literature.

Second, there are several areas of theorizing and research that have come to the foreground with respect to the interplay of emotion and cognition. They include the influence of emotion on cognitive processing, and emotion regulation and problem solving. We will briefly review theories and findings in each of these areas.

Is there a positivity effect with aging? An area that has received much theoretical attention in the extant aging literature is the positivity effect (Carstensen & Mikels, 2005) in which older adults show a processing priority for positive information leading to an accurate recall of positive information. In concert with the positivity effect, a negativity suppression effect (Blanchard-Fields, 2006) results in selective processing to minimize the processing of negative information. Research on both of these selective processing mechanisms has been spearheaded by a social cognitive and emotion-related research approach. The primary question asked is how shifts in goals and motivations change the way older adults process information. However, there is a third approach to selective processing that is most prominent in the social cognitive and neuroscience of aging literature: the negativity effect (Rozin & Royzman, 2001). This reflects a processing priority for negative information leading to an accurate recall of negative information. Given these three theoretical approaches, it is clear that there are a number of ways that individuals selectively process emotional information.

Empirical evidence in light of these theoretical approaches is mixed—reflecting the fact that the current status of research on emotion-cognition interfaces in adulthood and aging represent theories in transition. For example, evidence for older adults focusing more of their attention on positive information is not consistent. Yet, there is more consistent support for the negativity suppression effect, i.e., diverting attention away from negative information. Furthermore, researchers have suggested that an emotional enhancement in memory when processing negative information that is distinctive and salient, i.e., the negativity effect, is similar in both young and older adults or if there are any differences, this effect is diminished with age. Let us illustrate this transition along with recent methodological developments.

Let us briefly examine the evidence for a positivity effect. There are three major findings that suggest that a positivity effect should be prevalent in older adulthood (Carstensen, Mikels, & Mather, 2006). First, there is no evidence for age differences in the functionality of the emotion system. Second, there is evidence for a positive developmental trajectory for improved emotion regulation. Finally, with increasing age, there is an increase in the allocation of resources to emotion and emotion regulation (to enhance their current mood) when processing cognitive tasks. Thus, this motivational shift should have consequences on older adults' cognitive functioning (Carstensen et al., 2006).

The positivity effect is operationalized as age differences in the ratio of positive to negative material in information processing (Carstensen et al., 2006). Researchers find that older adults divert attention away from negative stimuli and in some cases attend more to positive stimuli (Mather & Carstensen, 2003, Experiment 1), i.e., older adults look more at happy faces and look away from angry faces in comparison to young adults. Older adults recalled and recognized more neutral images over negative ones in comparison with young adults and in one experiment they recognized more positive images (Charles, Mather, & Carstensen, 2003, Experiment 1); older adults performed better on a working memory task for positive emotional stimuli in comparison to negative emotional stimuli (Mikels, Larkin, Reuter-Lorenz, & Carstensen, 2005); older adults remembered more positive information during an autobiographical recall task (Kennedy, Mather, & Carstensen, 2004; Levine & Bluck, 1997); and older adults recalled their decisions in a way that was more positive than negative (Mather, Knight, & McCaffrey, 2005).

What happens when research focuses more on a negativity effect? There are studies that, in contrast to the positivity effect, find that older adults spend more time viewing negative stimuli (Charles et al., 2003) and display a negativity effect (Mienaltowski, Corballis, Blanchard-Fields, & Parks, 2006; Thomas & Hasher, 2006; Wood & Kisley, 2006). Grünh, Smith, and Baltes (2005) did not demonstrate a positivity effect in older adults, and instead, found evidence for a reduced negativity effect in older adults when remembering a list of words with negative, positive, and neutral valence. A negativity effect was found in both young and older adults in that they recalled more central elements of a negative scene than neutral peripheral elements. However, with instructions to pay attention to this tendency, only the young adults could overcome this encoding bias, whereas older adults could not overcome the memory trade-off (Kensinger, Piquet, Krendl, & Corkin, 2005).

Despite these mixed findings, we also need to address the important question of how these theoretical approaches inform adaptive functioning in the older adult. From an SST perspective, it is argued that a positivity effect is adaptive for older adults given that they typically have a constrained temporal horizon and thus are motivated to maintain emotionally satisfying experiences (Carstensen et al., 2006). By focusing on the positive to the exclusion of the negative, older adults may be able to create a positive and non-toxic environment that will not strain their limited cognitive as well as physiological resources. Furthermore, it may be the case that this heightened attention to positive emotional information to the exclusion of negative information (negativity suppression effect) may serve as an aid to processing complex material (Carstensen & Mikels, 2005). At a higher level, both of these benefits may operate in service of heightening emotional well-being in older adulthood (Carstensen & Mikels, 2005).

However, this form of processing may also lead to maladaptive effects. For example, it may impede the cognitive processing of important negative information such as information that should be taken into account when making a decision, e.g., the negative side effects of medication or a medical procedure. Along these lines, the counterpoint to the adaptive value of both the positivity and negativity suppression effects is that a negativity effect may be necessary for survival in that it is adaptive to process and attend to pertinent negative material to make adaptive decisions (Rozin & Royzman, 2001). Of course, there are maladaptive outcomes to this effect in that it could lead to overarousal and fragmentation. This could be particularly detrimental to older adults who have lower tolerance for high negative arousal levels (Consedine, Magai, & Bonnano, 2002).

