Handbook of the Psychology of Aging
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CHAPTER CONTENTS

Introduction 133
The Construction of Preferences in Older-Adult Decisions 134
Less Preference Construction in Familiar Decisions 135
Thinking and Feeling Our Way Through A Complex World 135
The Affect Revolution and Age-Related Differences in the Influence of Affect 136
Increased Influence of Affective Information 137
Endowment Effects 137
Risky-Choice Framing Effects 137
Affective Learning 138
Time Preferences 138
Incidental Affect 139
The Positivity Effect 139
Risky-Choice Framing Effects 140
Pre-Choice Information Processing 140
Age Declines in Deliberative Abilities and their Influence on Decision Making 141
Perceptions of Covariation 142
Other Decision Tasks that Require Deliberation 142
Query Theory 143
Numeracy 143
Selectivity and Motivated Use of Deliberative Processes 144
Limitations 144
Summary and Conclusions 145
Acknowledgments 146
References 146

INTRODUCTION

The psychological study of complex decision making examines the mechanisms underlying people’s choices and judgments and attempts to discover how to improve decision-making processes. Although many of the same cognitive processes underlying judgments and decisions have been studied in other fields of psychology (e.g., problem solving), the field of judgment and decision making has tended to focus more on how people process information (e.g., the use of heuristics, the balance between emotional and nonemotional ways of understanding), how they understand uncertainty and risk, and how they choose between alternative courses of action in an uncertain world.

Decision research developed out of economic theory and, as a result of this rationalistic origin, concentrated at first on calculation-based explanations for how people make decisions and form judgments (Kahneman & Tversky, 1979). The implicit assumption that good decision making is a conscious, deliberative process has been one of the field’s most enduring themes. More recent research, however, has examined the role of affect and intuition in decisions. In both cases (the study of deliberative and affective/intuitive processes), a major underlying theme has been the construction of preferences. Its central idea is that in many situations we do not really know what we prefer, and, as a result, we construct our preferences “on the spot” based on internal and external cues available at the moment. “Virtually every current theory in decision making can be considered a theory of preference construction” (Lichtenstein & Slovic, 2006, p. 3). Such judgments underlie preferences that decision makers form and decisions that they make.

In this chapter we cover research and theories, in a necessarily abbreviated form, that address some of the issues that older adults (generally defined as 65 years
and older) face in making everyday judgments and decisions. A decision, of course, is a choice between two or more options or alternatives (e.g., choosing a car). One of those options could be the status quo (e.g., doing nothing or making no change). A judgment, in contrast, is the psychological appraisal or evaluation of information. It is an understanding of a situation or an individual (e.g., I’m having some stomach distress. How likely is it to be due to my new medication?). Due to limited longitudinal research on age and decision making (see Limitations section on cohort effects), we generally discuss age differences rather than age changes in decision making.

THE CONSTRUCTION OF PREFERENCES IN OLDER-ADULT DECISIONS

Preference construction depends on how decision makers process available information. This processing can be altered by aspects of the situation and by characteristics of the individual decision maker. For example, in terms of situational aspects, preference construction can be influenced by how the decision is presented (e.g., framing effects), how it is asked (e.g., asking a decision maker to choose between two options can result in a different decision than asking her to reject an option; Shafir et al., 1993), and by the availability of logically irrelevant information (see many examples in Lichtenstein & Slovic, 2006). Individual differences also influence constructive processes because they can mark differences in what information a decision maker attends to and how he or she processes this information (e.g., emotional reactivity, memory, and numeracy). Decisions are not always constructed in the same manner, and some differences in constructive processes likely map on to age differences in information processing. As a result, we focus here on age as one particularly important individual difference.

Research suggests that preferences will more likely be constructed when decisions are (1) unfamiliar, (2) complex (including too much information and conflicting goals), or (3) familiar but not often experienced personally (Payne et al., 1999). Preference construction also may be more likely when (4) the decision maker’s values are clear, but how to make trade-offs between values is not (this may be particularly true with emotionally difficult trade-offs (Luce, 2005); and (5) decision makers lack an affective response to decision options, have difficulty translating feelings onto a numerical scale (e.g., fresh local produce tastes great; how much more am I willing to pay for it?) or have different affective responses depending on how options are presented (Peters et al., 2006).

These conditions imply that preferences are likely to be constructed in many consequential health, financial, and other life decisions that older adults face (moving to a retirement home, complicated and numerous medical treatments, retirement-income choices). A decision to give up driving, for example, is unfamiliar, complex, and involves emotionally difficult trade-offs as the older adult balances safety concerns with concerns about personal freedom and convenience. Decisions involving numeric information, such as indicators of hospital quality or characteristics of health insurance plans, may be particularly susceptible to preference construction because processing numeric information is difficult and people are not always proficient with numbers (Dehaene, 1997; Paulos, 1988). As a result, individuals will not always use numeric information in meaningful ways (Peters et al., 2009). The emerging view in the decision literature is that, in many situations, preference measurement is best considered as architecture (building a set of preferences) rather than as archaeology (uncovering existing preferences; Gregory et al., 1993; Payne et al., 1999; Slovic, 1995). These constructive processes can lead to preference instability, which is considered a sign of less competent decision making (Bruine de Bruin et al., 2007; Finucane et al., 2002). Understanding and harnessing the power of constructed preferences, however, can also lead to better decisions (see the Summary and Conclusions section and Epstein & Peters, 2009).

In this chapter we explore whether older adults might show less preference construction than younger adults in situations that take advantage of their greater experience (and therefore more stable values). They may, however, show greater or different preference construction in less familiar decisions because they process information in ways that are different from younger adults. These age-related differences in information processing include declines in deliberative efficiency, motivated selectivity in the use of deliberative capacity, and changes in the use of affective information. We cover a diversity of decision topics throughout this chapter including the use of heuristics; the influence of gains, losses, and probabilities; mood effects; pre-choice information processing; memory effects; and numeracy among others. Although the stereotype of older adults appears to include an inability to make good decisions, we suggest that the quality of older-adult decisions will sometimes be better and other times will be worse, than that of younger adults. This difference will depend on preference-construction processes and, specifically, on how older adults process information compared to younger adults. In addition, it will depend on diagnosing the decision situation and whether there is a match between the information processing that takes place and what information processing will produce better decisions in that given situation (see also Yoon et al., 2009).
LESS PREFERENCE CONSTRUCTION IN FAMILIAR DECISIONS

Some studies have emphasized the importance of experience – and its associated knowledge – as a moderator of age differences in the quality of judgments and decisions. If preferences are more stable in familiar situations and older adults, by dint of more years of experience, have greater familiarity with and knowledge in common decision situations, then they should demonstrate less preference construction in them. In fact, Tentori et al. (2001) demonstrated that older adults were less likely to let situational information (e.g., the attractiveness of a discount in comparison to other available discounts) influence their decision when its choice would require a larger minimum purchase than their usual budget. Tentori et al. (2001) argued that older adults’ everyday life experience with the grocery-store context is advantageous because they have knowledge of the situational variables that may influence their judgments and can discount irrelevant information (see also Kim & Hasher, 2005, for similar results).

