

An Age Apart: The Effects of Intergenerational Contact and Stereotype Threat on Performance and Intergroup Bias

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An experimental study examined the effect of intergenerational contact and stereotype threat on older people's cognitive performance, anxiety, intergroup bias, and identification. Participants completed a series of cognitive tasks under high or low stereotype threat (through comparison with younger people). In line with stereotype threat theory, threat resulted in worse performance. However, this did not occur if prior intergenerational contact had been more positive. This moderating effect of contact was mediated by test-related anxiety. In line with intergroup contact theory, more positive contact was associated with reduced prejudice and reduced ingroup identification. However this occurred in the high threat, but not low threat, condition. The findings suggest that positive intergenerational contact can reduce vulnerability to stereotype threat among older people.

Keywords: intergenerational contact, stereotype threat, test performance, ingroup bias

This article examines how stereotype threat and intergenerational contact combine to affect older people's cognitive performance, anxiety and intergroup attitudes. Stereotype threat theory (Steele & Aronson, 1995) holds that implied or explicit intergroup comparisons can impair test performance because of the threat that a negative stereotype of the ability of one's group may be confirmed. Intergroup contact theory (Allport, 1954; Pettigrew, 1998) holds that, under the right conditions, contact can reduce intergroup prejudice. We contend that one consequence of positive intergroup contact could also be to change the implications of intergroup comparison, and thus moderate stereotype threat effects. As well as testing these ideas, we examine the extent to which the effects of stereotype threat and contact on performance are mediated by performance-related anxiety.

Effects of Age Stereotypes and Stereotype Threat on Older People's Cognitive Performance

Ageist stereotypes are widespread (Kite & Johnson, 1988; Nelson, 2002; Whitbourne & Sneed, 2002). In Western societies, in addition to being stereotyped as irritable, nagging, grouchy, weak, verbose, and overly concerned with painful self-disclosures, older people are stereotyped as cognitively deficient (Braithwaite, 1986; Coupland, Coupland, & Giles, 1991; Gold, Arbuckle, & Andres, 1994; Nuessel, 1982). Younger and older people have negative implicit associations in images of older people relative to younger people (Nosek, Banaji, & Greenwald, 2002). There are also readily activated favorable stereotypes that older people are warm or friendly (Chasteen, Schwarz, & Park, 2002). Nonetheless, the general stereotype that older people are less competent than younger people is particularly pervasive (Age Concern England, 2005; Cuddy, Norton, & Fiske, 2005).

In various domains, objective performance differences between younger and older people appear to be negligible and sometimes even to favor older people (see McCann & Giles, 2002). In addition, age-related decline in cognitive performance (Salthouse, 1996) can be ameliorated by factors that affect performance expectations, such as whether there is an instructional emphasis on memory (Rahhal, Hasher & Colcombe, 2001). Levy and Langer (1994) and Yoon, Hasher, Feinberg, Rahhal, and Winocur (2000) found that older adults who held more positive beliefs about aging performed better on cognitive tests. Levy, Hausdorff, Hencke, and Wei (2000) showed that older people who were faced with a battery of cognitive tests showed heightened cardiovascular reactivity following priming of a negative, but not a positive, stereotype. Stereotypes also affect performance directly. Levy (1996)

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This research was supported by an Economic and Social Research Council grant (R451265070) to Dominic Abrams and a British Academy Post-Doctoral Fellowship to Anja Eller.

We thank Anat Bardi, Ana Guinote, Georgina Randsley de Moura, and Jacques-Philippe Leyens for their helpful comments on a draft of this article.

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found that elderly people performed worse on a memory test when they were primed with negative rather than positive stereotypes. Both Levy (1996) and Stein, Blanchard-Fields, and Hertzog (2002) revealed implicit stereotype activation effects on the performance of older but not younger people.