In sum, when do emotions help older adults? Simply put, when they create a supportive context for cognitive processing, such as the distinctiveness of emotions, or when it

helps older adults process information, such as being able to reduce the number of false memories produced (Kensinger & Corkin, 2004; May, Rahhal, Berry, & Leighton, 2005). It also helps them focus on important information when making decisions (Löckenhoff & Carstensen, 2004; Mikels et al., 2005). When do emotions impede information processing? First, the answer is that emotions that are high in arousal can create interference. For example, situations high in arousal and high in executive control processing demands lead older adults to poor remembrance and processing of information (Kensinger & Corkin, 2004; Mather & Knight, 2005; Wurm, Labouvie-Vief, Aycocock, Rebucal, & Koch, 2004). Second, when older adults focus only on positive information their decision making can lead them to overlook important criteria for making a quality decision (Löckenhoff & Carstensen, 2004).

Future research will need to address important theoretical questions that arise from these discrepant findings. For example, can they be integrated into a larger theoretical framework? If emotion regulation and motivation is implicated in the processing of information, we need better outcome measures of the long term consequences in order to truly assess its adaptive value. If older adults are selectively allocating resources toward positive and away from negatively valenced information, we need direct tests of this process. What is the role of arousal? What are the emotion regulation strategies that produce selective attention to emotions? And finally, under what conditions is it important to attend to negative stimuli and when are positivity and negativity suppression effects more adaptive?

Emotion Regulation and Everyday Problem Solving. As indicated above, research that explicitly examines the extent to which older adults adaptively manage their everyday lives (at least through the third age, 65–80 years of age) reveals positive developmental trajectories in the functioning of older adults. In particular, such positive developmental trends are observed in the strategies and goals older adults use to solve socio-emotional problems and how they regulate emotions in the context of these problems. For example, Blanchard-Fields and colleagues highlight the socio-emotional nature of ill-structured problems, which are unpredictable and continually transforming. Individuals are asked to appraise the causes and demands of the situation and decide between many potentially effective solutions. In these circumstances, older adults are presented with the opportunity to draw on accumulated experience in socio-emotional realms to solve problems effectively. This could involve an immediate proactive plan of action or a combination of regulating one's emotional composure followed by such proactive action. Emotionally laden or interpersonal problems (e.g., the decision to place your mother in a nursing home), along with more instrumental problems (e.g., returning defective merchandise), are presented to participants. They are asked how they would solve the problems or rate the degree to which they would employ particular strategies. Finally, two general categories of strategies: instrumental strategies (e.g., direct action taken to solve the problem) and emotion-regulation strategies (e.g., suppressing feelings, not trying to alter an uncontrollable situation; confronting emotions) were examined.

Findings demonstrate that older adults tend to use a more diverse repertoire of problem-solving and emotion regulation strategies to handle problems that are high in emotional involvement and are interpersonal in nature (Blanchard-Fields, 2007; Blanchard-Fields et al., 1995; Blanchard-Fields, Chen, & Norris, 1997; Blanchard-Fields, Stein, & Watson, 2004). Furthermore, they not only use a variety of strategies, but they use them more effectively than young adults do as indicated by expert panel ratings of the strategies selected (Blanchard-Fields, Mienaltowski, & Seay, 2007). This can lead to a

more flexible application of problem solving and emotion regulation strategies to varying contexts. This is especially evident in the way older adults combine the use of emotion-regulation strategies with instrumental strategies in emotionally-charged situations (Blanchard-Fields, 2007; Watson & Blanchard-Fields, 1998). For example, older adults used different strategies depending upon the discrete emotion they felt. When they felt angry, they used proactive strategies such as confronting one's emotions. In contrast, when experiencing sadness they primarily used passive emotion-regulation strategies such as withdrawal. In other words, older adults demonstrate an appreciation of when to be proactive and instrumental, when to passively accept a situation, and when to use a combination of the two. Accordingly, research shows that older adults report that they are better at emotion regulation (Gross, Carstensen, Pasupathi, Tsai, Gøtestam Skorpen, & Hsu, 1997; Lawton, 2001), report fewer negative emotions in daily life (Carstensen et al., 2000), focus more attention on regulating the emotional aspects of their environment (Carstensen & Mikels, 2005), have the capacity to spontaneously react to negative-emotion-evoking events (Kunzmann & Grühn, 2005), and use more passive emotion regulation coping when a stressful event is appraised as uncontrollable in comparison with young adults (Blanchard-Fields & Irion, 1988).

Whereas findings in this area of research are promising with respect to documenting the adaptive functioning of older adults, they are not without their limitations—in particular the self-report nature of data collection. It will be important for future research to further identify criteria for effective everyday problem solving and emotion regulation by extending outcomes to psychological and physiological well-being. Thus, methodological advances in time sampling techniques will be useful to examine naturally occurring emotional and physiological states that occur in association with day to day problem solving and emotion regulation strategy use. In this way problem solving and emotion regulation can be observed as they occur over time. This approach can examine questions regarding the sequential ordering of strategy use and at what point in the problem solving process are specific strategies effective and non-effective. Finally, what are the mechanisms driving age-related differences in emotion regulation and use of everyday problem solving strategies?

One candidate is affect complexity. Gisela Labouvie-Vief (2003) has examined the construct of cognitive-affective complexity, which involves the balanced integration of emotion and cognition (Labouvie-Vief, 1998; Labouvie-Vief, Hakim-Larson, & Hobart, 1987). Cognitive-emotional complexity involves the ability to integrate emotional and cognitive aspects of self and the environment. At high levels of cognitive-emotional complexity, emotion is seen as jointly reflecting internal states and external contexts. This form of affective complexity demonstrates significant growth until middle adulthood and then shows a decline in later adulthood. It should be noted that this is contrary to research on the positivity effect in that low affect complexity could pose emotion regulation challenges to older adults.

Labouvie-Vief (2003) proposes that older adults who are motivated to maximize positive emotions (i.e., the positivity effect) may be individuals who need to compensate for a decrease in cognitive-affective complexity. Thus, they engage in optimization which is a relatively automatic response to emotions, including passive suppression of negative emotions in favor of positive emotions. Affect differentiation requires more elaborative and cognitive resources in order to differentiate knowledge about one's emotions and confront one's emotions. In support of this, Labouvie-Vief finds that cognitive-affective complexity declines with advancing age, and older adults tend to rely more strongly on optimization strategies than younger age groups.