Other studies also have demonstrated older adults drawing on their life experiences. In an example in the domain of health, Meyer et al. (1995) studied a group of women diagnosed with breast cancer and found that the older women behaved more like experts by seeking out less information, making decisions faster, and arriving at decision outcomes equivalent to those of younger women. In a follow-up study, Meyer and Pollard (2004) suggested that the effect was due to the availability of specific information about breast cancer. Consistent with an expertise-based explanation, the presence of relevant information in the problem domain facilitated decision making in older women. Fisk and Rogers (2000) also reviewed evidence that decisions in well-learned environments (e.g., driving) are preserved with age. Finally, Bruine de Bruin et al. (2009) demonstrated that older adults had preserved decision-making ability on tasks that involve skills learned through experience (e.g., recognizing social norms and resistance to sunk costs; see also Strough et al., 2008). The association between age and performance on tasks that required experiential skills remained after controlling for fluid cognitive ability. Like the Tentori et al. (2001) study, these studies supported older adults’ ability to use their life experiences when considering contextual variables and to prevent this context from influencing judgments and decisions.

Older adults’ life experiences may allow them to develop both specific and general expertise in ways that benefit judgment and decision making. For example, Mata et al. (2007, 2009) found that both younger and older adults appeared to adapt to the demands of current decision environments. Although older adults have fewer cognitive resources upon which to draw and such deliberative declines could result in less ability to adjust to decision environments, both age groups adjusted information search and strategy selection as needed. Pachur et al. (2009) also found adaptive use of recognition as a simple heuristic strategy in decision making among younger and older adults faced with environments in which the use of recognition was a valid cue (e.g., population of American cities is well estimated by the recognizability of the city name) and a less valid cue (disease mortality statistics). Older adults, however, were somewhat more likely to (incorrectly) use the recognition heuristic when it was a less valid cue, suggesting that older adults may not adapt their use of the recognition heuristic as effectively as younger adults. Further research would be useful to uncover whether the strategies used by older adults might be based on their greater life experience with decisions, whereas that of younger adults might be based on more effortful strategies.

Although early research pointed toward improvements in everyday problem solving with age (Cornelius & Caspi, 1987), a more recent meta-analysis of studies of everyday problem solving found that age declines in everyday problem solving exist and are likely due to age-related cognitive declines (Thornton & Dumke, 2005). However, young and middle-aged adults did not differ in problem-solving ability, presumably because the benefits of accumulated experience outweighed deliberative decline. In addition, although older adults (mean age of 70 years) showed worse performance, this difference was attenuated when the problem content was interpersonal (involving other people) rather than instrumental (involving something one is trying to accomplish, achieve, or get better at) in focus, suggesting an important motivational component to older-adult problem solving (Blanchard-Fields et al., 1995, 2007; Thornton & Dumke, 2005).

THINKING AND FEELING OUR WAY THROUGH A COMPLEX WORLD

Information in decision making appears to be processed using two different modes of thinking: an affective/experiential mode and a deliberative one (S. Epstein, 1994; Loewenstein et al., 2001; Reyna, 2004; Sloman, 1996; these modes are sometimes called System 1 and 2, respectively – see Kahneman, 2003 and Stanovich & West, 2002). Both modes of thought are important to forming decisions. The experiential mode produces thoughts and feelings in a relatively effortless and spontaneous manner. The operations of this mode are implicit, intuitive, automatic, associative, and fast and appear to be based primarily on affective (emotional) feelings. As shown in a number of studies, affect provides information about the goodness or badness of
The experiential system is assumed to be intimately associated with the experience of affect, ... which refer[s] to subtle feelings of which people are often unaware. When a person responds to an emotionally significant event ... the experiential system automatically searches its memory banks for related events, including their emotional accompaniments ... If the activated feelings are pleasant, they motivate actions and thoughts anticipated to reproduce the feelings. If the feelings are unpleasant, they motivate actions and thoughts anticipated to avoid the feelings.

The deliberative mode, in contrast, is conscious, analytical, reason-based, verbal, and relatively slow. It is the deliberative mode of thinking that is more flexible and provides effortful control over more spontaneous experiential processes. Kahneman (2003) suggested that one of the functions of the deliberative mode is to monitor the quality of the information processing emerging from the experiential mode and its impact on behavior. Both modes of thinking are important and some researchers claim that good choices are most likely to emerge when affective and deliberative modes work in concert and decision makers think as well as feel their way through judgments and decisions (e.g., Damasio, 1994).

Some disagreement exists as to whether these influences on decision making are due to dual processes, a single process, or many interdependent processes. For example, deliberation about reasons for choice can distract decision makers from their feelings and have a negative effect on some decision processes (e.g., Wilson et al., 1989). Research has also demonstrated that affect may have a relatively greater influence when deliberative capacity is lower, suggesting that, at least in some cases, these two modes could exist on a single continuum (Hammond, 1996; Kruglanski et al., 2003; Peters & Slovic, 2007). Shiv and Fedorikhin (1999), for example, demonstrated that decision makers were more likely to choose an affect-rich option (and make a decision of the heart) when deliberative capacity was diminished by cognitive load. Finucane et al. (2000) also found that the inverse relation between risks and benefits (linked to affect by Alhakami & Slovic, 1994) was enhanced under time pressure; reducing the time for deliberation appeared to increase the use of affect. A balance between affect and deliberation could explain some age differences in information processing and decision making, with declining resources leading to greater affective input in decisions. As reviewed later, cognitive-aging research is more consistent with the existence of both modes of processing and understanding them (including their interactions) may ultimately enrich what we know about how information is processed in decisions across the life span.

