

**Chapter title:** Stereotype threat in older adults: When and why does it occur and who is most affected?

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**Abstract:** Stereotype threat occurs when people fear that poor performance on their part will confirm a negative, self-relevant stereotype. In response to this threat, people tend to underperform compared to their potential, thereby conforming to the stereotype. For example, older adults are stereotyped as having poorer memory abilities than younger adults; when this stereotype becomes salient to older adults their memory performance decreases, thereby conforming to the stereotype. The current chapter provides an overview of when, how, and why stereotype threat impacts memory performance in older adults. In particular, we identify situations that lead to stereotype threat in the context of aging and memory. We also discuss the potential mechanisms underlying this effect within older adults, and outline how individual differences can make older adults more, or less, susceptible to this form of stereotype threat. We conclude by discussing the potential implications, including those on health, of this form of stereotype threat and delineate future research avenues that remain unexplored.

**Keywords:** stereotype threat, aging, memory

**Introduction:**

Stereotypes about aging are prevalent, and almost unconditionally accepted in the United States (e.g., Kite & Johnson, 1988; for reviews, see Hummert, 1999; Kite, Stockdale, Whitley, & Johnson, 2005), as well as in other industrialized countries—even in Asian countries (Cuddy, et al., 2009). Like stereotypes about other minority groups, stereotypes about aging are multi-faceted in nature (e.g., Brewer, Dull, & Lui, 1981), with both positive and negative components (e.g., Cuddy, Fiske, & Glick, 2008; Hummert, Garstka, Shaner, & Strahm, 1994). For example, older adults are generally perceived as being high in warmth but low in competence (Cuddy, Norton, & Fiske, 2005), a combination that is the signature of pitying stereotypes (Cuddy et al., 2008). In addition, although positive stereotypes about older adults exist, negative stereotypes about older adults are more prevalent (Crockett & Hummert, 1987). For example, older adults are often perceived as being forgetful, slow, timid, weak, and set in their ways (for a review, see Nelson, 2004).

These negative stereotypes about aging are present across the lifespan; even preschool-aged children endorse negative stereotypes about older adults (e.g., Isaacs & Bearison, 1986). For example, in one study children were shown a picture of an 80 year old man, and were asked to imagine how they will feel at that age. The majority of children gave responses that were coded negatively (e.g., “I’ll be sick and tired and ready to be buried”, p. 509). This was especially true amongst the youngest groups of children, who were in preschool through fourth grade (Seefeldt, Jantz, Galper, & Serock, 1977). Furthermore, being older does not ameliorate negative attitudes about aging. An online study with over 60,000 respondents found that people have strong implicit associations between “bad” and “older” (Nosek, Banaji, & Greenwald, 2002; see Figure 1). On average, these implicit negative attitudes about aging were stronger than any other implicit attitudes tested, including race. Even more striking is that the implicit negative attitudes were strongly negative no matter what the respondents’ age, even

though explicit preferences for young over old diminished as the respondents' age increased.

A common negative stereotype about aging is the belief that cognitive abilities decline with age. People generally associate aging with forgetfulness, incompetence, and more senile thinking (Hummert, et al., 1994; see also Kite & Johnson, 1988). For example, both younger and older adults believe that memory abilities begin to decline in middle adulthood, and continue to decline throughout the lifespan (e.g., Lineweaver & Hertzog, 1998; Ryan, 1992; Ryan & See, 1993). These negative views about age-related cognitive decline can have a variety of effects on behavior (for a review, see Hummert, 2011). For example, they can affect how younger adults perceive older adults. Younger adults asked to judge the cause of a target person's memory failure are more likely to attribute it to poor memory abilities when the target person is an older, rather than younger, adult (e.g., Bieman-Copland, & Ryan, 1998; Erber, Szuchman, & Rothberg, 1990; Parr & Siegert, 1993). They are also more sympathetic when older, rather than younger, adults experience memory failures (Erber, Szuchman, & Prager, 1997).

Negative stereotypes about age-related cognitive decline can also affect cognitive performance in older adults. The current review focuses on this type of stereotype threat. In the following sections, we first define stereotype threat and review when it occurs for older adults. We then discuss the potential mechanisms underlying this effect in older adults, and identify which older adults are most susceptible to it. Finally, we discuss applications of these findings in real-world settings.

### **What is stereotype threat and when does it occur?**

Stereotype threat occurs when members of a stigmatized group feel that if they perform poorly on a task they will confirm, or be judged by, a negative self-relevant stereotype. Ironically, their reactions to this threat may inadvertently cause them to conform to the negative stereotype by impairing their performance. Stereotype threat was first reported by Steele and Aronson in 1995 to explain why African-American students tend to underperform on

standardized tests. Steele and Aronson reasoned that African-American students are aware of cultural stereotypes depicting them as intellectually inferior to their Caucasian peers, and fear of confirming these stereotypes causes them to underperform on standardized tests compared to their potential. Results supported these predictions. African-American students performed worse than Caucasian students when a test was described as being diagnostic of intellectual abilities, but not when it was described as being diagnostic of problem solving abilities.

Hundreds of studies have now documented stereotype threat effects for a wide variety of situations and populations. For instance, women are often stereotyped as being less competent at math than men. When this stereotype becomes salient to women their performance on math-based tasks actually decreases, thereby conforming to the stereotype (e.g., Spencer, Steele, & Quinn, 1999). Similarly, stereotype threat impairs negotiation and driving abilities in women (e.g., Kray, Galinsky, & Thompson, 2002; Yeung & von Hippel, 2008), and academic performance in students from low socioeconomic backgrounds (e.g., Croizet & Claire, 1998).

Stereotype threat can also be induced in groups that are not typically thought to be subject to negative stereotypes and that are not chronically the victims of stigmatization. For example, when Caucasian men think they are being compared to Asian men their math performance decreases (Aronson, Lustina, Good, Keough, Steele, & Brown, 1998). When they think they are being compared to African-American men their athletic performance decreases (Stone, Lynch, Sjomeling, & Darley, 1999). So stereotype threat can theoretically be experienced by *anyone* encountering negative self-relevant stereotypes about their performance.