Stereotype threat theory (Steele, 1997; Steele & Aronson, 1995) holds that evocation of a pervasive negative stereotype (e.g., that a group is intellectually inferior to a comparison group) may create a "burden of suspicion" that acts as a threat to its members. This effect appears to operate in many different intergroup relationships and is cued by the "mere recognition that a negative group stereotype could apply to oneself in a given situation" (Steele, 1997, p. 617). Hence, the negative stereotype need not be believed, but merely known.

Minor changes in testing situations, which create stereotype threat, can produce significant differences in performance on relevant tests of ability. For example, Steele and Aronson (1995) showed that when instructions described a test as "ability diagnostic," for example, a test of intellectual ability, African American students underperformed European American students. Stereotype threat has been offered as an explanation for pervasive performance differences between stigmatized (e.g. ethnic minority) and dominant (e.g. White) groups, particularly in academic domains (McFarland, Lev-Arey, & Ziegert, 2003). Similar findings have emerged in studies involving men and women on difficult math tests (O'Brien & Crandall, 2003; Spencer, Steele, & Quinn, 1999). Hess, Auman, Colcombe, and Rahhal (2003) demonstrated stereotype threat effects on older people's math performance. Hess, Hinson, and Statham (2004) replicated this stereotype threat effect using an intentional memory task, and found that when explicit linkages were made between aging and performance, or when stereotype primes were relatively blatant, memory performance decreased.

Anxiety as a Mediator of Stereotype Threat

There are a number of physiological and psychological responses that may mediate stereotype threat effects on performance (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Blascovich, Spencer, Quinn, & Steele, 2002; Brownley, Hurwitz, & Schneiderman, 2000; Croizet et al., 2004; Quinn & Spencer, 2001; Schmader & Johns, 2003; see J. L. Smith, 2004). One of the first mediators to be proposed was anxiety. Steele and Aronson (1995) hypothesized that "the effect of stereotype threat on performance is mediated by apprehension over possibly conforming to the negative group stereotype" (p. 801). Support for the involvement of anxiety in stereotype threat comes from several studies (e.g., Bosson, Haymovitz, & Pinel, 2003; O'Brien & Crandall, 2003; Osborne, 2001; Spencer, Steele, and Quinn, 1999) but is lacking in others (e.g., Aronson, Lustina, Good, & Keough, 1999; Hess et al., 2003; Hess et al, 2004; Steele & Aronson, 1995). However, Wheeler and Petty's (2001) review concluded that the evidence for a mediating role of anxiety in stereotype threat effects was mixed and that "because there are a very limited number of published studies that test for anxiety mediation, more research is necessary before a definitive position can be taken on this issue" (p. 806).

The weak and inconsistent findings may be because the mediating role of anxiety depends on the presence of factors that affect how a person will interpret the potential threat, a possibility examined in the present research. An important potential factor may be the extent to which different stereotypic expectancies are activated in the test situation (cf. Snyder, Tanke, & Berscheid, 1977). One important variable that could affect stereotypic expectancies is intergroup contact (Allport, 1954; Pettigrew, 1998). Therefore, the present research examines the role of older people's prior relationships and experience of intergroup differences. We test the idea that people who have had more positive intergroup contact experiences will be less anxious when a situation implies an intergroup comparison. As a result they may also perform better than people who have experienced less positive contact. Specifically, we test the idea that contact *moderates* the effect of stereotype threat on anxiety and that anxiety *mediates* the relationship of contact and threat to performance.

Intergenerational Contact

Many young people choose to spend their free time with people of their own age and intergenerational contact is often very limited (for supporting evidence see Williams & Giles, 1996, and Hagestad & Uhlenberg, 2005). According to intergroup contact theory, when people have positive relationships, especially friendships, across intergroup boundaries, this may create the potential for better understanding of the outgroup (Pettigrew, 1998) and perhaps establishment of a superordinate, or common ingroup, identity (Gaertner & Dovidio, 2000), as well as linking a member of the outgroup to the self-concept (McLaughlin-Volpe, Aron, Wright, & Lewandowski, 2005). Provided that category boundaries are at least somewhat salient (Brown & Hewstone, 2005), these processes can help to produce generalization of more positive attitudes and less stereotyping of the outgroup as a whole. Moreover, the potential for inclusion of other in the self may even arise vicariously, through a (close) member of the ingroup who has an outgroup friend. "Extended contact," the idea that "knowledge that an in-group member has a close relationship with an out-group member can lead to more positive intergroup attitudes" (Wright, Aron, McLaughlin-Volpe, & Ropp, 1997, p. 74) appears to be quite promising for improving intergroup relations.