THE AFFECT REVOLUTION AND AGE-RELATED DIFFERENCES IN THE INFLUENCE OF AFFECT

Two dominant perspectives exist on the influence of affective considerations on cognitive performance (e.g., memory, judgment processes, decision making). The first is a motivational perspective that is focused on aging-related chronic activation of emotion-regulation goals and an associated motivation to process affective information, as typified in socioemotional selectivity theory (Carstensen, 1993, 2006). This theory posits that changes in time perspective result in emotional goals becoming increasingly important as the end of life nears, which in turn results in greater monitoring of affective information. Because older adults are, by virtue of age, closer to the end of life, age should be associated with an increased importance of emotional goals that allow for the optimization of emotional experience. Thus, the increased importance of emotional goals results in two separate predictions: (1) an age-related increase in attention to emotional content and choices that allow for the regulation of emotional experiences; and (2) a positivity effect, with either an increased focus on positive information and/or a decreased focus on negative information. These predictions have potentially great relevance to the impact of affect and emotions in judgment and decision making.

Novak and Mather (2007), for example, explored variety seeking in younger and older adults. They presented participants with choices among jellybeans and different types of music. Older adults showed less variety seeking when choosing what to use at a later time as compared to immediate consumption. Younger adults engaged in the same amount of variety seeking when choosing what to use immediately and what to use at a later time. The authors relate this finding to the tendency for older adults to focus more on regulating future emotional experiences. Novak and Mather (2007) argued that this regulatory process results in older adults choosing reliably satisfactory products for future consumption so as not to take the emotional risks associated with variety seeking for future consumption.

The second perspective is more cognitive in nature and focuses on the impact of changing cognitive skills on the relative influence of affective processes on performance. This perspective is typified by theories such
as the dynamic integration theory by Labouvie-Vief (2003, 2005) and by neuropsychological approaches that focus on the differential impact of aging on normative changes in cortical systems underlying affective and deliberative processes. Research suggests that neural structures associated with affective processing (e.g., amygdala) undergo less normative functional change with aging relative to those areas underlying executive or deliberative functions (e.g., the dorsolateral prefrontal cortex; e.g., Bechara, 2005; Chow & Cummings, 2000; Moscovitch & Winocur, 1995). This relative-preservation view is supported by research demonstrating that adult age differences in performance are less on those tasks thought to be supported by affective-processing systems (e.g., Kensinger et al., 2002; MacPherson et al., 2002; Mikels et al., 2005) compared to those associated with executive functions (for reviews, see Grady, 2000; West, 1996). Its primary prediction overlaps with the prediction of the socio-emotional selectivity theory of an age-related relative increase in the influence of affective information. The cognitive-decline perspective presumably requires the effect, however, to be stronger for older adults with fewer cognitive resources; this second prediction has received scant attention.

In the next two sections, we review whether existing evidence supports an increased influence of affective information in older-adult decisions and a positivity effect in decision processes.

**Increased Influence of Affective Information**

Recent empirical work has shown that aging is associated with an increase in attention to emotional content. For example, Fung and Carstensen (2003) found that, relative to younger adults, older adults exhibited greater preference and superior memory for emotional advertisements than for nonemotional ones. Several effects on judgments and decisions might be observed if this is the case. First, more affective sources of information such as anecdotal or hedonic information may receive greater weight (Dhar & Wertenbroch, 2000; Strange & Leung, 1999). Consistent with this notion, Blanchard-Fields et al. (1997) found that older adults focus more than younger adults on emotional aspects of everyday problems. Second, losses may loom equally large or larger for older adults than for younger adults if both positive and negative information are accentuated. Decision paradigms, such as endowment studies and risky-choice framing studies, often involve positive and negative information and can be used to examine these age-difference hypotheses.

**Endowment Effects**

Different processing of negative and positive information is used to explain effects such as the “endowment effect.” In endowment-effect studies, subjects are either (1) endowed with a product such as a coffee mug and asked the minimum amount for which they would sell it, or (2) they are not endowed with the products and are asked the maximum amount for which they would be willing to buy it. Sellers tend to require much more money than buyers are willing to pay (Thaler, 1980). The effect has been linked to affective processes, with losses looming larger than gains (also called loss aversion or a negativity bias) and appears to be larger when subjects have stronger affective reactions (Knutson et al., 2008; Lerner et al., 2004; Peters et al., 2003). Older adults, if they generally rely more on feelings, should therefore exhibit a stronger endowment effect. In support, Johnson et al. (2006) demonstrated greater endowment effects with increasing age in a large sample of auto buyers. Kovalchik et al. (2005), on the other hand, found no endowment effect for older or younger adults, but their task appeared to maximize the amount of deliberation in the task and therefore may have minimized the role of feelings found to be important to this effect (Peters et al., 2003). No other age-difference studies of the endowment effect could be located.

**Risky-Choice Framing Effects**

A similar prediction can be tested within the domain of framing effects, in which the same decision problem is framed or described in a positive or negative format. One of the most well-known findings in the decision-making literature concerns risky-choice framing effects (Tversky & Kahneman, 1981). In the classic “Asian Disease” problem, individuals presented with options described in a gain frame (the number of lives saved) tend to be risk averse, choosing an option that saves a guaranteed number of lives over an option with a possibility of saving all lives. In contrast, decision makers presented with options described in a loss frame (the number of lives lost) tend to be risk seeking, choosing an option with a possibility of not losing any lives rather than losing a certain number of lives. Although gain and loss options are numerically equivalent, different affective reactions are elicited from the separate frames.

If a general affective bias is evident, then the negativity bias should be enhanced and older adults should produce stronger framing effects relative to younger adults, leaving them more vulnerable to possible manipulation through intentional or nonintentional framing. In support of this interpretation, framing effects were larger for undergraduate participants low in need for cognition (Smith & Levin, 1997). In addition, Bennett (2001) linked larger framing effects to the addition of emotion-laden visual portrayals. Multiple studies concerning age differences in framing effects have found that older adults demonstrated significantly stronger framing effects (Kim et al., 2005;
Lauriola & Levin, 2001; Weber et al., 2004; Weller et al., 2010). Three remaining studies, however, found no age difference in the effect of frames (Holliday, 1988; Mayhorn et al., 2002; Rönnlund et al., 2005), and one study found weaker framing effects with age (Mikels & Reed, 2009). In particular, Weller et al. (2010) reported that the degree to which individuals displayed the classic “preference shift” in risk taking (i.e., with risk taking to avoid losses being greater than risk taking to achieve gains; see Levin et al., 1998) increased as a function of age, and reached an asymptote around 45 years. The bulk of the evidence demonstrates stronger effects of frame for older than younger adults, consistent with the affective bias posited both by socioemotional selectivity theory and the cognitive-decline perspective (although note that not all study results are consistent). In a later section, we review existing evidence for the Positivity Effect in these and other studies.