This theoretical approach is further supported in that older adults who were lower in affect complexity were more likely to use passive emotion regulation strategies (Coats & Blanchard-Fields, 2006). It is suggested that those older adults who are less able to think in complex ways about the role emotions play in the context of everyday situations are the individuals who are more likely to rely on passive strategies. This is consistent with Labouvie-Vief's (2003) theory in that strategies such as avoidance and escape are more commonly endorsed by individuals of low cognitive-emotional complexity. Moreover, the ways that people regulated sadness in everyday problem situations depended upon how likely an individual was to outwardly express sadness. Those older adults who were more expressive when experiencing sadness were also the ones who were more likely to rely on more direct, action-related strategies. The role of affect complexity on problem solving and emotion regulation deserves increasing attention in future research.

Finally, there are other numerous candidates explaining age-related differences in emotion regulation that deserve future investigation including decreases in autonomic and cardiovascular reactivity to emotionally-charged events (Cacioppo, Berntson, Klein, & Poehlmann, 1998; Levenson, Carstensen, Friesen, & Ekman, 1991), motivation to maintain emotional balance related to a reduced future time perspective (Charles & Carstensen, 2007), and the disruptive effects of high arousal level (Wurm et al., 2004).

The Neuro-Scientific Influence on Theories of Cognitive Aging

Cognitive aging is one of the major domains of theories and research in adult development. Classic theories of cognitive aging have been developed based on behavioral data (Salthouse, 1996; Schaie, 1996). In the last years, the availability of neuro-scientific methods has stimulated research that allows us to study cognitive processes—and changes in these processes—in the living brain using non-invasive brain imaging techniques, such as functional magnetic resonance imagery (fMRI) techniques. This opens new opportunities to test models of cognitive aging. Brain research has become increasingly more relevant to cognitive aging research as the focus has shifted from studying pathologies of the brain, such as Alzheimer's or Parkinson's disease, towards investigating normal aging. In addition, neuro-scientific data are more informative for mainstream cognitive aging research because researchers interested in models of cognitive aging become involved in this research and drive advancement in the field by testing established theories using cutting-edge methods. Studies on the structure and function of the brain have therefore become more informative for cognitive aging research as they shift their focus from describing brain activation patterns towards explaining them. Still, because of the relative newness of the available methods the neuroscience of aging is a field that is in need of additional theoretical foundation. The field of cognitive aging is an example of a field that is driven these days by major advances in neuro-imaging techniques that have revealed findings that enhance our understanding of normal and pathological aging and require theoretical explanations (Cabeza, 2004; Hedden & Gabrieli, 2004; Kramer, Fabiani, & Colcombe, 2006).

One of the most influential findings is the greater non-selective activation of brain regions in the aging brain. Older adults' brains tend to show neural activation in regions that are not used by younger adults. Two models that attempt to explain these findings are the HAROLD Model by Cabeza (2002) and the CRUNCH Model developed by Reuter-Lorenz and her colleagues (Reuter-Lorenz, 2002; Reuter-Lorenz & Mikels, 2006). Both models assume that the main reason for greater activation in different brain

regions is the need for the recruitment of additional brain regions in order to successfully execute cognitive functions.

Younger adults show unilateral brain activation when they work on cognitive tasks. In contrast, older adults' brains tend to show increased activation in both brain hemispheres. This finding has led to the development of the HAROLD model, *Hemispheric Asymmetry Reduction in Older Adults* (Cabeza, 2002). The HAROLD model basically describes the empirical finding of reduced lateralization in prefrontal lobe activity in older adults. It also suggests that the function of the reduced lateralization is compensatory, that is additional neural units are being recruited to increase attentional resources, processing speed, or inhibitory control.

According to the *compensation-related utilization of neural circuits hypothesis* (CRUNCH), the aging brain adapts to neurological decline by recruiting additional neural circuits (in comparison to younger adults) to perform tasks adequately (Reuter-Lorenz, 2002; Reuter-Lorenz & Mikels, 2006). Two main mechanisms are suggested that the older brain uses to perform tasks: "More of the same" and "supplementary processes." When task demands are increased, more activation can be found in the same brain region relative to easier tasks. This effect can be found in younger adults as well as in older adults. In older adults neural efficiency declines, therefore, additional neuronal circuits are recruited earlier than in younger adults. "Supplementary processes" are taking place when different brain regions are activated to compensate for lacking processing resources. Reduced lateralization is one way of recruiting additional resources. In addition, however, compared to young adults' brains, older adult brains also show over-activation in different brain regions, suggesting that compensation can take different forms in the aging brain.

These findings have stimulated scientific debates on the mechanisms and functional adaptiveness of reduced lateralization. Whereas Cabeza and Reuter-Lorenz and colleagues interpret their findings in the light of a compensational framework, other researchers have challenged this interpretation by suggesting a cortical decline interpretation of the findings (Kramer et al., 2006; Logan, Sanders, Snyder, Morris, & Buckner, 2002). Both with respect to theoretical work and empirical data, the field of neuro-cognition is still in its early stage of development. Therefore definite conclusions about the adaptiveness and functionality of the observed patterns of increased brain activation cannot be drawn.

One of the most significant issues in the theoretical discussion of the implications of neuro-scientific findings is the relationship between brain patterns and behavior. Does the overactivation found in older brains relative to young adults reflect successful compensation or does it reflect greater cognitive deficits? Longitudinal research may be necessary to investigate the time course of neurological decline and additional recruitment of resources. Also, studying the effect of cognitive training on lateralization and over-recruitment could provide important insights into the functional meaning of brain activation changes.