Compared with extensive evidence about younger people's views of older people (Cuddy et al., 2005; Kite, Stockdale, Whitley, & Johnson, 2005; Nelson, 2002; Williams et al., 1997) there is less research on the attitudes of older people toward younger people, and particularly little on the effects of contact on older people's intergroup attitudes. Specific familial intergenerational relationships are generally likely to be positive, but close family relationships have also been characterized as ambivalent (Fingerman, 1998; Fingerman, Hay, & Birditt, 2004; Luescher & Pillemer, 1998). Moreover, research on intergenerational relationships has tended to focus on personal or interpersonal experiences and outcomes rather than effects of contact on *intergroup* relations. Intergenerational contact research from an intergroup contact perspective has also concentrated on the attitudes of younger people (Anderson, Harwood, & Hummert, 2005; Caspi, 1984; Knox, Gekoski, & Johnson, 1986; Schwartz & Simmons, 2001). For example, in line with current theory in the intergroup contact literature (Brown &

Hewstone, 2005), Harwood, Hewstone, Paolini, and Voci (2005) found that the frequency of high-quality contact when intergroup differences are salient predicted positive intergroup attitudes.

The present research is the first, to our knowledge, to examine how positivity of intergenerational contact affects intergenerational attitudes among older people. On the basis of intergroup contact research, it can be predicted that more positive intergenerational contact overall should result in less bias against younger people and weaker identification with older people (cf. Brown & Hewstone, 2005; Eller & Abrams, 2004; Pettigrew, 1998; Pettigrew & Tropp, 2006).

Moderator and Mediator Effects of Contact and Anxiety

In the present research, older adults were randomly assigned either to a high-threat or low-threat (control) condition. We measured cognitive performance, time taken to complete the test, how anxious participants felt during the test, evaluative intergroup bias and ingroup identification. Amount of positive prior intergenerational contact was also measured.

According to stereotype threat theory, threat should potentially create anxiety, which could in turn adversely affect performance. However, stereotype threat theory makes no specific predictions about the effects of intergroup contact on anxiety or performance. Intergroup contact theory predicts that more positive intergroup contact should be related to more positive intergroup attitudes, but it makes no predictions about performance. The further questions to which we now turn are how intergroup contact and stereotype threat combine to affect performance as well as intergroup attitudes and identification.

Anxiety and Performance

Anxiety has been considered an important variable in intergroup contact theory, but this work has focused on anxiety about future interaction with outgroup members (Brown & Hewstone, 2005; Stephan & Stephan, 2000). Given the increasing emphasis on affect in intergroup processes (cf. E. R. Smith, 1999), it is of interest to explore the potential role of anxiety in the relationship between contact and performance. Levy's (1996; Levy et al., 2000) and Hess et al.'s (2003, 2004) research is consistent with the idea that activation of positive age-related ingroup stereotypes should be unthreatening, whereas the activation of negative stereotypes is likely to cause performance decrements. When age comparisons are made in domain-relevant areas, such as cognitive ability, it seems probable that older people who have little positive intergenerational contact may by default bring to mind socially pervasive negative stereotypic expectations (see Age Concern England, 2005; Cuddy et al., 2005). We contend that those who have more positive relationships with younger people may be less likely to evoke the societally pervasive negative stereotype and should be less anxious during the test. Therefore, contact should moderate the effect of the stereotype threat manipulation on anxiety.