**Affective Learning**

Hess et al. (1996) also examined adult age differences in the ability to learn about a prototypical group member from descriptions of group members and nonmembers. Despite the claim by Fisk and Warr (1998, p. 112) that “it is well established that older people tend to learn more slowly than do younger ones,” older adults performed better than younger adults in abstracting a prototype based on affective information, providing support for an overweighting of emotional information. Hess et al. (1996) argued that the greater controlled-processing abilities of younger adults interfered with their ability to abstract the affective information.

These findings suggest that in choice tasks that involve learning through experience, affective information should be particularly salient to older adults, thus improving their ability to abstract and use it in their choices despite cognitive declines. Evidence in favor of such an explanation comes from studies examining performance in the Iowa Gambling Task (IGT) and other similar tasks (Damasio, 1994) in which age differences are sometimes observed to be absent (e.g., Denburg et al., 2005; Kovalchik et al., 2005; MacPherson et al., 2002; Zamarian et al., 2008). Denburg et al. (2005) found, however, that a subset of older adults made particularly poor choices, but none of the cognitive measures used could explain the difference between older adults who made good choices and those who made bad choices. This research was consistent with similar, independent investigations (Denburg et al., 2009; Fein et al., 2007; Zamarian et al., 2008), demonstrating age-related declines in IGT performance.

Prior research has shown that performance on this task is based in part on affective processes, as scores on self-report measures of affective reactivity were associated with choices made by college-student participants in the original and modified versions of the task (Peters & Slovic, 2000). Wood et al. (2005) also found that older and younger adults performed equally well on the original version of the gambling task. Using a cognitive model for this task that provides a theoretical decomposition of performance into learning, motivational, and response components, they were able to demonstrate different processes used by younger and older adults. Specifically, younger adults relied more on memory processes whereas older adults relied more on an accurate representation of gains and losses in the task. This suggests that the relative preservation of affective processes in older adults could enable them to compensate for losses in deliberative processes.

At this point, the mixed results make it unclear what age differences may exist in performance on the IGT and similar risky-choice tasks. The conflicting results may be due in part to age differences in responses to ambiguity as opposed to risk per se (Zamarian et al., 2008). Alternatively, individual difference variables (not yet identified) may be differentially associated with performance across different age groups, and perhaps across the various samples that have been used (e.g., Denburg et al., 2009). It is clear, however, that older adults perform less well than younger adults when payoff structures change unexpectedly, perhaps because of the flexibility of overwriting a learned concept based on working-memory processes as opposed to affective processes (Mell et al., 2005).

Recent research has also suggested that, under some circumstances, performance in complex decisions can be better when individuals do not engage in extensive deliberation (Dijksterhuis & Nordgren, 2006). Although the validity and generalizability of the theory of unconscious thought are still open issues, parallels exist between their effects and the age differences we address. Older adults may rely more on affective and intuitive processes in their everyday decisions (a general affective bias) and they may actively deliberate less in those decisions due to cognitive limitations. Whether the Dijksterhuis et al. (2006) findings are based on these same kinds of processes is an open question. However, Queen and Hess (2010) demonstrated that older adult decision making was relatively preserved on an affective (unconscious thought processing) task, whereas they showed the typical declines on a separate deliberative (conscious thought processing) task as compared to younger adults.

**Time Preferences**

Finally, socioemotional selectivity theory suggests that in old age, when time is perceived as limited, short-term benefits should become relatively more important (Lang & Carstensen, 2002). In terms of time preferences, it implies that older adults will value future money relatively less and, thus, would show a
relative preference for a smaller immediate reward over a later reward. Economic theory and results thus far are mostly consistent with this suggestion (Lee et al., 2008; Read & Read, 2004; Sozou & Seymour, 2003; Trostel & Taylor, 2001). A simpler explanation is that older adults may perceive the likelihood of cashing in later as being lower due to shorter expected life span or shorter expected healthy life span. Although the short time spans used in most of these studies makes this explanation somewhat less tenable, we could say with greater assurance that the effect was due to chronically activated emotional goals if such effects were shown by older adults more for affective options over less affective options.

**Incidental Affect**

A large body of research findings suggests that incidental sources of affect (mood states, affective primes, or conditioned responses that are normatively irrelevant to a decision) influence people’s evaluations, judgments, motivation, and information processing (for a review see Forgas, 1995). We predict that incidental affect may particularly influence older adults’ judgments for two reasons: (a) incidental mood states are more frequent, intense, and salient among older adults (Lawton, 2001); and (b) older adults may lack the capability of discounting or correcting for the influence of mood in judgments and decisions, a cognitive process that younger adults are capable of performing under normal conditions (Schwarz & Clore, 1983).

Results from several studies partially support this hypothesis with incidental sources of affect influencing both younger and older adults. This influence, however, tends to be similar between the two age groups with older adults perhaps showing the effect in a more robust way across studies. For example, in looking at mood-congruency effects, individuals induced to a positive mood tended to respond more to positive items than negative ones, whereas those induced to a negative mood showed the opposite pattern (Ferraro et al., 2003; Knight et al., 2002). Knight et al. (2002) did demonstrate more robust effects with older than younger adults across multiple tasks. Using a different source of incidental affect, Hess et al. (2000) examined the effects of affective primes on likeability judgments about Japanese Kanji characters. Presentation of each of these characters was preceded by a positively or negatively valenced word that was presented either above or below the participant’s perceptual threshold. Consistent with previous research by Murphy and Zajonc (1993), likeability judgments tended to be consistent with the valence of the prime word when participants were unaware of the prime word. It appeared that individuals misattributed the primed affective response to the Kanji characters when they were unaware of the source. In contrast, when participants could consciously perceive the prime, only older adults exhibited priming effects, suggesting that younger adults could correct for the prime’s influence whereas older adults could not.

Results from a modest number of studies have generally supported the hypothesis that affective information has a relatively greater influence on older adults than on younger adults. These results are consistent with both socioemotional selectivity theory and cognitive-decline perspectives. The cognitive-decline perspective also predicts that the increased influence of affect would be even greater for those older individuals with fewer cognitive resources, but this additional hypothesis has received little attention.