In the current review we focus primarily on how stereotype threat affects memory performance in older adults. This effect was well-demonstrated in a study by Hess, Auman, Colcombe, and Rahhal (2003). Here, younger and older adults read fictional news articles describing research about how aging affects memory. For participants in the control (no-threat)

condition, these articles were relatively positive and described the maintenance of memory abilities across the lifespan. In contrast, for participants in the stereotype threat condition, these articles were relatively negative and described age-related declines in memory. For example, they were told that “older adults may have to increasingly depend upon the help of memory tools as well as friends and family” to cope with age-related memory declines. A short time after reading these articles, all participants were given a memory test that involved learning and recalling a list of words. Results revealed age differences in memory performance, but only within the stereotype threat condition. Younger and older adults did *not* differ in recall after reading articles that described maintenance of memory abilities across the lifespan. In contrast, younger adults had significantly higher recall than older adults after reading articles that described age-related memory declines. This result is consistent with stereotype threat theory. When negative stereotypes about age-related memory decline were made salient to older adults their memory performance actually declined, thereby conforming to the stereotype.

**How is stereotype threat induced in older adults?** Stereotype threat about age-related cognitive decline can be evoked in a number of different ways. In some studies, such as the one by Hess and colleagues (2003) described above, participants are exposed to fictitious news stories or conference proceedings confirming that cognitive abilities decline with age (e.g., Coudin & Alexopoulos, 2010; Hess & Hinson, 2006). In other cases researchers have simply stated that the purpose of the experiment is to examine age-related declines or differences in memory (e.g., Abrams, Eller, & Bryant, 2006; Hess, Emery, & Queen, 2009; Hess, Hinson, & Hodges, 2009). However, stereotype threat can also be induced using more subtle manipulations. For example, Kang and Chasteen (2009) induced threat in older adults by having them explicitly report their age before completing the experiment alongside a younger adult confederate. These subtle indications that the researchers were examining age-related differences in memory were enough to induce stereotype threat and reduce memory

performance relative to older adults in a control condition.

As another example of how subtle situational cues can induce stereotype threat, age-related stereotype threat can occur when researchers simply state that the purpose of the experiment is to examine memory performance (e.g., Desrichard & Kopetz, 2005; Rahhal, Hasher, & Colcombe, 2001). This is likely because older adults' negative stereotypes about age-related cognitive decline are activated when they know that their memory is being examined. Because of this, older adults tend to have higher performance on a test if it is *not* described as assessing memory compared to when it *is* described as assessing memory.

Similar results have been obtained in other lines of research that were not necessarily designed to examine stereotype threat, but rather to examine how memory is affected by the intentionality of processing performed at encoding and/or retrieval. Looking first at encoding, several studies have reported a reduction of, or even an elimination of, age differences in memory performance when participants complete the encoding task without awareness that there will be an upcoming memory test. That is, age-differences in memory performance are sometimes attenuated when *incidental* encoding instructions rather than *intentional* encoding instructions are used (for reviews, see Perlmutter & Mitchell, 1982; Yonelinas, 2002). Although some subsequent research has failed to replicate this effect (e.g., Kausler, Lichty, & Freund, 1985; Verhaeghen, Marcoen, & Goossens, 1992), when there are increased age-differences for intentional rather than incidental encoding instructions this may in part be due to stereotype threat. This is because stereotypes about age-related memory decline are more likely to come to mind when older adults are explicitly told their memory will be assessed.

Similar results have also been found from studies that manipulated the intentionality of processing at retrieval rather than at encoding (for reviews, see Fleischman & Gabrieli, 1998; Light, Prull, La Voie, & Healy, 2000). Age-differences are typically observed on explicit memory tests, which involve the intentional and conscious retrieval of past events. In contrast, age-

differences are sometimes reduced, or even eliminated, on implicit memory tests. Here, memory is assessed as changes in behavior that are a result of prior experience, but that are (importantly) unaccompanied by intentional or conscious recall of previous learning (e.g., Mitchell & Bruss, 2003). Although performance on these implicit tests is highly variable and likely dependent upon a myriad of additional factors, there do tend to be larger age differences in memory performance when participants are consciously aware that their memory is being tested. Again, this may in part be due to stereotype threat. When participants are aware that memory is being assessed, the threat is “in the air” (Steele, 1997).

**A distinction between implicit and explicit stereotype activation.** So far we have only discussed how explicitly inducing stereotype threat can affect performance in older adults. However, some of the first research examining the influence of age-related stereotype activation on performance used implicit priming. Here, performance is examined after subliminally exposing participants to age-related primes. In the typical paradigm negative age-related words (e.g., *feeble, forgot, incompetent, senile*) or positive age-related words (e.g., *accomplished, knowledgeable, successful, wise*) are briefly flashed on the screen at a faster speed than can be consciously perceived (e.g., Hess, Hinson, & Statham, 2004). Participants then complete a subsequent task. The expectation is that participants will show a different pattern of performance when primed with the negative, versus positive, age-related words. Results generally support this prediction. Older adults walk slower (Hausdorff, Levy, & Wei, 1999), have poorer handwriting (Levy, 2000), have poorer physical balance (Levy & Leifheit-Limson, 2009), have increased physiological responses to stress (Levy, Hausdorff, Hencke, & Wei, 2000), and are more likely to refuse health interventions to artificially prolong life (Levy, Ashman, & Dror, 1999-2000) when exposed to negative, rather than positive, age-related primes.

Implicit priming can also affect memory performance. In general, older adults perform worse on a memory test following negative, rather than positive, age-related primes (Hess, et

al., 2004; Levy, 1996; Levy & Leifheit-Limson, 2009; Stein, Blanchard-Fields, & Hertzog, 2002). Although this has been inconsistently observed across memory measures, the general pattern suggests that unconsciously activated stereotypes about aging can negatively affect memory.

How do these implicit priming effects differ from the explicit stereotype threat effects discussed earlier? Some research has suggested that the two effects differ in magnitude (Hess, et al., 2004). However, in contrast to this proposition, a recent meta-analysis found no difference in effect magnitude as a function of whether participants were aware of the stereotype or not (Meisner, in press). Rather, the primary difference between implicit priming and explicit stereotype threat appears to be in whether the effects are limited to people personally stigmatized by the stereotype (for a review, see Wheeler & Petty, 2001). This can be illustrated by examining how younger adults are affected by stereotype threat (about age-related cognitive decline) versus by implicit stereotype activation (about age-related stereotypes). Results show that younger adults do not exhibit changes in memory performance as a function of explicit stereotype threat (e.g., Chasteen, et al., 2005; Desrichard & Kopetz, 2005; Hess, et al., 2003; Rahhal, et al., 2001). For example, memory performance for younger adults does not vary as a function of whether the experiment is described as examining age-related declines in memory performance or not. In contrast, younger adults sometimes exhibit implicit stereotype activation effects similar to those exhibited by older adults. Priming age-related stereotypes in younger adults can result in assimilation to these stereotypes: they walk slower (Bargh, Chen, & Burrows, 1996), respond more slowly (Dijksterhuis, Spears, & Lépinasse, 2001), drive more cautiously (Gray & Branaghan, 2009), and sometimes remember less (Dijksterhuis, Aarts, Bargh, & van Knippenberg, 2000; but see Hess, et al., 2004 for conflicting results and discussion of this issue).