We also hypothesize that the relationship between stereotype threat and performance should be stronger when intergroup contact has been less positive. However, this effect should depend on the anxiety generated by the intergroup comparison. Therefore, for performance, the moderating role of contact on stereotype threat

should be mediated by anxiety during the test. That is, we expected to find a pattern of mediated moderation.

Intergroup Attitudes and Identity

Stereotype threat theory (Steele & Aronson, 1995) suggests that people may respond to stereotype threat by defensively distancing themselves from the domain or even from their own group (cf. Pronin, Steele, & Ross, 2004; Schmader, 2002). If threat is highest among those with less positive contact, such individuals may show lowest identification with the group.

Social identity theory (Hogg & Abrams, 1988; Tajfel & Turner, 1979) yields different predictions. For older people, age intergroup boundaries are likely to be viewed as impermeable. When faced with a potentially threatening comparison (cognitive competence in this case) and impermeable boundaries, group members may respond with a "social creativity" strategy, such as enhancing ingroup status on another dimension. Stereotypes of older people tend to emphasize their warmth rather than their competence (see Cuddy et al., 2005). Therefore, one creative response to threat in terms of competence may be to make more negative social evaluations of the threatening younger outgroup.

If prior contact experiences have been less positive, we think the intergroup comparison invoked by a stereotype threat is likely to evoke a social creativity response (cf. Ellemers, Spears, & Doosje, 2002). More positive contact is likely to predispose people to view the ingroup and outgroup as a single common group (see Eller & Abrams, 2003; Gaertner & Dovidio, 2000). People with more positive contact might also see the intergroup comparison as an opportunity to engage with or approach the outgroup rather than to distance themselves from it (cf. McLaughlin-Volpe et al., 2005; Seibt & Förster, 2004). As a result, those who have had more positive contact may identify less strongly with their own group and show more favorable outgroup attitudes. Therefore, in contrast to the defensive disidentification hypothesis, it seems possible that the effects of more versus less positive contact might be largest when the relationship between the groups is most salient (cf. Harwood et al., 2005). In the present study, this should be in the high-threat rather than the low-threat condition.

To summarize, we predicted main effects of threat on performance on the test, time taken to complete the test, and anxiety related to the test. We expect these effects to be moderated by contact such that threat effects should be ameliorated when contact has been more positive. We further hypothesized that anxiety would mediate the relationship between threat and test performance. We expected main effects of positive contact on identification with older people and intergroup bias. We expected the effects of contact to be moderated by threat such that the effects would be larger in the threat condition.

Method

Design

There were two independent variables, stereotype threat (high vs. low) and intergroup contact (relatively less positive to relatively more positive). Threat was manipulated experimentally. Contact was a continuous measure based on participants' self-reports and was defined in terms of the amount of positive contact with younger people. We measured test performance,

time taken to complete the test, ingroup identification, and intergroup bias. Participants were assigned to condition randomly, thereby ensuring that the experimenter was blind to the combination of contact and condition.

Participants

Participants were 32 male and 65 female retired adults, ranging in age from 59 to 89 years; mean age = 74.81 ($SD = 7.43$). Participants' pre-retirement occupations varied such that 12% had been unskilled, 44% semi-skilled, 21% skilled, and 15% professional workers. They were recruited from various social groups and organizations for retired people, within the county of Kent, United Kingdom. All participants were physically well and could be characterized as cognitively and socially active. They lived independently in their own homes, in sheltered housing, or in a residential setting.

Procedure

Participants were tested individually by a 24-year-old female experimenter, in a private room. The session was introduced as a study of attitudes, experiences, and skills. Prior to the start of the experimental session, participants were informed in writing that their responses would remain confidential and that they were free to withdraw from the study at any time. A tape-recorded instruction informed participants that they would be given a short test and would then be asked to complete a brief questionnaire.