**The Positivity Effect**

Socioemotional selectivity theory also predicts, for motivational reasons, a specific focus on positive over negative information in later life as older adults seek to optimize emotional experience. The dynamic integration theory of adult development by Labouvie-Vief (2003) suggested a similar positivity effect arising out of qualitative differences in the processing of affect across ages that is based in aging-related changes in the dynamic balance between processes of affect optimization (of happiness) and affect differentiation (the ability to tolerate negativity to maintain objective representations). Her prediction of a positivity bias, however, is based on age-related limitations in cognitive resources that result in an adaptive shift to less resource-demanding positive affect (Gross et al., 1997). In her view, older adults’ declining cognitive resources may lead to a gating out of negative information and other sources of negative emotion. However, the results of memory studies by Mather and Knight (2005) do not support this cognitive-decline hypothesis as positivity effects were shown only by older adults with access to greater cognitive resources, leaving socioemotional selectivity theory with greater support thus far.

Leaving aside whether positivity effects shown in attention and memory studies are due to cognitive decline or motivational goals, the possible existence of a positivity effect has marked implications for judgments and decision making. Older adults who focus relatively more on positive information may process gain versus loss information in decisions differently than their younger counterparts who do not share this same focus. Robust findings with younger adults (illustrated by the S-shaped value function of prospect theory) indicate that losses tend to loom larger than gains (Kahneman & Tversky, 1979). If a positivity effect exists among older adults, then losses may not loom as large for them as for younger adults.

Decision paradigms originally conducted with younger adults show some inconsistent support for the positivity effect and are used to examine whether the effect is due to a greater focus on positive information, a lesser focus on negative information, or both. For
example, the IGT, described earlier, can also be used to examine the negativity bias because decision makers face both gains and losses in that task. Wood et al. (2005) examined model parameters from their theoretical decomposition and concluded that older adults, unlike the younger college students, did not show a negativity bias, providing some support for the positivity effect. However, as discussed in the next section, results are equivocal in risky-choice framing studies.

**Risky-Choice Framing Effects**

If age differences exist such that older adults weigh positive outcomes more, then they should show greater risk aversion in gains compared to younger adults. This prediction is because, if older adults weigh positive information more than younger adults, then the value function should be steeper near the origin in the domain of gains for older adults than for younger adults. Thus, the smaller number for sure should be valued higher for them. While there may also be an age difference in value between that smaller amount and the larger one, presumably that difference will be smaller than the age difference in value for the smaller amount due to diminishing marginal returns. This conjecture is based on the assumption that the value function curves for each age group converge at a higher outcome level. However, if older adults weigh negative outcomes less, less risk seeking in losses should be found; and if they weigh affective information more in general, then they should show greater risk seeking in losses and greater risk aversion in gains relative to their younger counterparts. Five relevant studies have been conducted and show age results that are largely inconsistent with the positivity effect, and more so, even with each other. First and consistent with one interpretation of the positivity effect, Weller et al. (2010) found that risk aversion in gains increased consistently across the life span (as if positive information was weighed more), whereas for loss-related decision making, risk seeking was relatively constant across ages. Their study included a large sample of individuals ranging from 5 to 85 years of age. Consistent with a different interpretation of the positivity effect, Mikels and Reed (2009) found that older adults demonstrated less risk seeking in the loss frame compared to younger adults (as if negative outcomes were weighed less) but similar choices in the gain domain; their study may not have been sufficiently powered due to small sample sizes.

Other risky-choice framing studies have not supported the positivity effect, however. Lauriola and Levin (2001) found results consistent with a greater weighing of both positive and negative information (a more general emotion bias as suggested in the last section). Specifically, older adults demonstrated both greater risk aversion in gains and greater risk seeking in losses. Weber et al. (2004) conducted a meta-analysis of studies and found that increasing age (age ranges were not specified in their paper) was associated with greater risk seeking in losses (more choices of a gamble over a sure thing) as if older adults weighed negative information more; no significant link existed between increasing age and risk aversion in gains (more choices of a sure thing over a gamble) — suggesting no age-related changes in the domain of gains. Finally, Holliday (1988) found no age differences from 20 to 76 years old in choices between gambles and sure things for gains or losses.

Findings from framing studies highlight two important points. First, they support the idea that decision making for risky gains and losses may follow different developmental paths. Findings that older adults may choose to take similar risks as younger adults when faced with losses (Weller et al., 2010) are consistent with the notion that risk taking to avoid losses is an early learned, reflexive strategy (Reyna, 2004) and are consistent with the findings of Mather and Knight (2006) that threat detection (i.e., recognition of angry faces) are not impaired in older adults. Due to conflicting findings across studies, however, it is not yet clear whether the propensity to take risks to avoid certain losses may develop early and may be less affected by age-related cognitive declines. Second, and perhaps most important, inconsistency across framing studies points toward the possible existence of as yet undiscovered but important moderating or mediating variables. It may be, for example, that heterogeneity exists across individuals, age groups, and specific paradigms used in what is considered negative and positive information (if I don’t win money, do I consider it a loss; if I don’t lose money, do I consider that a gain?).

**Pre-Choice Information Processing**

Support for the positivity effect is more robust when pre-choice information processing is considered. L ö ckenhoff and Carstensen (2007, 2008), for example, have examined how older and younger adults use and recall valenced information in a context-rich healthcare decision-making task. Participants were presented with computer-based healthcare scenarios that had positive, negative, and neutral information about different doctors and healthcare plans. When making choices, older adults were found to examine and recall a greater proportion of positive information as compared to younger adults. They replicated this finding in a second study ( L ö ckenhoff & Carstensen, 2008), but also found that the effect was only present when older adults made choices for themselves or for someone else of similar age. When older adults were asked to choose for a person considerably younger, they did not show an increased focus on positive information. Younger adults did
not show any differences in information use or recall when asked to choose for themselves, someone the same age, or someone considerably older.

Pre-choice information processing was also considered by Kim et al. (2008), who had younger and older adults make choices between products. In one condition, they were asked to explicitly evaluate the options, whereas in the other condition they were not. In the evaluation condition, older adults listed more positive than negative attributes of the options prior to choosing, and they were more satisfied with their choices than younger adults. These evaluation-condition findings are consistent with post-choice findings of Mather and Johnson (2000), who found that older adults were more likely than young adults to remember positive features over negative features of selected options but remembered negative features more than positive features of unselected options, even when overall level of memory performance was controlled. Importantly, in the study by Mather and Johnson (2000), younger adults were found to exhibit a similar bias when asked to focus on the emotional content of their choices. Kim et al. (2008) also found, however, that the positivity effect for older adults was dependent on whether they were asked to explicitly evaluate the options in a choice task. There were no differences between younger and older adults in the no-evaluation condition.