Thus, younger adults are differentially affected by stereotype threat (about age-related cognitive decline) versus implicit stereotype activation (about age-related stereotypes). These

differences are likely because the two effects emerge for different reasons (e.g., Marx & Stapel, 2006). Reviewed in more depth below, stereotype threat is typically thought to occur when people fear that poor performance on their part may confirm a negative, self-relevant, stereotype. That is, stereotype threat requires conscious awareness both of the stereotype and of its applicability to one's own performance. Furthermore, its effects seem to rely upon these conscious mediation processes. In contrast, building upon James's (1890) idea of ideomotor action, implicit stereotype threat activation can affect behavior because action can proceed directly from perception. When stereotypes are unconsciously activated people tend to behave in line with them (e.g., Bargh, et al., 1996; Dijksterhuis, 2001). Interestingly, when stereotypes are self-relevant they may therefore induce both stereotype threat as well as ideomotor effects (Dijksterhuis, 2001; Dijksterhuis & Bargh, 2001). In summary, although implicit priming and explicit stereotype threat both reflect how stereotypes can affect performance (and are therefore sometimes grouped together even within meta-analyses, see Horton, Baker, Pearce, & Deakin, 2008), they are due to different mechanisms.

### **Why does stereotype threat occur?**

Although a large body of research has clearly demonstrated *that* stereotype threat effects occur, across studies it is less clear *why*. Below, we briefly outline four potential mechanisms: negative affective responses, lowered performance expectations, executive control interference, and changes in motivational orientation. We also review how well each of these mechanisms can account for older adults' stereotype threat effects.

**The role of negative affective responses.** Negative affective responses were one of the first mechanisms proposed to underlie stereotype threat effects (e.g., Steele & Aronson, 1995). In particular, stereotype threat is assumed to be associated with increased negative affective states (such as test anxiety), which in turn are associated with negative thoughts or

increased levels of anxiety, which in turn lead to performance decrements (Steele, 1997; Steele, Spencer, & Aronson, 2002).

Results in support of this mechanism have been mixed. Within the broader stereotype threat literature using younger adult participants, some studies have found that self-reported anxiety partially mediates stereotype threat effects (e.g., Osborne, 2001), others have found *no* mediation (e.g., Spencer, et al., 1999), and others have found that mediation occurs only for people with a high personal investment in the domain being threatened (Delgado & Prieto, 2008). Mixed results have also been obtained when examining how stereotype threat affects memory performance in older adults. One study reported that older adults under threat experience greater test anxiety, and that this increased anxiety mediated the extent of subsequent memory performance decrements (Abrams, et al., 2006). However, a large number of additional studies have failed to demonstrate a mediating relationship between stereotype threat manipulations and either anxiety (e.g., Chasteen, et al., 2005; Hess, et al., 2003; Hess & Hinson, 2006), or negative mood states (e.g., Hess, et al., 2009; Kang & Chasteen, 2009) in older adults. This is true even when examining skin conductance responses, an index of autonomic nervous system functioning (Hess, et al., 2009) rather than self-reports of anxiety or arousal. In particular, although skin conductance increased for older adults in the stereotype threat condition relative to the control condition this did not mediate the subsequent memory performance decrements (Hess et al., 2009).

In summary, stereotype threat has traditionally been explained as arising from hot motivational factors such as anxiety or arousal (see Wheeler & Petty, 2001). Although older adults sometimes display these negative affective responses in response to threat, this does *not* appear to be a key cause of stereotype-threat-related memory impairments.

**The role of lowered performance expectations:** In contrast to the conflicting findings about the role of negative affective responses, results have consistently implicated performance

expectations in modulating stereotype threat effects. The idea here is that when people expect to do poorly on a task then they will underperform compared to their potential (e.g., Kray, Thompson, & Galinsky, 2001). This appears to play a role in explaining stereotype threat effects. For example, younger adult women under threat about their spatial abilities expect to perform worse on a subsequent spatial abilities test than do younger adult women not under threat (Stangor, Carr, & Kiang, 1998). These decreased performance expectations partially mediate subsequent stereotype threat effects (Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003). Similar results have also been reported for older adults. Older adults under threat about their memory abilities expect to do worse on a subsequent memory tasks, and these lowered expectations mediate stereotype threat performance decrements (Desrichard & Kopetz, 2005, see also Hess, et al., 2009). Although this factor has not yet received a great deal of investigation in older adults, extant results suggest it may be a key factor contributing to their stereotype-threat-related memory impairments.

**The role of executive control interference.** As noted above, in this review we focus only on a few potential mechanisms underlying stereotype threat effects. However, across studies there are a variety of affective, motivational, physiological, and cognitive factors that have all been shown to mediate stereotype threat effects. To reconcile these disparate results, a recent model proposes that executive control interference is the common distal mediator linking these aforementioned factors (Schmader, Johns, & Forbes, 2008). Below, we outline this integrated model before reviewing whether evidence from older adults supports it.