Health and Cognition: Healthy Bodies, Healthy Minds

Aging is associated with a variety of declines in both cognitive and physical capacities. Historically, health has been conceptualized mainly as an outcome measure of successful development (Rowe & Kahn, 1987) or as a variable used to describe the difference between older and younger samples. In some studies, better than average health is considered to be a necessary condition for participants to be included in studies (Mather & Carstensen, 2003). Recently, this perspective has changed and health is increasingly investigated as a process variable—that can be influenced by life-style variables such

as exercise, and that influences other domains of functioning, such as cognitive performance, wisdom, and personality (Aldwin, Spiro, & Park, 2006). In this section, we focus on the relationship between health and cognition that has been investigated most recently using innovative intervention study designs.

The field of health and cognition is another example of a domain of research in which methodological advances led to new findings that require theoretical explanation. In recent years, the dynamic interplay between cognition and health has received increasing attention as studies linking physical exercise to level of mental functioning have reported evidence for a causal relationship between cardio-vascular fitness and cognitive functioning. The main support of a causal relationship between health and cognitive functioning comes from intervention studies demonstrating that exercise training increases cognitive performance (see Colcombe & Kramer, 2003, for a meta-analysis). Evidence for complex relations between physiological and psychological functioning has been discussed before, for example, in research in very old adults demonstrating a strong link between sensory and cognitive performance (Lindenberger, Scherer, & Baltes, 2001).

These findings require additional theoretical work linking body and mind mechanisms. It has been demonstrated that exercise is beneficial. However, the specific mechanisms of physical training need to be theoretically and empirically investigated. For instance, it has been suggested that some forms of exercise, such as aerobic activity training improve executive control functioning (Hall, Smith, & Keele, 2001). Moreover, the specific neurological changes associated with exercise need to be investigated in more detail (Colcombe et al., 2003).

The studies also may have implications for theories on cognitive plasticity. For instance, a certain level of physical plasticity may be required in order to achieve plasticity in cognitive functioning. Moreover, incorporating physical training into cognitive training studies might enhance the transfer of cognitive training. Finally, these studies strongly support the influence of lifestyle on cognitive functioning and therefore have important practical implications.

Self-Regulation and Control in Adult Development

The direction of adult development depends largely on actions an individual takes to shape his or her own development (Lerner & Busch-Rossnagel, 1981). Historically, developmental theories of self-regulation were influenced by general psychological action theoretical approaches (Carver & Scheier, 1999; Gollwitzer & Bargh, 1996; Little, 1989). A life-span perspective on self-regulation led to the development of developmental theories of self-regulation, such as the theory of selective optimization with compensation (Baltes & Baltes, 1990; Freund & Baltes, 2000), the theory of primary and secondary control, and the theory of assimilative and accommodative coping (Brandtstädter & Renner, 1990; Brandtstädter & Greve, 1994). The goal of our chapter is to provide a brief overview of these theoretically refined theories. For a more extensive recent review, see Boerner and Jopp (2007).

These three selected theories identified principles, such as selection, optimization, and compensation or primary and secondary control that are essential to successful development in all phases of life. These models suggest that the relative adaptiveness of engagement and disengagement strategies changes across the life span.

Selective Optimization with Compensation Theory (SOC). The theory of selective optimization with compensation was proposed by Baltes and Baltes (1990; Freund & Baltes, 2000) as

a meta-theory to describe processes that characterize development and facilitate successful aging. Three interrelated processes are distinguished: selection, optimization, and compensation.

Selection describes specialization. In general, specialization characterizes every form of development, from the specialization of embryonic stem cells into different organs, to the physiological fitness of a marathon runner, the structure of a cello player's left and right hands, the development of interests in acquiring knowledge in different fields, or the change in ways of thinking that occurs through life experiences or education. Selection is a necessary condition for development as time, money, and other resources are inherently limited. Once the domains of functioning are selected, the development of these domains can be more or less optimal. The process of *optimization* describes the refinement of means to achieve a desired outcome. Refinement can be achieved through practice or through the use of better means and resources. Finally, *compensation* is a process that is directed towards coping with a loss in means of goal attainment. If previously established means do not lead to the desired outcome, other means may be discovered that can serve the same goal. For instance, a retired CEO may volunteer to advise young entrepreneurs and as such keep his sense of professional efficacy.

The theory of selective optimization with compensation describes processes that can facilitate successful aging. Successful aging in this context involves the attainment of desired outcomes when faced with losses by optimizing the available resources and focusing them on the most important goals. Furthermore, the theory provides a meta-theoretical framework that can be extended in different ways for describing successful development across the lifespan and within different contexts (see B.B. Baltes & Dickson, 2001).

As a meta-model, SOC can be applied to different domains of functioning and levels of analysis. It has been most successfully applied to the domain of goals (Freund & Baltes, 2002). For instance, Li, Lindenberger, Freund, and Baltes (2001) found that older adults prioritized walking over memorizing, suggesting selection of the more important domain of functioning. In addition, when offered external compensatory aids, older adults optimized their walking while younger adults optimized their memorizing. Selective optimization is used to achieve goals. Some goals may change as people age. Ebner, Freund, and Baltes (2006) investigated general goal orientations towards either growth or maintenance/loss-prevention. They found that whereas younger adults focus on growth-related goals, middle-aged and older adults focus on maintenance and loss prevention goals. They argue that the maintenance/loss prevention focus in middle-aged and older adults may be related to the conservation of resources. To support this idea, they found in two experimental studies that when growth-oriented goals were introduced that required more resources than maintenance/loss-prevention goals, both older and young adults chose to focus on maintenance/loss-prevention goals. These findings are consistent with the theoretical ideas of SOC as they show that older adults selectively optimize the domains that are most important to them and that are adaptive.