Of interest, the positivity effect among older adults requires greater deliberative input rather than compensating for declines in deliberation (Mather & Knight, 2005). This research implies that the relatively greater influence of positive than negative information on older-adult decisions will occur only for those older adults who have the resources necessary (due to ability, motivation, or time) to meet the motivational goals hypothesized in socioemotional selectivity theory. It is suggestive of another explanation for the mixed findings in this literature such that, across studies, populations may differ in deliberative abilities, and minor changes in decision paradigms may alter the degree of deliberative effort required. Interestingly, the findings of Mather and Knight (2005) also support the existence of dual processes rather than a single continuum, with greater deliberative capacity associated with greater affective input. However, we are not aware of any published research directly examining this possibility in decision making.

To summarize, the results of findings on the positivity effect have been somewhat supportive (particularly for pre-choice information processing) at the same time as it has been difficult to pin down whether the positivity effect emerges due to an age-related positivity bias (greater weighing of positive information) or an age-related lack of a negativity bias (lesser weighing of negative information). Research has demarcated some boundary conditions for the positivity effect – the effect appears to emerge only when older adults are evaluating information for themselves or a similar aged adult and may exist only when older adults have sufficient cognitive capacity to enact their motivational goals (Mather & Knight, 2005). Importantly, the effect is also shown by younger adults asked to focus on the emotional content of their choices, supporting the underlying motivational and emotional basis of the effect.

**AGE DECREASES IN DELIBERATIVE ABILITIES AND THEIR INFLUENCE ON DECISION MAKING**

Although older adults do show improvements or at least resilience in experience-based and affective processes, several lines of research support declines in the controlled processes of the deliberative system that may have negative impacts on decisions (see also Chapter 4, this volume). First, because older adults process information less quickly than younger adults do (e.g., Salthouse, 1992, 1994), their deliberative abilities may suffer due to less efficient processing of perceived information. Salthouse (1996) has hypothesized that the products of older adults’ early processing may be lost by the time later processing occurs and/or that later processing might not occur because early processing required so much time. Second, the evidence indicates age-related deficits in explicit memory, explicit learning, and other executive functions (Cohen, 1996; Kausler, 1990; Salthouse et al., 1999). In particular, working memory and executive functions (e.g., the control and regulation of cognition) associated with the prefrontal cortex deteriorate with normal aging (e.g., Amieva et al., 2003). In the past decade, a rapidly expanding body of evidence from the field of geriatric neuropsychology has provided support for the “frontal lobe hypothesis” of cognitive aging, which states that the frontal lobes are the first brain areas to show functional decline over the life span (Brown & Park, 2003; West, 1996). This theory is supported by both longitudinal and cross-sectional neuroanatomical data that show age-related structural declines in the prefrontal cortex, particularly the orbitofrontal and lateral prefrontal cortices (Good et al., 2001; Kennedy et al., 2008; Raz et al., 2005; Resnick et al., 2003). Older adults have been found to perform more poorly than their younger counterparts on executive function tasks, which are presumably related to frontal lobe function, while performing comparably on tasks that are not dependent on frontal lobe function. Finally, Hasher and Zacks (1988) argued that aging is associated with a decrease in the ability to inhibit false and irrelevant information. If good decisions depend on such deliberative skills (and deliberation is often considered the hallmark of
Perceptions of Covariation

Several studies have identified biases on judgment processes that increase with age and were linked with deliberative processes such as working memory. For example, Mutter (2000) and Mutter and Pliske (1994) examined the impact of illusory correlation on performance. (In an illusory correlation, people perceive that two variables covary consistently with their prior expectations even though no actual relation exists.) They found that older adults’ judgments were more influenced by prior expectancies than were those of younger adults, particularly under distraction conditions. This finding is important because we often judge whether one action produces a particular outcome or not (e.g., will taking an aspirin reduce my headache?).

Older adults were also less likely to correct their judgments when accurate information regarding the co-occurrence of events was made salient. Interestingly, Mutter (2000) found that age differences were more evident for memory-based judgments than for on-line judgments, suggesting that age differences in illusory-correlation biases may be based in part on the declining ability to encode and retrieve veridical information from episodic memory. Such a conclusion is bolstered by other research that examined age differences in the ability to detect covariation between two events when there were no strong prior expectancies regarding contingencies between the events (Mutter & Pliske, 1996; Mutter & Williams, 2004). In this research, aging-related declines in the ability to accurately judge covariation were eliminated when performance was adjusted to take into account memory errors. Finally, age differences were greater when accurate performance depended upon construction of a rule rather than just retrieval of cue–outcome associations. Such findings suggest that some declines in judgments and decisions in later adulthood may be tied to age-related reductions in cognitive resources.

Other Decision Tasks that Require Deliberation

Consistent with this, older adults are less able than younger adults to control the impact of automatic processing on their judgments (Hess et al., 1998, 2000). Note, however, that Healey and Hasher (2009) argued that an inability to inhibit irrelevant information may sometimes produce better decisions when irrelevant information is remembered and later becomes relevant to the next decision. Compared with younger adults, older adults also may be less consciously aware of factors that influence their judgments and decisions (Lopatto et al., 1998). They are less accurate in estimating absolute numeric frequencies (Mutter & Goedert, 1997) and may be more overconfident in their judgments (Crawford & Stankov, 1996). In a recent study, Hansson et al. (2008) predicted and found that older age resulted in more overconfidence when reporting confidence through a confidence interval, but not when reporting confidence through a probability assessment (see similar probability results in Bruine de Bruin et al., 2007). Their prediction was based on a process model in which generating confidence intervals requires more working memory and executive processing capacity than probability estimation. These effects were, indeed, mediated by a general cognitive ability factor suggesting that the decreased executive processing capacity of the older adults was responsible for the greater overconfidence in the interval estimation task. In a similar manner, Bruine de Bruin et al. (2009) demonstrated that older adults show declines on specific decision-making tasks that involve fluid cognitive ability (e.g., resistance to framing, applying decision rules). The relation between age and performance on these tasks was mediated by fluid cognitive ability.