In brief, this integrated model (Schmader, et al., 2008) proposes that stereotype threat is due to three interrelated mechanisms that selectively impair performance on tasks that require executive control resources (i.e., the set of interrelated abilities involved in controlling and directing attention). First, stereotype threat is thought to induce physiological stress. When people encounter stereotype threat they sometimes show increases in stress-based arousal

(e.g., Ben-Zeev, Fein, & Inzlicht, 2005), and this in turn can negatively affect task performance (e.g., Eysenck & Calvo, 1992). This is particularly true for tasks that rely upon executive control and prefrontal cortex functioning, since prefrontal function and performance on executive-control-based tasks are known to be especially sensitive to stress-based arousal (e.g., Arnsten, 2009; Schoofs, Wolf, & Smeets, 2009). Second, stereotype threat can increase performance monitoring and concerns about task performance (e.g., Beilock, Rydell, & McConnell, 2007). Because performance concerns and stereotype threat concerns compete for executive control resources, they together induce a divided attention state in the participant. This in turn can impair performance. Finally, stereotype threat may also induce negative moods and thoughts that people then attempt to regulate (e.g., Steele, 1997; Steele, et al., 2002). Suppression of negative moods and thoughts is cognitively costly, requiring executive control resources to complete (e.g., Muraven & Baumeister, 2000). Thus, emotion regulation processes also compete for executive control resources, leaving even fewer resources available to perform the task at hand. In summary, this integrated model proposes that stereotype threat leads to increased stress, increased performance monitoring, and an increased need to regulate negative affective states. This in turn leads to lowered availability of executive control resources and hence lower performance on tasks that require the use of executive control resources.

Although research supports this model in younger adults (e.g., Beilock, Jellison, Rydell, McConnell, & Carr, 2006; Régner, Smeding, Gimmig, Thinus-Blanc, Monteil, & Hugert, 2010; Schmader & Johns, 2003), empirical evidence has been mixed when examining older adults. Looking first at evidence in favor of the model, research has shown that stereotype threat preferentially decreases older adults' ability to use controlled, rather than automatic, memory processes (Mazerolle, Régner, Morisset, Rigalleau, & Huguet, in press). Similarly, older adults under threat tend to respond more on the basis of familiarity and less on the basis of

recollection when completing a memory test under time pressure (Hess, et al., 2009). Given that controlled memory processes and recollection-based judgments rely more heavily upon executive control resources than automatic memory processes and familiarity-based judgments, these findings support the notion that stereotype threat temporarily reduces the amount of executive control resources available and hence preferentially affects tasks that require executive control.

However, there has also been evidence suggesting that executive control interference is not a key factor underlying stereotype threat effects in older adults. For example, stereotype threat does not impair older adults' ability to selectively prioritize learning high, over low, value information (Barber & Mather, 2012), even though this ability is dependent upon executive control (Castel, Balota, & McCabe, 2009). Furthermore, although performance on a working memory measure is impaired following stereotype threat for younger adults (Johns, Inzlicht, & Schmader, 2008) it is not for older adults (Hess, et al., 2009), unless it is described as being a test of memory abilities (Mazerolle, et al., in press; see also Abrams, Eller, & Bryant, 2006; Desrichard & Kopetz, 2005; Experiment 2). The finding that working memory is not necessarily impaired for older adults following stereotype threat is problematic for an executive resource account of stereotype threat. A possibility that seems more consistent with these findings using working memory tasks is that stereotype threat reduces older adults' performance on all tasks clearly identified as memory tasks by lowering performance expectations.

In summary, although executive control interference appears to be a key cause of stereotype threat in younger adults, based upon the extant literature it is unclear what role it plays for older adults. One possibility is that executive control interference mediates stereotype threat more strongly in younger, compared to older, adults due to age-related changes in emotion-regulation abilities. As noted above, arousal increases as a function of stereotype threat in older adults but this does not mediate subsequent performance decrements (Hess, et

al., 2009). This may be because regulating negative emotions is less cognitively costly for older, compared with younger, adults. For example, research has shown that conducting emotion regulation while performing a cognitive task leads to performance decrements for younger, but not older, adults (Scheibe & Blanchard-Fields, 2009). So although stereotype threat may induce negative affective states that people try to regulate this may be more cognitively costly for younger than for older adults.

**Motivational orientations: The role of regulatory fit.** The final mechanism that we review here is a motivation-based explanation of stereotype threat that hinges on the role of *regulatory fit* (Seibt & Förster, 2004). This explanation is drawn from regulatory focus theory (Higgins, 1997, 1999), which proposes that people differ in how they pursue goals. People with a *promotion focus* concentrate on goal-related rewards and aspirations, and are sensitive to the presence or absence of rewards. Furthermore, people with a promotion focus tend to use approach strategies when completing tasks (e.g., try to gain hits and minimize misses during a recognition memory test). In contrast to this, people with a *prevention focus* concentrate on goal-related losses and responsibilities, and are sensitive to the presence or absence of losses. Furthermore, people with a prevention focus tend to use avoidance strategies when completing tasks (e.g., try to avoid false alarms and ensure correct rejections).

Although regulatory focus can directly affect performance, its precise role depends upon the nature of the task. People tend to have higher task performance when their regulatory focus matches the reward structure of the task, i.e., when there is a *regulatory fit* (e.g., Shah, Higgins, & Friedman, 1998). People with a promotion focus typically do better when the task emphasizes gaining rewards rather than avoiding losses. The reverse is true for prevention focus.

Plenty of research suggests that people differ in their dispositional promotion and prevention focus tendencies (e.g., Higgins, Shah, & Friedman, 1997). However, a variety of factors can also affect an individual's temporary situational regulatory focus (e.g., Förster,

Higgins, & Idson, 1998; Freitas, Liberman, & Higgins, 2002; Friedman & Förster, 2001). One such variable may be stereotype threat. In particular, stereotype threat may invoke a prevention focus, where people are concerned with minimizing losses and avoiding risks (Seibt & Förster, 2004; see also Smith, 2004). Interestingly, an extension of this proposition is that stereotype threat impairments reported in previous research may be due to the fact that studies have almost exclusively used reward-based tasks (e.g., how many hits were gained?). This is problematic as these situations represent a regulatory mismatch for people with a prevention focus. In other words, although stereotype threat is usually thought of as impairing performance, this may only occur when the task emphasizes rewards. In contrast, performance under stereotype threat may *increase* when the task emphasizes losses (i.e., when there is regulatory fit).

Results have tended to support this theory. Looking first at younger adults, stereotype threat is associated with an increased focus on prevention, rather than promotion, related concepts (Seibt & Förster, 2004, see also Oyserman, Uskul, Yoder, Nesse, & Williams, 2007). Furthermore, younger adults under stereotype threat respond more slowly during a task (Seibt & Förster, 2004), and are more risk-averse in their decision making (Carr & Steele, 2010), as would be expected by a more cautious prevention focus. Also as predicted, stereotype threat effects disappear, and sometimes even reverse, when the task has a losses-based structure rather than a gains-based structure (Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Förster, 2004). For example, one study examined whether women's performance on a math task depended upon both stereotype threat and the task's reward structure. Results showed that women under threat underperformed when the math task had a reward-based structure (i.e., more points awarded for correct than incorrect answers), but showed no impairment when the task had a losses-based structure (i.e., more points lost for incorrect than correct answers; Grimm, et al., 2009).