The Theory of Primary and Secondary Control. The dynamics between engagement and disengagement processes in successful development were conceptualized in a different way by Heckhausen and Schulz (1995). The theory of control distinguishes two processes: primary and secondary control. Primary control is oriented towards the environment, that is, to achieve changes within the environment to achieve desired outcomes. Secondary control, on the other hand, focuses on the alteration of the self. For example, secondary control can include changing the value of goal attainment and disengaging from a certain goal or attributing failures of goal attainment to external causes.

Heckhausen and Schulz (1995) suggest that primary control is the foremost form of control that is employed because it enables the individual to shape his/her environment to fit particular needs and realize his/her developmental potential. However, secondary control strategies are seen as adaptive when primary control cannot be executed. Because of changing developmental potential of an individual at each segment of the lifespan, different stages in life require different control strategies. Specifically, as aging individuals are becoming increasingly restrained through biological and societal constraints, secondary control becomes an adaptive coping mechanism. Wrosch and Heckhausen (1999) conducted a study in which they investigated the deactivation of partner-relevant goals in late midlife. They found that while young separated adults were actively looking for new partners, people who were in late midlife focused on other social goals, such as the maintenance of friendships. This was interpreted as applying a secondary compensatory control strategy because, in later midlife, the opportunity structures (developmental deadlines) for finding a partner are decreasing.

Assimilative and Accommodative Coping. The issue of adaptiveness and coping with developmental challenges is also described in Brandtstädter's and colleagues' theory of assimilative and accommodative modes of coping with critical life events and life transitions: *Assimilation* is adjusting the environment to match one's personal preferences. *Accommodation* is adjusting one's personal goals to constraints of the environment (Brandtstädter & Renner, 1990; Brandtstädter & Greve, 1994). Both processes are seen as adaptive and related to life satisfaction. Assimilative and accommodative tendencies are measured at the dispositional level. Assimilation is reflected in tenacious goal-pursuit, whereas accommodative tendencies are characterized by flexible goal attainment. The balance between gains and losses becomes increasingly negative with old age (Baltes, 1987, 1997). Brandtstädter's model suggests that in order to cope with these developmental changes as people get older there will be a gradual shift from assimilative to accommodative modes of coping.

The three models reported suggest that self-regulation in old age is not characterized by universal disengagement from goals (Cumming & Henry, 1961) but rather by the selection of important domains of functioning. All of these theories describe the dynamic interplay between different strategies to successfully achieve goals. They all suggest that some strategies of goal-achievement may be more adaptive than others and that the specific adaptiveness of strategies changes across the life span as psychological, social, and biological resources change.

The field of self-regulation is an example for a domain of research that is theoretically well substantiated and is in the process of being fine-tuned with innovative studies and new methods, such as time-sampling studies (Riediger et al., 2005), eye-tracking studies (Isaacowitz & Light, 2006), and studies investigating specific behavioral choices instead of general behavioral preferences (Ebner et al., 2006). A challenge for all of these theories is the phenomenon of the fourth age with its prevalent losses in resources, the main question being how very old adults can age successfully.

Social Cognition

In the past sixteen years, there has been considerable growth in theory and research on social cognition and aging (Blanchard-Fields & Hess, 1999; Blanchard-Fields & Horhota, 2006). Instead of something to be controlled, social context has taken its rightful place as an important influence on cognitive functioning as we grow older. Similar to placing

information in an emotion-based context, by adopting a social cognitive perspective, researchers in cognitive aging have broadened their understanding of cognitive functioning to include factors such as goals and motivation.

A social cognitive perspective focuses on understanding how people come to learn and make sense of the social world around them including how people think about themselves, others, and the events that occur in everyday life. With respect to aging, this raises questions as to how developmental changes in pragmatic knowledge, social expertise, and values influence social cognitive processes. Even if certain basic cognitive mechanisms decline, older adults may still possess the social knowledge and skills that allow them to function effectively in everyday life. Thus, two theoretical mechanisms that are receiving considerable attention in the social cognition and aging literature are cognitive mechanisms that underlie social cognitive processes and the influence of beliefs, values, and personal dispositions on social cognitive processes.

Cognitive Mechanisms and Social Information Processing. Recent studies on social cognition and aging have investigated whether age-related changes in processing capacity relate to changes in social cognitive processes. Even more importantly, do these age-related processing changes explain age differences in social judgment biases? Recent research draws on theories from social psychology to answer this question (Gilbert & Malone, 1995). When individuals are asked to make an attribution as to the cause of an event such as an interpersonal dilemma, initially they are more likely to attribute the cause to or lay blame on personal characteristics of the target character (i.e., dispositional attributions). Because this type of attribution tends to be more automatic and less cognitively demanding, it typically represents individuals' initial judgment. A second process involves adjusting one's initial blame inference by considering external extenuating circumstances that could have affected the situation. Alternatively, this type of processing requires cognitive effort (Gilbert & Malone, 1995).

There are a number of recent studies suggesting that older adults consistently make dispositional attributions to a greater extent than do young adults (Blanchard-Fields & Beatty, 2005; Chen & Blanchard-Fields, 1997; Follett & Hess, 2002); they rely more on easily accessible heuristics, schemas, and belief systems when forming impressions (Hess, 1999); and they rely more on stereotypes when making source attributions leading to false judgments (Mather, Johnson, & De Leonardis, 1999).

In a number of studies older adults are found to consistently blame characters more (i.e., make dispositional attributions) than young adults do, particularly in relationship dilemmas resulting in a negative outcome (Blanchard-Fields & Beatty, 2005). That older adults are more likely than young adults to make less effortful blame attributions suggests that cognitive mechanisms play a role in social judgments.