Stereotype threat manipulations in previous research have ranged from merely mentioning the outgroup comparison category (see Spencer et al., 1999; Steele, 1997) to more explicit confrontation with evidence supporting stereotypical differences relating to performance on the test (e.g. Aronson et al. 1999; Hess et al., 2003; Pronin et al., 2004). The present study used a less extreme manipulation in line with less blatant manipulations used in other recent research (e.g. Stricker & Ward, 2004). It was intended to make the age-related stereotype salient and relevant to the testing situation and to be ecologically valid without introducing strong demand characteristics or a specific standard that could be used as an anchor for performance. In the high-threat condition participants were informed, "It is widely assumed that intellectual performance declines with age, so the purpose of this study is to see whether old people do perform more poorly on intellectual tasks than young people. Both older and younger people will be taking part in this research." In the low-threat condition, the description of the study made no reference to intellectual ability. Instead, participants were told that the purpose of the study was "to see how people differ in their responses on different tasks. Different types of people will be taking part in this research."

Test performance. Following the threat manipulation, the first part of the test commenced. The test involved nine sections, with items tapping cognitive abilities adapted from the Wechsler Adult Intelligence Scale—Third Revised Edition (Wechsler, 1998) and the Cambridge Cognitive Examination—Revised (CAMCOG-R; Roth, Huppert, Mountjoy, & Tym, 1998). The items of these measures assessed comprehension, recall, verbal facility, and digit span. The time taken to respond to each question was recorded with a stopwatch. Participants were first asked to listen to a short tape recording of a man who gave a brief description of himself. The first two test items asked participants to name two things that the character enjoyed doing (scored from 0 to 2) and where he took his dog for a walk (scored 0 or 1). Next, the words *apple*, *table*, and *penny* were read aloud, and participants were asked to remember these. This was followed by presentation of six digit-span items, which increased in difficulty from 4 to 9 digits. Participants were asked to repeat each list backwards. A score of 0 to 6 was assigned depending on how many of these the participants answered correctly. Participants were then asked to explain up to three ways in which each of three pairs of objects were alike (scores could range

from 0 to 9). Participants were asked to name the objects that had been listed earlier in the test (scores ranged from 0 to 3). Finally, participants were asked to complete a brainstorming task in which they had to think of as many different uses as possible for a pair of scissors within 30 s (scores ranged from 0 to 5).

Analysis of the test item scores revealed that they all loaded on a single factor, accounting for 44.1% of the variance (highest loading scores were recall and digit span, both $>.78$), and factor scores were saved for analysis. We also checked the standardized reliability coefficient for the test items treated as a scale. The scale had acceptable reliability (Cronbach's alpha = .75). The total time taken to respond to all questions, excluding the brainstorming task, was recorded.

Following the test, participants completed a self-report questionnaire designed to assess how much anxiety they had experienced during the test, their quantity and quality of prior intergroup contact, intergroup bias, and ingroup identification.

Anxiety. Anxiety was measured using items from Osborne (2001). The items were also similar to those used by Bosson et al. (2003; cf. Spencer et al., 1999). Participants rated on a scale ranging from 1 (*not at all*) to 7 (*very much*) the extent to which they felt the following while answering the test questions: under pressure, tense, nervous/jittery, confident, uneasy, calm, afraid of not doing well, and uncomfortable. Items were later scored such that a higher number represented greater anxiety. Factor analysis confirmed that these items were unidimensional, and we computed an averaged scale score (Cronbach's alpha for this scale = .93).

Positive intergroup contact. Intergroup contact was measured with a series of items. These items were devised to address principles outlined recently by Brown and Hewstone (2005), who advocated that quality of contact, particularly friendship, is likely to provide a basis for more positive intergroup relationships. We intended to design contact measures that would be brief but would sample across the range of contacts so as to reflect the overall quality of experiences of intergenerational contact. Thus, whereas each item may be a partial indicator on its own, taken together, the items were intended to capture the overall level of positive contact experienced by the participant.