Support for this theory has also been found when examining older, rather than younger, adults. Consistent with the idea that stereotype threat induces a prevention focus, older adults under stereotype threat are more risk-averse in their decision making than older adults not under stereotype threat (Coudin & Alexopoulos, 2010). Furthermore, more direct evidence for this theory can be seen in results from our own laboratory (Barber & Mather, 2012). In two experiments, older adults (either under stereotype threat or not) were asked to learn a series of words paired with point values. Some words led to point-gains if remembered whereas others led to point-losses if forgotten. Memory was then tested using both a free recall test (Experiments 1 & 2), as well as a subsequent recognition test (Experiment 2). Supporting the prediction that stereotype threat induces a prevention focus, in both experiments there was a significant interaction between stereotype threat condition and point value. Older adults under stereotype threat recalled fewer of the gain-related items, but *more* of the loss-related items than older adults in the non-threat condition. Furthermore, on the subsequent recognition test older adults under stereotype threat had more conservative response biases, than did older adults in the non-threat condition. Together, these results are consistent with a prevention focus, which is associated with an increased concern with losses, minimizing errors, and avoiding risk. This mechanism predicts that stereotype threat will not always impair memory performance in older adults. Rather, stereotype threat could even *improve* memory when the task is framed as relating to losses rather than gains.

**Interactions between the different explanations of stereotype threat.** In the previous section we have outlined four potential reasons why stereotype threat might occur. However, it is important to note that this is not an exhaustive list. For example, stereotype threat may also impact behavior by reducing the effort people exert towards the task (e.g., Schimel, Arndt, Banko, & Cook, 2004; Stone, 2002), by depleting their ability to engage in self-control and effortful processing (e.g., Inzlicht, McKay, & Aronson, 2006), by increasing attention

or effort towards procedural tasks that are best performed automatically (e.g., Beilock, et al., 2006), or by causing participants to use an inefficient task strategy (e.g., Hess, et al., 2003). In the present review we have focused only on the subset of mechanisms that have been widely cited as accounting for stereotype threat effects, or that have received a large amount of experimental support when examining memory performance in older adults.

It is also important to note that although we have outlined these four potential mechanisms as independent causes of stereotype threat, in actuality they likely interact with one another. For example, the regulatory fit model of stereotype threat is not incongruent with the executive interference hypothesis. For example, within the integrated executive control interference model proposed by Schmader, Johns, and Forbes (2008), regulatory focus is included as one of the reasons that stereotype threat induces task-monitoring behavior (e.g., by increasing vigilance towards avoiding errors). This in turn is thought to reduce the number of executive control resources available for completing the task at hand.

As a second example of the interaction between these mechanisms, it is possible that performance expectations are related to regulatory focus. People with a prevention focus tend to have performance avoidance goals whereas people with a promotion focus tend to have performance approach goals (Smith, 2004; 2006). One way that these differences in task strategy may manifest themselves is through performance expectations. Avoidance goals may lead people to be concerned with failure to meet minimal expectations (i.e., vigilant not to be the worst) rather than with the ability to meet maximal performance (i.e., eager to be the best). This could in turn cause people in a prevention focus to set low performance expectations. So, the mediating role of performance expectations may actually be due to the fact that stereotype threat induces a prevention focus.

To summarize, although stereotype threat effects are robust and occur across a wide variety of situations for a wide variety of populations, the precise mechanisms underlying these

effects are still unclear. However, research examining older adults has tended to support two mechanisms. First, stereotype threat appears to reduce performance expectations, and this in turn mediates the amount of stereotype threat induced memory impairments observed in older adults (e.g., Desrichard & Kopetz, 2005). Second, regulatory fit appears to be a key factor modulating stereotype threat effects in older adults. According to this model (Seibt & Förster, 2004), stereotype threat induces a prevention focus where people focus on loss, rather than gain, related information, and are concerned with minimizing mistakes and risks. Although some recent research in our own lab supports this proposition (Barber & Mather, 2012), future research is needed to more fully examine the role of regulatory fit in underlying stereotype threat effects in older adults. Furthermore, future research is also needed to clarify the conflicting findings about executive control interference's role in underlying stereotype threat effects in older adults, compared to younger, adults.

### **Who is most affected by stereotype threat?**

In the previous section we examined four potential mechanisms underlying stereotype threat occurs in older adults. We now turn to an examination of individual differences in older adults' susceptibility to stereotype threat. In particular, we examine how domain and group identification, intergenerational interactions, and perceptions of societal and cultural views of aging may modulate the extent to which older adults experience stereotype threat.

**Identification with the threatened domain.** Stereotype threat effects have long been thought to be moderated by how much people value achievement within the threatened domain (e.g., Aronson, et al., 1998; Steele, 1997). People are only expected to feel threatened about how their performance will be perceived if they personally care about, or care about the societal implications of, whether they have the ability being tested (e.g., Brunstein & Gollwitzer, 1996; Steele, 1997). Results have generally been consistent with this (e.g., Stone, et al., 1999). For example, when younger adult Caucasian men think that their math performance is being

compared to younger adult Asian men, their performance generally decreases. However, this is only true for Caucasian men that strongly care about their math abilities (Aronson, et al., 1999).

Similar results have also been found when examining how older adults respond to stereotype threat about their memory abilities. In fact, some research has suggested a strong relationship between these factors. When under stereotype threat (but not within a control condition), the amount that older adults value their memory has a large negative association with the amount of information they recall,  $r = -.70$  (Hess, et al., 2003). Although subsequent research has failed to replicate this effect (Hess & Hinson, 2006), it suggests that stereotype threat may have the greatest negative impact on older adults who value their memory abilities. This may explain why stereotype threat impairments on memory are strongest for older adults with high levels of education (Barber & Mather, 2012; Hess, et al., 2009; but see Andreoletti & Lachman, 2004). High levels of education may be associated with increased identification with the ability to perform well on memory tests (as this is a common occurrence in higher education).