Similarly, older adults made higher dispositional ratings than young adults did when given a short time period in which to respond (Chen & Blanchard-Fields, 1997). In contrast, older adults made lower dispositional attribution ratings when they were given more time to think about the situations. Again, this suggests that older adults' dispositional bias is partially due to cognitive limitations that make fast effortful processing difficult. Similar findings were evident with a different social judgment paradigm that used a distracter task instead of limited time (Chen & Blanchard-Fields, 2000). Finally, cognitive mechanisms such as increased rates of false memories also impacted older adults' dispositional attributions (Chen, 2002). Along these lines, Ybarra and Park (2002) found that although reduced cognitive resources did not influence young adults when forming impressions of others, resource limitations did affect older adults' ability to process social information completely.

In sum, evidence suggests that the social judgments of older adults are influenced by cognitive capacity to some extent; older adults tend to rely on easily accessible schematic information more so than young adults. However, processing capacity is not the only possible explanation for these findings. Age-related differences in beliefs, values, motivation, and goals have also been shown to have an impact on social judgments.

Beliefs, Values, and Social Information Processing. There is growing evidence to suggest that individual differences in attitudes, values, and beliefs may determine the degree to which older adults are susceptible to biased social judgments (Blanchard-Fields & Hertzog, 2000; Hess, 1999). Recall the Chen and Blanchard-Fields (1997) finding that constraints in time pressure increased older adults' use of dispositional attributions, thus implicating a cognitive mechanism. However, in this same study, social beliefs related to the situations were also assessed, and they were the better predictor of when dispositional judgments were made. Social beliefs reflected statements on whether an actor violated a social rule and on how one should behave in a particular relationship situation. Older adults were more likely to generate such beliefs as well as attribute the cause of the negative outcome to dispositional characteristics of that actor. This tendency towards evoked beliefs on the part of older adults in relation to the situational dilemmas accounted for age differences in dispositional biases over and above the influence of cognitive constraints.

Similarly, Klaczynski and Robinson (2000) found older adults accepted evidence that was consistent with their personal positions in a scientific reasoning task and subsequently dismissed evidence that portrayed their beliefs to be inaccurate. Their conclusion was similar to Chen and Blanchard-Fields: Increases in reasoning biases are not occurring due to declines in cognitive ability, but rather to the fact that older adults are more likely than young adults to base their judgments on their own beliefs.

Other researchers have examined motivational goals and dispositional styles that influence social information processing. For example, individuals with a high need for closure (a preference to come to quick and expeditious conclusions) tend to form quick and biased judgments and not consider all the relevant factors (Webster & Kruglanski, 1994). Interestingly, Hess, Waters, and Bolstad (2000) found that need for closure did not influence young and middle-aged adults' social judgments; however, it did predict social judgment biases in older adults. With age-related changes in both cognitive and social resources, it may be the case that motivational factors such as preserving cognitive resources become more important to older adults.

Finally, in a recent study, Blanchard-Fields and Hertzog (2002) examined age differences in blame attributions for characters who behaved traditionally (e.g., a character who insists on marriage before cohabitation) or nontraditionally (e.g., a character who consents to live together before marriage) in interpersonal conflict situations. Individuals who held traditional beliefs about appropriate behavior in interpersonal relationships were more likely to blame individuals whose behavior violated those beliefs. In contrast, individuals who held nontraditional beliefs were more likely to blame traditional characters. Older adults held more traditional beliefs than young adults, and this accounted for older adults' greater tendency to blame nontraditional characters. These studies suggest that generational differences in the content of beliefs and values may contribute to age differences in attributional processing.

Together these findings suggest that older adults are able to apply the rich experience they have accumulated during a lifetime to guide their judgments, especially when it is relevant to their daily life. However, when older adults are in a context in which the task is narrowly defined and the focus is on the ability to produce solutions in a novel context older adults are unable to take advantage of life experiences and perform more poorly.

Evidence for a Cognitive Complexity Mechanism. Another candidate explanation for age differences in attributional processes is cognitive complexity. From an adult developmental perspective, cognitive complexity is a higher form of reasoning that involves the ability to consider multiple perspectives and causal explanations for behaviors or events (Blanchard-Fields & Norris, 1994; Labouvie-Vief, Chiodo, Goguen, Diehl, & Orwoll, 1995). An individual at higher levels of cognitive complexity should be less prone to making the correspondence bias.

Cognitive complexity in the form of ego level is characterized by the ability to embrace the multifaceted and uncertain nature of people and situations. Individuals with high ego level are more likely to consider both situational and dispositional causes of outcomes in achievement-oriented and interpersonal scenarios (Blanchard-Fields & Norris, 1994). Cognitive complexity in the form of attributional complexity (Fletcher, 1986) (i.e., a preference for complex explanations) also played a role in judgments about actors' attitudes. Young, middle-aged, and older adults watched actors answer questions about social beliefs, such as "Should people have the right to burn flags?" In the choice condition, participants believed the actors could choose how to answer the questions. In the no-choice condition, participants believed the actors were forced to respond a particular way, regardless of their true attitudes. Participants committed the correspondence bias if they rated the actor's true attitude as reflecting their statements, even in the no-choice condition. Individuals with high levels of cognitive complexity were less likely to demonstrate the correspondence bias (Follett & Hess, 2002). Finally, Horhota and Blanchard-Fields (2006) found that young and older adults who were high on attributional complexity did not differ in their attributional processing. However, older adults who were low in attributional complexity committed the correspondence bias more than young adults who were low in attributional complexity did. Again, attributionally complex individuals are more likely to take into account the situational pressure and dispositional factors when making their attributional judgments.

Overall, we find that a simple resource reduction interpretation is inadequate to explain many of the age differences found in social judgments. Instead our review has highlighted the importance of also considering social factors such as cognitive style and values to explain social cognitive functioning.