Research by Chen (2002, 2004; Chen & Blanchard-Fields, 2000) has also suggested that aging-related declines in deliberative processes negatively influence judgment processes. In these studies, participants were presented with information about an individual, some of which was identified as true and some as false (and thus to be ignored); then they were asked to make judgments based upon this information. Chen found that the judgments of older adults were more likely to be influenced by the false information than were those of younger adults. In addition, younger adults in a divided-attention condition performed similarly to older adults under full attention. These findings suggest that older adults may have more difficulty controlling attention and monitoring the accuracy of information in memory, which in turn makes judgments more prone to error based upon irrelevant information. In a related study, Skurnik et al. (2005) found that repeatedly identifying a (false) consumer claim as false assisted older adults short-term in remembering that it was false. Longer term, however, the repetition caused them to misremember it as true. A pragmatic implication of these studies is that information providers need to take care to not provide older adults with a “fact” and then state that it is a myth. This and similar tactics are surprisingly common (e.g., the U.S. Food and Drug Administration’s “Facts about Generic Drugs” poses a question such as “Are brand-name drugs made in better factories than generic drugs?” and then answers “No.”).

Evidence exists also that, when making decisions, older adults use less complex strategies and consider
fewer pieces of information than younger adults do. In a series of studies, Johnson and colleagues (Johnson, 1990, 1993; Johnson & Drungle, 2000; Riggle & Johnson, 1996) examined decision-making strategies by different-aged adults using an information matrix that contained specific features (shown in rows) for different product choices (shown in columns). Participants were allowed to view only one cell of the matrix at a time, but they could view as many cells as they wished for as long as necessary before making a product decision. A relatively consistent finding in this research, across different types of products (e.g., cars, apartments, over-the-counter drugs), was that older adults spent a longer time studying each cell but sampled fewer pieces of information than did younger adults before making their decisions. Similar results were obtained by Streufert et al. (1990) in a study of decision making in managers, and by Hershey et al. (1990) in a financial-planning task.

**Query Theory**

A recent addition to the decision literature, Query Theory, may be extended at some point to account for some age differences in decision making due to memory declines. According to Query Theory (Johnson et al., 2007; Weber et al., 2007), questions that the decision maker asks him or herself during the decision process prompt the decision maker to serially reflect on specific memories about choice alternatives. The first query generally makes the strongest impression, due to a temporary decrease in the accessibility for other competing options (i.e., retrieval interference). Query Theory, for example, can account for endowment effects in the sense that buyers and sellers base their valuation on different queries. Buyers first consider why they might not enter into the transaction (resulting in more thoughts about why the good is not worth much), whereas sellers consider why they might enter the transaction first (resulting in value-increasing thoughts about the good). Such differential ordering of queries leads to disparities in object valuation. However, by simply switching the order of the query for one party, the endowment effect diminishes in younger adults (Johnson et al., 2007). Although not yet tested with older adults, one might expect older adults to show a greater effect of query order because they are less able to avoid retroactive interference (e.g., Hedden & Park, 2001) and show less ability in directed forgetting tasks (Zacks et al., 1996). Thus, Query Theory would predict that some decision effects, such as preferences for immediate rewards (time preference effects) and endowment effects, would be greater among older adults. Query Theory also points toward prescriptive solutions for undesired effects; simply directing decision makers to change the order of the queries they ask themselves appears to attenuate these effects.

**Numeracy**

Many choices that individuals make involve numeric information that generally requires deliberative capacity to process; comprehension and use of such information appears to decline with age. For example, results from health plan choice studies support these age declines in comprehension of numeric information and suggest that elderly decision makers do not always comprehend even fairly simple information. Hibbard et al. (2001) presented employed-aged adults (18–64 years old; n = 239) and older adults (65–94 years old; n = 253) with 33 decision tasks that involved interpretation of numbers from tables and graphs. In one task, participants were asked to identify the health insurance plan with the lowest copayment from a table that included four plans with information about monthly premiums and copayments. A comprehension index reflected the total number of errors made across the 33 tasks. The youngest participants (aged 18–35) averaged 8% errors; the oldest participants (aged 85–94) averaged 40% errors; the correlation between age and the number of errors was 0.31 (p < 0.001). Higher education was somewhat protective of these age declines. Age declines in numeric ability have been demonstrated across age cohorts as well as longitudinally (Peters, 2008; Reyna et al., 2009; Schaie & Zanjani, 2006). More research is needed to uncover age versus cohort differences in the wide range of abilities with numbers that could influence older adult decisions (e.g., reading tables and figures, addition/subtraction, understanding of risk including probabilities).

Less numerate individuals, whether young or old, do not necessarily perceive themselves as “at risk” in their lives due to limited skills; however, research shows that having inadequate numeric skills is associated with lower comprehension and use of numeric information. In particular, inadequate numeracy may be an important barrier to individuals’ understanding and use of health, financial, and other risks. Further study is required to discover formats to provide numeric information that will facilitate processing even in less numerate older adults (Peters et al., 2007). Formats that highlight the affective meaning of numbers may be particularly appropriate for them (Peters et al., 2009).

Given the age-related declines in deliberative processes, it is not surprising that older adults may sometimes prefer less choice for themselves (Reed et al., 2008). For example, a majority of older adults feel that the current Medicare Prescription Drug Benefit is too complex and provides too many choices (Cummings et al., 2009). Hanoch et al. (2009) found that, indeed, older age was associated with more errors in choosing the best Medicare prescription drug plan. In another study by the same group, however, older age was not a significant predictor of decision-making performance.
in a task modeled after Medicare Part D, although numeracy and speed of processing did affect performance (Tanius et al., 2009).

In sum, the pattern of observed performance in these studies appears to be consistent with what might be expected with a decline in deliberative processes with aging. In fact, research has demonstrated that younger adults adopt a strategy similar to that observed in older adults when task demands are increased. It may be that information load interacting with limited cognitive resources in later adulthood results in the adoption of strategies that minimize demands on deliberative processes (e.g., eliminating alternatives, satisficing, etc.).

There are several findings from these studies, however, that might temper interpretation of the observed age differences in terms of declining resources. First is the observation that age differences in decision outcomes were not always observed in these studies. Thus, even though older adults tended to sample less information and to do so occasionally in a less systematic fashion than younger adults, the chosen option did not vary with age (e.g., Meyer et al., 1995). Second, it was also found that experience-based factors moderated searches. For example, in examining decisions about over-the-counter drugs, Johnson and Drungle (2000) found that older adults were more likely to focus on active ingredients than were younger adults and were also more systematic in their information searches, presumably reflecting their greater experience with using these drugs. Stephens and Johnson (2000) also found that older adults were more likely to focus on side effects and drug interactions than younger adults. Such information is of obvious relevance to older adults, who are more likely than the young to be taking multiple prescription drugs at any one time.