One item evaluated the quality of contact with people age 35 years or younger during the previous week. This was intended to tap relatively salient recent experiences of contact. Participants were asked to indicate how many such contacts they had had that were pleasant and how many they had had that were unpleasant. A simple index of relative pleasantness was derived by subtracting the number of unpleasant contacts from the number of pleasant contacts. A second measure tapped longer term positive contact as friends by asking participants to state how many close friends they had in that age group. A third item tapped extended contact (Wright et al., 1997), "How many people of your age group do you know who have one or more close friends from a younger generation (e.g. 20–35 years old)?" Finally, we included items to measure close family contact. We asked how many children and grandchildren participants had, and how often they saw them. We also asked to what extent the relationship with grandchildren could be characterized as very negative or very positive. The overwhelming majority were rated very positively ($M = 6.7$ on a 7-point scale), indicating that people with more grandchildren experienced more instances of positive contact. Therefore, we simply used the number of children and frequency of contact with grandchildren as the indices of positive family contact. Factor analysis of all five measures of contact quality (recent quality of contact, friends, extended contact, contact with children, frequency of contact with grandchildren) revealed that all loaded on a single factor that accounted for 42.5% of the variance. The highest loading measures were close friends and extended contacts (both $>.75$). Close friendship is often regarded as the form of positive contact quality most relevant to intergroup relations (Pettigrew, 1998). Therefore, this factor would appear to represent quality of contact in the way

Table 1
Correlations Among Variables and Means and Standard Deviations

Variable	2	3	4	5	6	7	8	<i>M</i>	<i>SD</i>
1. Age	-.17	.31**	.16	.36***	.18	-.18	.19	74.81	7.42
2. Performance	—	-.36***	-.49***	-.29**	-.30**	.10	-.43***	0.00	1.00
3. Time (s)		—	.42***	.14	.17	-.10	.31**	256	47.6
4. Anxiety			—	.25*	.45***	-.29**	.34***	2.51	1.41
5. Identification				—	.56***	-.24**	-.13	5.38	1.34
6. Bias					—	-.30**	-.11	0.88	1.79
7. Contact						—	-.15	0.00	1.00
8. Threat							—		

Note. Performance and Contact are factor scores; time and age are objective measures; and anxiety and identification are averaged scores rated on 7-point scales, with higher scores indicating greater anxiety and identification, respectively. Bias is a difference score that can range from -6 to $+6$. Threat is a manipulated variable, coded such that a positive value represents more threat.

* $p < .05$. ** $p < .01$. *** $p < .001$.

we intended. We saved the factor scores to provide an index of quality of contact. We used each participant's contact factor score in the analyses that follow.¹

Intergroup bias. To measure intergroup bias, we included the 6-item General Evaluation Scale (Wright et al., 1997). Outgroup evaluation was measured by asking participants to indicate "how you feel in general about younger people (35 years and under)?" Ingroup evaluation was measured by asking, "how you feel in general about older people (age 65 years and over)?" The groups were rated with 7-point bipolar semantic differentials scales: *cold-warm*, *negative-positive*, *hostile-friendly*, *suspicious-trusting*, *contempt-respect*, *disgust-admiration*. Responses were scored such that the more positive adjective received the higher score. For each dimension, the rating of younger people was subtracted from the rating of older people. An average ingroup bias score was computed ($\alpha = .89$). Factor analysis also confirmed that these six difference scores formed a single factor.

Ingroup identification. Five items tapped identification with older adults, on the basis of similar measures used in previous research (e.g. Abrams, Ando, & Hinkle, 1998). Measured on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), participants were asked "how much do you agree with the following statements?" For example, "I have a strong sense of identity with older people" and "I do not feel strong ties with people of my age group" (reverse scored). We computed a single averaged identification score (Cronbach's $\alpha = .93$).

Background variables. Finally, participants were asked to state their age, sex, marital status, and occupation at retirement. At the end of the session, participants were debriefed regarding the rationale of the study, and any questions were answered as fully as possible.