Age-Related Stereotypes. Another important mechanism that has taken center stage as an important social factor influencing the nature of cognitive change in older adulthood is age-related stereotyping. Negative stereotypes about aging are pervasive in our society, in particular those that refer to declines in competency. Recent evidence suggests that traditional cognitive aging research may underestimate older adults' cognitive performance due to the debilitating effects of such stereotypes (Andreoletti & Lachman, 2004; Chasteen, Bhattacharyya, Horhota, Tam & Hasher, 2005; Hess, Auman, Colcombe & Levy, 1996; Levy, 1996; Hess, Auman, Colcombe, & Rahhal, 2003). It should be noted that stereotypes are not assumed to fully account for observed declines in cognitive performance, but their activation simply impedes optimal functioning.

Evidence for the negative influence of stereotypes on cognition in older adults suggests that when negative stereotypic traits are activated, memory performance tends to be lower (Hess et al., 2003; Levy, 1996; Rahhal, Hasher, & Colcombe, 2001). This is accomplished by simply framing the task as assessing memory as opposed to a learning task or by telling participants that memory declines with age as opposed to increases with age. More recently, findings reveal that the detrimental effects of negative stereotyping are most prominent with adults who are holding on to more youthful identities (O'Brien &

Hummert, 2006). Furthermore, there is some evidence suggesting a beneficial effect of positive stereotypes on older adults' cognitive performance (Hess et al., 2003; Levy, 1996; Stein, Blanchard-Fields, & Hertzog, 2002). For example, within cultural groups who hold positive views of aging, older adults may show no significant declines in memory performance in comparison to young adults (Levy & Langer, 1994, but see Yoon, Hasher, Feinberg, Rahhal, & Winocur, 2000).

Overall, social cognition and aging research highlights the importance of social factors underlying age-related differences in cognitive functioning. In addition, it suggests that it is important not to limit explanations of cognitive change to cognitive processing mechanisms. The above research suggests that under some conditions motivational goals as well as values and beliefs play a major role in the types of judgments and reasoning observed in older adulthood. It will be important for future research to determine the conditions under which reasoning and judgments reflect cognitive capacity on the part of older adults and the conditions under which such reasoning reflects age differences in social mechanisms, e.g., well-substantiated beliefs or motivational differences or stereotypes.

Challenges for Current Theories of Adult Development

In this chapter we have covered a number of representative theories and empirical findings of adult development that reflect important research innovations and trends in the 21st century. In addition, our review illustrates the ebb and flow of theoretical development. Whereas some theories are well substantiated and are in the process of being more fully elaborated, such as self-regulation theories, other theories are experiencing the growing pains of inconsistent support which should ultimately yield to a more integrated theoretical perspective, i.e., emotion and cognition theories. Furthermore, there are areas of research, such as social cognition and aging that draw upon mainstream psychological theories but need to be elaborated further into lifespan developmental theories. Finally, other fields are in relatively early stages of theoretical development and are in need of additional empirical validation and theoretical refinement, i.e., cognitive neuroscience and, in particular, health.

Recent interest in placing behavior in both in a socio-emotional and biological context has broadened the investigation of adult developmental theories from a unidimensional focus on mechanisms to the consideration of multiple determinants of behavioral change. For example, changes in processing of information are not simply a function of biological decline, but instead are also influenced by social context, motivation, beliefs, emotions, and life experiences. As a result we can observe a proliferation of research examining the nature of the emotion-cognition interface in the aging mind. Motivational shifts towards an increased importance of emotional gratification have been shown to influence older adults' differential allocation of cognitive resources to positive and negative information. Another important determinant of cognitive performance in adulthood is social context, for instance by activating positive and negative stereotypes of aging. Other examples of determinants of behavioral change are life-style interfaces with biology as reflected in the influence of health on cognition.

Our discussion of neuro-scientific methods has demonstrated that cognitive functioning can be understood at new levels. These methods allow us to adequately test conditions under which structural change is associated with decline, compensation, or even improvement in functioning. Rather than using general biological deterioration as the default explanation for cognitive changes, we can now identify specific biological

mechanisms reflected in different structures of and activation patterns in the brain. For example, we are now able to differentiate preserved areas of the brain, such as the amygdala, from areas that are more prone to decay, such as specific areas in the prefrontal cortex. These respective areas relate to preserved emotional processing on the one hand, and decline in other more effortful cognitive processes on the other. To summarize, we will revisit the five domains of functioning introduced earlier and discuss challenges they face for the future.

Emotion and Cognition

As indicated earlier, the number of studies examining the interface between emotion and cognition in the aging mind has been rapidly increasing. At this stage, the empirical findings have been somewhat supportive of a shift in motivational goals on the part of older adults. Although the shift towards instantiating emotionally gratifying experience is not challenged, how this shift influences cognitive processing is still to be more fully explained. Future research will need to address important theoretical questions that arise from these discrepant findings. For example, can they be integrated into a larger theoretical framework? As methodologies for time sampling are becoming more accessible and reliable, emotional processing can be more explicitly examined in and generalized to an everyday life-context. Furthermore, the advances in statistical procedure analyzing intraindividual variability and the coupling of psychological constructs will allow for an on-line assessment of the coupling between emotion and cognition. More information is needed on the degree to which emotion processing is resource demanding. Is this a more automatic process for older adults in comparison to young adults or does it strain valuable resources? How is this process reflected in structural and functional changes in the brain?

Neuroscience and Cognition

Advances in neuro-scientific methods have stimulated a vast amount of research in cognition and aging. New findings describing linkages between behavioral and brain data require theoretical explanations. A new challenge for this field is that the same behavior can be related to different neuronal activation patterns. The question remains as to whether they are functionally equivalent, yet represent biologically different mechanisms. In addition, more theoretical and empirical work is needed to investigate whether different changes in the brain may be associated with identical or differential mechanisms. Another challenge is to study changes in the brain longitudinally to investigate causal relationships. For instance, it may well be that certain brain patterns or changes in brain patterns can predict longitudinal behavioral changes. This, in turn, may have implications for pathologies of aging.