It is interesting to note that while stereotype threat effects may be moderated by domain identification, it is also true that stereotype threat affects domain identification. In particular, stereotype threat may lead people to disidentify with the domain being threatened to preserve their self-esteem (e.g., Osborne, 1997; Steele, 1997; Steele & Aronson, 1995). This logic can explain why there are so few women who study math and engineering. Stereotypes about women's incompetence in math may cause women to disidentify with domains related to math, and therefore decide not pursue this type of career. To our knowledge this has not yet been studied with aging stereotypes. However, it would suggest that exposure to negative age-related stereotypes leads older adults to devalue memory performance.

**Identification with the threatened group.** Domain identification is not the only factor that can modulate stereotype threat. Group identification may also play a role. For example,

younger adult women generally underperform on math tests when the link between their performance and gender is salient. However, this is moderated by group identification; only women whose gender is central to their self-identity are susceptible to these effects (Schmader, 2002). Although support for this has also been found when looking at age-related stereotypes in late middle-aged adults (O'Brien & Hummert, 2006), little research has directly examined older adults. Results of one study suggest that the more that people self-identify as older adults, the lower their memory performance. However, this did not moderate the observed threat effects (Kang & Chasteen, 2009). Future research is needed to explore the relationship between age-group identification and stereotype threat effects within older adults.

As was the case with domain identification, it is worth noting that while stereotype threat effects may be moderated by group identification, it is also true that stereotype threat affects group identification. Although identification with the older adult age group can actually help older adults cope with perceived age-discrimination (Garstka, Schmitt, Branscombe, & Hummert, 2004), research suggests that stereotype threat *decreases* identification with the older adult age group. For example, correlational research suggests that older adults who perceive there to be greater age-related stigma also report less identification with the older adult age group (Hess & Dikken, 2010). A similar result has also been found experimentally. When older adults are presented with negative stereotypes about aging, they subsequently direct their gaze away from pictures of older adults and towards pictures of middle-aged adults. They also perceive themselves as being more similar to middle-aged, compared to older, adults (Weiss & Freund, in press). This distancing may be accomplished via social comparisons (e.g., considering oneself as being better off than other members of one's age group; see Heckhausen & Krueger, 1993). It may also explain why older adults report subjectively feeling younger than their chronological age (e.g., Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008; Montepare & Lachman, 1989; Rubin & Berntsen, 2006).

**Intergenerational Interaction.** The previous two factors, domain and group identification, both serve to make older adults *more* susceptible to stereotype threat effects. However, there are also protective factors that make older adults *less* susceptible to stereotype threat effects. One such factor appears to be positive intergenerational interactions.

A large body of literature has shown that under the appropriate conditions intergroup contact is one of the most effective ways of reducing prejudice and stereotypes (Allport, 1954, for a review or a meta-analysis of these effects see Pettigrew, 1998 and Pettigrew & Tropp, 2000, respectively). For example, younger adults that experience positive interactions with older adults hold fewer stereotypes about older adults (e.g., Hale, 1998; Schwartz & Simmons, 2001). Of greater interest to the current review, they can also reduce stereotype threat for the outgroup members. This is because older adults that have had positive interactions with younger adults may be less anxious about being compared to younger adults and may be less likely to bring to mind negative age-related stereotypes (Crisp & Abrams, 2002). Results have been in line with this; intergenerational contact moderates stereotype-threat related memory performance in older adults such that stereotype-threat-related memory impairments are less likely to occur as older adults report increases in positive intergenerational contact within their daily lives (Abrams, et al., 2006). Interestingly, these benefits can also occur for older adults who simply *imagine* positive interactions with younger adults (in this case on a test of math abilities; Abrams, Crisp, Marques, Fagg, Bedford, & Provias, 2008).

The benefits of intergenerational contact on reducing stereotype threat in older adults likely arose for two reasons. First, older adults who reported having positive intergenerational contact also felt less anxious in response to stereotype threat. Furthermore, after accounting for these differences in anxiety there was no remaining benefit of intergenerational contact in reducing stereotype threat effects (Abrams, et al., 2006). Second, older adults who reported having positive intergenerational contact were also less likely to self-identify as an older adult

(Abrams, et al., 2006). This may serve as a protective factor since identification with the threatened group tends to amplify stereotype threat effects (e.g., O'Brien & Hummert, 2006). Thus, intergenerational contact reduces stereotype threat by making older adults feel less anxious about the possibility of being compared to younger adults, and also by decreasing their identification with the older adult age group.

In summary, although intergenerational interaction is relatively uncommon (e.g., Hagestad & Uhlenberg, 2005) it can have positive consequences both for younger and older adults. This appears to be true even when the contact does not actually occur and is simply imagined. Given the relative ease of imagining a positive intergenerational interaction, this may be an effective means of reducing stereotype threat in real-world settings (for a review, see Crisp & Abrams, 2002; but for criticisms see Bigler & Hughes, 2010). Future research is needed to examine the use of this as an intervention, particularly amongst older adults most susceptible to stereotype threat effects (such as those who highly value their memory abilities).

**Perception of age-related stereotypes.** Finally, cultural and personal perceptions about age-related cognitive decline may also affect the amount of stereotype threat impairments observed. Looking first at the role of culture, some of the first work examining stereotype threat suggested that older adults from cultures presumed to hold positive perceptions about aging (i.e., Chinese and the American Deaf) showed fewer age-related memory impairments than older adults from cultures presumed to hold more negative perceptions of aging (i.e., Americans). Also, the relationship between culture and memory was mediated by the extent to which older adults held positive views about aging (Levy & Langer, 1994). This result could be explained as being due to stereotype threat. That is, older adults from cultures that hold more positive views of aging are less likely to experience stereotype threat when their memory is being tested, and so show less age-related declines in memory performance when compared to older adults from cultures that hold more negative views of aging.

Although these results are compelling, a subsequent failure to completely replicate this effect has made the relationship between cultural views of aging and age-related memory decline less clear. In a study by Yoon and colleagues (2000), there was a reduction in age-related memory impairments for people from a culture that presumably has positive views on aging (i.e., Chinese immigrants that had recently moved to Canada) compared to people from a culture that has negative views on aging (i.e., Anglophone Canadians). However, in contrast to the results reported by Levy and Langer (1994), this was not mediated by the extent to which older adults held positive views about aging. In fact, there was no significant correlation between beliefs about aging and memory performance (Yoon, Hasher, Feinberg, Rahhal, & Winocur, 2000; see also Kahn, Zarit, Hilbert, & Niederehe, 1975; Scogin, Storandt, & Lott, 1985).