Results

We checked for potential confounds with demographic variables and found that none of the dependent or independent measures were related significantly to participants' gender, occupational status on retirement, or marital status. We also found that even where age was significantly associated with dependent measures, its inclusion in the analyses did not affect whether any of the effects of contact and threat were significant. Therefore, unless indicated, we have not included age in the analyses reported below. The means and standard deviations for each variable, together with the correlations among variables, are provided in Table 1. As expected, on the basis of random assignment, prior contact did not differ significantly between threat conditions. Analyses relied on a multiple regression

approach. We centered Threat (low vs. high, coded as $-.5$ and $.5$, respectively), and Contact (factor scores) and, in a second step, included their interaction term as an independent variable. A significant interaction term indicates that the interaction accounts for a significant proportion of variance over and above the main effects.

Test Performance and Time

Table 1 shows that test factor score was significantly and negatively correlated with the time taken to complete the test. Table 2 shows that the regression analysis revealed a significant effect of Threat, but not of Contact. Moreover, the Threat \times Contact interaction was significant, overall, $F(3, 93) = 10.12, p <$

¹ In retrospect it would have been useful to measure the frequency of contact with children too. However, we reasoned that most people have no choice but to know their children well, so having more children would imply a potential for more connections with people in their generation. The decision to use a difference score to measure relative positivity of contact was based on analyses showing that the number of negative encounters was low ($M = 0.10, SD = 0.31$) compared with positive encounters ($M = 1.20, SD = 2.78$). At the suggestion of a reviewer, when both measures were included separately in the factor analysis, they both loaded on the same factor, with opposite valence. Therefore they form part of the same unidimensional construct with the other measures. In addition, we checked the results using a factor score that included only the number of positive contacts. The factor analytic results and rank order of loadings was unchanged as were the results of the subsequent regression analyses conducted with the factor score as an independent variable. We are also aware that the literature suggests extended contact and direct contact represent different ways to reduce intergroup bias, but given the factor analytic results, there seemed little empirical basis for treating their effects independently. In addition, the Contact \times Threat interaction effect on anxiety was significant when we used each of the contact measures individually (aside from contact with grandchildren) as the independent variable. We also checked the standardized reliability coefficient for a scale based on these items. This was acceptable, Cronbach's $\alpha = .71$. Therefore, the factor score seemed to provide the most parsimonious way to operationalize positivity of contact.

.001.² Analysis of simple slopes was conducted, following procedures recommended by Aiken and West (1991). Threat had a significant and large effect on performance among participants with relatively less positive contact, $\beta = -.68, t(93) = 5.20, p < .001$, whereas it had no significant effect on those with relatively more positive contact, $\beta = -.13, t(93) = 0.95, ns$. This interaction is shown in Figure 1, which represents the slopes between test scores when values of contact are one standard deviation above and below the mean.

Time taken to complete the test was subjected to a similar analysis. There was a significant effect of Threat, but not of Contact. The Threat \times Contact interaction was significant, overall $F(3, 93) = 6.46, p < .001$. Simple slopes analysis confirmed that the effect of Threat was significantly larger among participants with relatively less positive contact ($\beta = .59$) than those with relatively more positive contact ($\beta = -.01$).

Speed of response may have contributed to the level of performance because of speed/accuracy tradeoff (performance and time were significantly negatively related; $r = -.36, p < .001$). Time was also significantly associated with age ($r = .32, p < .005$), raising the possibility that age might indirectly affect performance level by slowing the speed of answering. We checked whether the effects of contact and threat on performance were partially attributable to age or time taken to complete the test by including both age and time as covariates in the analysis of test scores. There was a significant effect of time, $\beta = -.24, t(89) = 2.45, p < .05$, but not of age ($\beta = -.06$). The effects of Threat, $\beta = -.41, t(87) = 4.36, p < .001$; Contact, $\beta = .02, t(87) = 0.32$; and Threat \times