**LIMITATIONS**

The study of age-related changes in decision making is quite new, with only a smattering of different decision paradigms in use and at most a handful of studies in any one area. Thus, many opportunities exist for future research. Most published studies have also used only small samples of older and younger adults and some question exists as to whether they are adequately powered. Inconsistency of the comparison age groups also exists across studies. Although research is becoming increasingly sensitive to this issue, results may vary as a function of comparison group. Some research has used age groups as young as 18 years old, generally undergraduates, as a comparison group with a community sample of older individuals. All efforts should be made to collect data from a large spectrum of ages, if possible. A further complication of cross-sectional designs is, of course, cohort effects. The wider the age difference between groups, the greater potential exists for contamination of cohort effects. Individuals from different cohorts have grown up in different time periods, and each generation may possess a different perspective toward and expertise in approaching decisions. Although costly and time-intensive to conduct, use of accelerated longitudinal designs (Aber & McArdle, 1991) that enable researchers to study individual development over a longer interval of the life course by gathering data during a comparatively short interval of time would be ideal. Most important, such designs also allow one to separate developmental effects from cohort and period effects. Currently, however, even

**SELECTIVITY AND MOTIVATED USE OF DELIBERATIVE PROCESSES**

Older adults, in fact, also may adapt to real or perceived declines in cognitive resources by becoming increasingly selective about where they spend effort (Hess, 2000). They may be more careful than younger adults in how and when they allocate their more limited cognitive resources. According to Hess, this aging-related resource conservation should be most apparent in situations of low relevance or meaningfulness to the individual, with fewer age differences as relevance and meaningfulness increase.

In support of this hypothesis, Hess et al. (2005) examined the extent to which attitudes toward proposed legislation were influenced by irrelevant affective information (i.e., the likeability of the lawmaker proposing the legislation). When the personal relevance of the legislation was low, older adults exhibited attitudes that were consistent with how much they liked the lawmaker, whereas younger adults’ attitudes were unaffected by this information. In contrast, when the legislation was rated high in personal relevance, neither the younger or older adults were influenced by the irrelevant affective information. Related findings were reported by Chen (2004), who observed that increasing personal accountability had a disproportionate benefit on older adults’ source memory relative to the effects on younger adults’ performance. Aging appears to be associated with increased selectivity in engagement of deliberative processes, with older adults’ selective engagement dependent on the availability of and motivation to use limited cognitive resources. Situations may occur in which older adults are capable of completing cognitive tasks but lack the motivation to do so.
SUMMARY AND CONCLUSIONS

Life-span theories are used fruitfully to provide predictions about age differences in judgment and decision making. Thus far, research to date has begun to attempt replications of well-known decision phenomenon examined initially in younger-adult studies with older-age samples (e.g., heuristics, risky choices, negativity biases). One of the main findings is that this literature is small but growing rapidly and offers sometimes opposing results. As a result, it also offers many opportunities for research that can illuminate both life-span and decision theories. In many areas of decision making, few, if any, published age-difference studies exist. In general, older adults appear to rely more on affective information when making judgments and decisions, and they appear to show a positivity effect at least in pre-choice information processing. Older adults’ stereotypical less efficient judgment and decision-making processes are evident, but, among healthy older adults, such declines in decision making may be found mostly in unfamiliar situations devoid of affective significance to the decision maker.

Life-span theories also point toward phenomena in decision making that have been little studied. The role of arousal in decision making is one example. Based on dynamic integration theory, Wurm et al. (2004) proposed that age-related cognitive declines could be used to explain an age-related increase in the disruptive influence of emotionally arousing stimuli and thus increased attention to emotional content and other automated processes. In particular, they point toward arousal as the key mechanism, however, rather than valence (although they predict a positivity effect, their prediction is based on positive information being less arousing than negative information). Arousal has been little studied in decision making up to this point, but seems likely to be a key construct with respect to older-adult decision making in particular. Additional research is needed to clarify theoretical propositions linking affect, arousal, and cognitive resources in information processes important to decision making (e.g., memory, attention).

The use of processes other than arousal also might change across the life span (e.g., personality). For example, individual differences may moderate older adults’ decision making in ways that are different from younger adults. Denburg et al. (2009) found that older adults who self-reported higher levels of experiencing negative emotional states also performed the most poorly on a decision task that involved learning about gains and losses, compared to older adults lower in negative emotionality. This finding contrasts with Peters and Slovic (2000) who found that younger adults high in negative emotionality learned more quickly to avoid losses in a similar decision task compared to those low in negative emotionality. Few decision studies exist examining age differences in the effects of individual-difference variables such as personality, gender, educational level, or ethnicity.

According to Hibbard and Peters (2003), making good decisions (which is what we want informed decision makers to do) requires information to be available, accurate, and timely. Information provided about Medicare Part D prescription plans, for example, meet this requirement. Decision makers also, however, must comprehend the information and comprehend the meaning of the information. The information provided about Part D plans, however, is not always understood (Hanoch et al., 2009). Beyond simple comprehension, individuals must be able to determine meaningful differences between options, weigh factors to match their needs and values, make trade-offs (e.g., between costs and benefits or pros and cons of a course of action), and ultimately choose. These steps are open to preference-construction processes. Given recent studies on the importance of cognitive and decision abilities to making good decisions about health (Peters et al., in press), these processes are important to understand.

Because older adults process information in ways that are different from younger adults, how they construct their preferences will also be different. These preference-construction processes may thus play a determining role in choices and undermine the notion of “informed choice” as aspects of the situation push individuals toward particular choices. The power of preference construction, however, can also be harnessed by understanding descriptively how decision makers make choices and normatively (or logically) what they should choose. Finally, one can examine the difference between the normative analysis and descriptive study to offer prescriptive interventions that help decision makers arrive at better choices. Applied to older adults’ decisions, such an approach can recognize and describe the challenges that older people face and their successes in addressing them. It can also recognize that competence varies by individual and by decision, leading to domain-specific policies and interventions that “nudge” older adults toward better decisions (Sunstein & Thaler, 2003). Through an understanding of how older adults construct preferences in ways that differ from younger adults, researchers will begin to unlock some of the mysteries of decision making and will be able to begin to prescribe interventions that can improve decisions.
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