There are many open questions for future research to answer. For instance, new methods will allow researchers to combine structural and functional imaging methods. The fourth age is a challenge that all areas of research will have to face in the future. For example, in very old adults there may be limitations in the degree to which the aging brain can compensate through recruitment of alternative areas of the brain. Another challenge for brain research is the issue of variability, both inter-individually and intra-individually. Is aging associated with uniform patterns of changes or are older adults compensating differentially for declines? How variable is the recruitment of additional

brain resources within an individual? Is the same brain region consistently recruited for similar and different tasks?

Health and Cognition

The health domain has recently received a lot of attention due to empirical findings linking changes in life-style to changes in cognition. Similar to the domain of neuroscience and cognition, the new empirical findings in this research area require theoretical foundation and explanation. More intervention research is needed to identify causal mechanisms linking health-related life-style and cognition as well as parameters influencing the effectiveness of interventions, such as temporal boundaries. Moreover, the longitudinal effects of training have to be empirically explored and theoretically explained. A unifying theory on health as a process variable still warrants further development. Aldwin, Spiro, and Park (2006) suggest conceptualizing health as a life-long process. They advocate that life-span psychology principles be applied to the study of health, such as multidimensionality including multiple levels of analysis, the need for interdisciplinary approaches, the recognition of the dynamic interaction of gains and losses, and the importance of considering the socio-historical context of health. As a process variable, health needs to be understood as a dynamic and fluctuating state variable rather than as a static trait variable.

Future research in this field is needed to better understand how changes in health are related to changes in other domains of functioning, such as cognition. Because of its fluctuating nature, it will be important to study changes in health, such as illnesses, including recovery, in relation to other domains of functioning. New methods will facilitate the understanding of these phenomena. For instance, measuring biological parameters of stress, such as cortisol, has become increasingly accessible. In addition, time-sampling and longitudinal studies will be necessary to identify specific mechanisms of change.

The findings on health and cognition may also have important implications for studying the fourth age. Plasticity in old age has been found to be limited in testing-the-limits paradigms focusing on cognitive training interventions (Singer et al., 2003). Perhaps, cognitive plasticity could be potentially enhanced through health interventions, such as aerobic exercise training.

Self-Regulation and Control

As outlined earlier, the major theories of self-regulation are theoretically well founded and are at a stage of theoretical refinement. This refinement is mainly aimed at better operationalizing self-regulatory processes as they function inside and outside the laboratory. For instance, Riediger, Li, and Lindenberger (2006) distinguish resource-versus process-based selection. Resource-based selection is applied to situations in which the processing resources are limited because of multiple overlapping tasks consuming the same resources. Process-based selection, on the other hand, refers to selection that is due to a processing conflict between established modes of processing (experientially selected processes) and current actions in new contexts. The preference for habituated processes may impair functioning in new developmental contexts. These more specific predictions can be operationalized and tested empirically and advance our understanding of self-regulation in adulthood and aging. Another open question within the field of self-regulation is the relationships among different models of self-regulation. They all

focus on similar questions. At this stage, however, it is still unclear whether differential predictions can be drawn from these models and to what degree they are in accordance or in conflict with each other.

One of the major strengths of this field is the longitudinal investigation of self-regulatory processes in everyday contexts. For instance, Riediger et al. (2005) investigated goal-achievement and goal-coherence in young and older adults using time-sampling methods. They found that older adults selected goals that are more coherent and less conflicting with each other in everyday life.

A challenge for the field of self-regulation research is the fourth age and the increasing vulnerabilities associated with it. For instance, some of the core assumptions of theories of human development, namely, the notion of the individual as a master of his or her own development may be more difficult to find in individuals who are faced with increased losses of control over their environment as well as their own behavior and body.

Social Cognition

Similar to research on emotion and cognition, the major import of the current growth in research placing cognition in a social context is that it has unveiled important areas of reasoning and cognitive functioning that are relatively spared and may even improve in older adulthood. This is illustrated in research assessing the degree to which social cognitive functioning is related to cognitive mechanisms that decline with age as opposed to social cognitive mechanisms that are largely preserved. This research is still in early stages and future research needs to establish the conditions under which older adults' reasoning and decision making is adaptive and the conditions under which older adults fare poorly. Growing trends in social neuroscience have the potential to shed light on preserved processes as is currently being examined in cognitive neuroscience and aging research. Moreover, researchers need to determine the degree to which social cognitive mechanisms such as beliefs, values, and social knowledge account for older adults' preserved performance in everyday life. Finally, given that social psychologists have studied social cognitive phenomenon primarily on college-aged individuals, the influence of developmental theories and developmental research will trigger further advancement in other fields.

The remaining issue in this concluding section is to link the status of adult developmental theories to learning as a lifelong process. First, age-related motivational shifts in goal-orientations and processing preferences have strong implications for designing learning environments for older adults. For example, the fact that older adults have less difficulty processing emotional information while at the same time they focus less on negative information, needs to be taken into consideration when designing learning materials. Similarly, if older adults are more likely to draw upon their rich accumulated experience, care needs to be taken to design materials that are relevant to an older adult's life. Evidence suggests that facilitative social contexts promote optimal functioning on the part of older adults. For instance, creating a social environment that highlights competencies rather than decrements in older adults' functioning may allow older adults to exercise cognitive processes at their full capacity. The revolutionary findings related to health interventions influencing cognition suggest that promoting a healthy lifestyle can facilitate learning. Finally, it should be noted that learning in the service of maintenance is more predominant in older adults, and particularly in the fourth age. Thus, learning is no less important to older adults than it is to young adults as it may enhance the quality of life in the face of a continually rising life expectancy.

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