Thus, although studies suggest that age-related memory impairments are reduced for people from cultures with more positive views about aging, it is unclear whether this is in fact due to cultural views about aging. One alternative is that these results may have been due to cultural differences in the amount of positive intergenerational interactions amongst the older adults. For example, Yoon and colleagues (2000) note that a unique feature of their Chinese, compared to Anglophone, Canadians was that they tended to live in multi-generational households. So it is possible that cultural differences in the extent to which older adults engage in intergenerational interactions, a factor known to reduce stereotype threat related memory impairments (e.g., Abrams, et al., 2006), is the driving force behind the reduction in age-related memory differences. It is also worth noting that recent evidence suggests that Eastern and Western cultures have mostly similar ageist stereotypes (Boduroglu, Yoon, Luo, & Park, 2006). For example, recent evidence shows that Asian cultures, like Western cultures, have multi-faceted stereotypes about older adults in which they are perceived as high in warmth but low in competence (Cuddy, et al., 2009).

In contrast to the conflicting literature on the role of cultural perceptions of aging, there is more consistent evidence implicating personal perceptions of age-related stereotypes in modulating stereotype threat. Research in this area has examined the role of perceived stereotype threat. This is defined as the extent to which people expect and perceive others to be stereotyping them. It can occur both as general stigma consciousness (Pinel, 1999), where people tend to expect or perceive negative stereotypes in their daily lives. It can also occur as a situational perception of threat within a specific context (Kang & Chasteen, 2009). Research has shown that perceptions of stereotype threat can moderate stereotype-threat-related memory impairments in older adults. Older adults who tend to perceive a high degree of threat in their environment are more susceptible to stereotype threat as evidenced by poorer memory performance when under threat (Kang & Chasteen, 2009; see also Chasteen, et al., 2005).

### **What are the implications of stereotype threat?**

So far we have examined what stereotype threat is, why it occurs for older adults, and which older adults are most affected by it. We now turn our attention to examining how stereotype threat might impact older adults in real-world settings. Although some have argued that stereotype threat exerts little effect outside of the laboratory (e.g., Cullen, Hardison, & Sackett, 2004; Stricker & Ward, 2004), recent research has called this conclusion into question. For example, Danaher and Crandall (2008) reanalyzed data from Sticker and Ward (2004) and found that when students were asked to indicate their gender after (rather than before) an AP Calculus test, there was a 33% reduction in the gender gap between male and female performance. Building on the notion that stereotype threat likely has many important ecological implications (e.g., Burgess, Warren, Phelan, Dovidio, & van Ryn, 2010), below we briefly outline ways that stereotype threat may influence older adults outside of the laboratory.

First, it is likely that stereotype threat negatively impacts memory performance in many everyday settings. This could be evidenced as forgetting of appointments, or the name of an

acquaintance when placed in situations where age-related stereotypes are prevalent. If these everyday memory failures occur frequently, they may lead older adults to seek neuropsychological testing to determine whether their memory failures are indicative of dementia. Here, stereotype-threat-related memory impairments can have serious clinical implications. In a recent study 70% of older adults met diagnostic criteria for dementia when assessed under stereotype threat, compared to only 14% when no assessed under threat (Haslam, Morton, Haslam, Varnes, Graham, & Gamaz, in press). This increase in false-positive diagnoses could lead to a myriad of negative outcomes for older adults. Not only would these older adults face the anxiety and stigma of receiving the dementia label, but they could also face monetary costs associated with follow-up testing, or could needlessly be prescribed antidementive drugs. Given that one out of every five Americans is expected to be over the age of 65 by 2030 (US Census, 2011), and given that there is increased advocacy that older adults receive routine dementia screenings (e.g., Ashford, et al., 2007), in the future it will be increasingly important for clinicians to be aware of how stereotype threat may influence older adults' neuropsychological test performance (see also Burgess, et al., 2010).

Stereotype threat may also exacerbate the degree to which older adults are dependent upon younger adults. Previous research has shown that younger adults tend to perceive older adults as being less cognitively capable, and so tend to intervene and provide older adults with task assistance. For example, in nursing home settings caregivers overwhelmingly reward residents for being dependent upon them (e.g., by praising residents for accepting help or by discouraging them from executing tasks without help), and this is true even when the residents themselves are exhibiting independent behavior (e.g., Barton, Baltes, & Orzech, 1980). This pattern also occurs in community, rather than institutional, settings (Baltes & Wahl, 1992). Problematically, this assistance may lead to subsequent performance decrements for the older adults being assisted. For example, in one study older adults were either provided with

assistance in completing a puzzle, or were simply given verbal encouragement while completing a puzzle. Interestingly, the older adults provided with assistance showed *decreased* performance over time, whereas the older adults provided with verbal encouragement showed *increased* performance over time (Avorn & Langer, 1982). One possibility is that this was due to stereotype threat, such that providing older adults with cognitive assistance made salient for them stereotypes about age-related cognitive declines, which in turn lowered their cognitive performance, and made them more dependent upon younger adults. In line with this, research has shown that older adults under stereotype threat do request assistance from younger adults more frequently than older adults not under threat (Coudin & Alexopoulos, 2010). This increased dependency upon younger adults is particularly problematic as dependency is associated with a number of negative outcomes. For example, dependent older adults frequently show a loss of motivation, depression, and other health problems (e.g., Solomon, 1990). Furthermore, unnecessary reliance on caregivers for activities of daily living, such as getting dressed, may needlessly accelerate the aging process through disuse of muscles or motor skills. In contrast, increasing feelings of independence in older adults in nursing homes is associated with increases in happiness and activity levels (e.g., Langer & Rodin, 1976; for a review, see Rowe & Kahn, 1987).

Finally, views about aging can also exert a direct impact on health. In general, having positive views about aging is associated with better physical recovery from heart attacks amongst older adults (Levy, Slade, May, & Caracciolo, 2006). In contrast, having negative views about aging is associated with greater hearing loss over time (Levy, Slade, & Gill, 2006), and decreased longevity (Levy, 2002). Not only can views about aging affect health, but stereotype threat can also play a role. Older adults under stereotype threat rate their own health as being subjectively worse than older adults not under threat. They also rate themselves as lonelier than older adults not under threat (Coudin & Alexopoulos, 2010). This is

problematic as lonely people show greater age-related increases in blood pressure and poorer sleep quality than non-lonely people (Cacioppo, et al., 2002). They also have higher rates of mortality even after accounting for a variety of health-related behaviors (Berkman & Syme, 1979). Although the current review focuses on how stereotype threat impacts cognitive performance it is important to keep in mind that it also exerts other effects, some that have negative health implications.

### **Conclusions:**

Negative stereotypes about age-related cognitive decline are prevalent in the United States (e.g., Kite & Johnson, 1988). As in many stereotypes, there is some truth to these generalizations -- the normal aging process is associated with some degree of memory decline. However, of interest to the current review, negative stereotypes about age-related cognitive decline can also exacerbate these deficits via stereotype threat. When older adults encounter negative stereotypes about age-related cognitive decline, their memory performance decreases (e.g., Hess, et al., 2003). This has important implication in assessing how age impact memory abilities. For example, older adults recruited to participate in a study about "aging and memory" will likely underperform compared to their potential. This will in turn exacerbate, or possibly even create, age-differences in memory performance, rendering it difficult to draw strong conclusions about how aging (in and of itself) affects memorial processing.

Although it is now clear that stereotype threat occurs, it is less clear why. Within the older adult age group, two mechanisms appear to play a critical role. First, stereotype threat influences performance expectations. When faced with stereotype threat older adults do not expect to perform well on the subsequent memory test, and so underperform compared to their potential (Desrichard & Kopetz, 2005). Second, regulatory focus also appears to play a role (Barber & Mather, 2012). Stereotype threat induces older adults to focus more on goal-relevant losses, and adopt a conservative, risk-averse approach to performing tasks. Although this may

lead to performance benefits in some situations, it will generally lead to performance decrements when the task emphasizes gains (e.g., learning as many words as possible). However, future research is needed to more fully examine both of these potential mechanisms, as well as to examine how they might be inter-related.

Finally, the individual differences factors identified in this review also have important implications in designing prevention or intervention strategies. Based upon the extant literature, it appears that older adults that place a great importance on memory abilities (Hess, et al., 2003), or who tend to perceive stereotype threat in everyday situations (Kang & Chasteen, 2009) are the most susceptible to stereotype threat effects. In contrast, intergenerational contact (Abrams, et al., 2006), even when it is imagined (Abrams, et al., 2008), appears to be a protective influence against stereotype threat. Given that it is likely difficult to change domain identification, this suggests that interventions may be more effective if they aim to either reduce the perception of stereotype threat in ambiguous situations or if they aim to increase positive contact between younger and older adults. Because stereotype threat exerts negative influences across a wide-variety of domains for older adults (e.g., memory performance, group identification, dependency, subjective health), designing effective stereotype threat interventions could improve the quality of life for older adults in a variety of different domains.

### **Future Directions:**

A large number of areas remain open for future research. Below we have outlined what we consider to be some of the most important.

First, there needs to be a targeted examination of whether stereotype threat's effects on older adults' memory depend upon the type of memory being tested, or upon the type of stimuli being examined. For example, no research has yet examined whether stereotype threat affects all forms of memory equally. Is semantic memory as affected by stereotype threat as episodic memory? Is prospective memory as affected as retrospective memory? Is associative memory

as affected as item memory? Given that age-related memory impairments vary in magnitude across different forms of memory, it is possible that stereotype threat effects may also vary in magnitude as well. For instance, if older adults' stereotype threat effects are due to executive control interference, then stereotype threat should exert larger effects on memory tasks requiring executive control—which are also often the tasks most impaired in normal aging (e.g., Mather, 2010). As a related issue, it is not yet known whether stereotype threat's effects on memory depend upon the type of stimuli being examined. Given that older adults tend to have better memory for socially-meaningful (e.g., Cassidy & Gutchess, 2012) or emotional (e.g., Mather, 2004) information, it is possible that older adults will be less affected by stereotype threat on these types of materials. This is an important issue when one considers whether stereotype threat will exert equivalent effects in ecological settings as it does in the laboratory. In everyday life, people are often trying to remember personally-relevant or emotional information (rather than lists of words). Thus, determining whether stereotype threat effects are affected by the type of stimuli has implications in determining how stereotype threat will affect the every-day memories of older adults.

A second important, but unexplored, area of inquiry is to determine how individuals who have cognitive impairments, such as Alzheimer's disease (AD), are affected by stereotype threat (for a discussion of this issue see Scholl & Sabat, 2008). One possibility is that individuals with AD may be more susceptible to stereotype-threat-related memory impairment than healthy older adults. This likely occurs for several reasons. First, these individuals are subject to both stereotypes about age-related memory decline and also to stereotypes about AD-related memory failures. Second, people with AD do experience frequent memory problems, which likely increases the salience of memory-decline-related stereotypes. Finally, these individuals interact with caregivers who likely expect them to perform poorly on memory tasks. Together, these factors may increase stereotype threat for these individuals, and in turn

increase their memory failures. This is particularly problematic as it will exacerbate their existing memory problems.

Finally, given that the development of effective stereotype threat interventions relies upon an accurate understanding of its underlying mechanisms, one area of particular importance is to clarify why stereotype threat occurs for older adults. Three key areas of inquiry are needed to answer this question. First, although research has tended to support the role of reduced performance expectations (Desrichard & Kopetz, 2005) and regulatory fit (Barber & Mather, 2012) in underlying stereotype threat in older adults, these mechanisms have only been directly examined in a small number of studies. To have confidence that they are the key causes of stereotype threat in older adults, they need to be replicated in future research. Second, there have been contradictory findings about executive control interference's role in underlying stereotype threat effects in older adults. To clarify this, we suggest that future studies include measures of executive control abilities following stereotype threat, but importantly not describe these tests as assessing memory abilities. This will elucidate whether stereotype threat reduces performance on memory tests or reduces executive control resources in older adults. Finally, there is a need for targeted research examining whether the mechanisms underlying stereotype threat change with age. This is important in determining whether the results from stereotype threat experiments with younger adults will hold when examining how stereotype threat affects older adults.

In summary, we conclude by noting that stereotype threat adversely affects a wide-range of domains and populations beyond those covered in the current review. Because of this, future research that increases our understanding of why stereotype threat occurs, and under what conditions stereotype-threat-related performance impairments are eliminated, has the potential to increase both health and educational outcomes for variety of vulnerable populations.

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Figure 1. Implicit and explicit negative views of aging as a function of respondent age (from Nosek, et al., 2002)