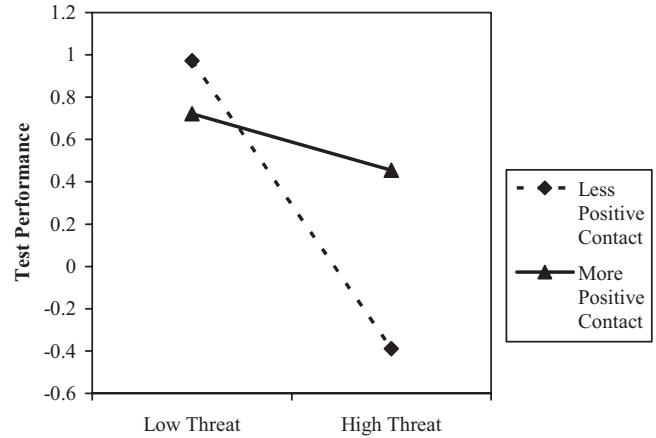


Figure 1. Test performance as a function of threat and amount of positive intergenerational contact.

Contact, $\beta = .27, t(86) = 2.43, p < .05$, were virtually unaffected; overall $R^2 = .36, F(5, 86) = 9.81, p < .001$.³

Anxiety

There were significant effects of Threat, Contact, and Threat \times Contact, overall $F(3, 93) = 13.05, p < .001$. Analysis of simple slopes revealed that threat had a large significant effect on anxiety among participants with relatively less positive contact, $\beta = .67, t(93) = 5.29, p < .001$, whereas its effect on those with relatively more positive contact was nonsignificant, $\beta = -.10, t(93) = 0.76, ns$. This interaction is shown in Figure 2, which represents the slopes with values of Contact at one standard deviation above and below the mean. In summary, the similar pattern of the Contact \times Threat interaction for the performance and anxiety measures supports our hypotheses that participants who had experienced more positive contact would be relatively unaffected by the threat manipulation, whereas those who had experienced less positive contact would be more anxious and perform less well in the high-threat than in the low-threat condition.

Mediation Analyses

Table 1 shows that anxiety is significantly related to performance, $r = -.49, t(96) = 5.44, p < .001$. According to the stereotype threat model, we expected the effect of stereotype threat

Table 2
Prediction of Dependent Variables: Standardized Regression Coefficients

Dependent variable/ predictor variable	β	t	ΔR^2
Test score			
Threat	-.42	4.51***	
Contact	-.03	0.37	.19***
Threat \times Contact	.27	2.74**	.06**
Test time			
Threat	.31	3.09**	
Contact	-.05	0.56	.10**
Threat \times Contact	-.29	2.83**	.07**
Anxiety			
Threat	.31	3.24**	
Contact	-.25	2.59*	.18***
Threat \times Contact	-.38	3.99***	.12***
Intergroup bias			
Threat	-.15	1.56	
Contact	-.33	3.34**	.17***
Threat \times Contact	-.33	3.25**	.04**
Identification			
Threat	-.16	1.64	
Contact	-.26	2.64**	.08**
Threat \times Contact	-.20	1.88†	.04†

Note. Main effects of threat and contact were tested in a single block ($df = 94$), and the Threat \times Contact interaction was tested in a second block ($df = 93$). If the interaction term was significant, there was a significant change in R^2 .

† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

² Analysis of the individual test items (with a mean split for Contact) revealed significant multivariate effects of Threat, $F(6, 83) = 8.54, p < .001$, and Threat \times Contact, $F(6, 83) = 2.77, p < .05$. The univariate interaction effects were significant on five of the six measures ($ps < .05$), and marginally significant ($p < .07$) on the sixth (digit span).

³ We also checked whether the Threat \times Contact interaction effect on performance was confounded by the Threat \times Time interaction term or the Contact \times Time interaction term (see Yzerbyt, Muller, & Judd, 2004). Neither of the alternative interactions involving time was significant, $\beta = .08$ and $.01$, respectively, $t(93) < .60$, whereas the Threat \times Contact interaction term remained significant, $\beta = .28$ and $.27$, respectively, $t(91) = 2.48, p < .05$.

on test performance to be mediated by anxiety. We therefore expected that because anxiety itself is affected interactively by threat and contact, we should observe a mediated moderation effect. That is, once the interactive effect of Threat and Contact on anxiety is accounted for, there should be a reduced interactive impact on test performance. Given the similar pattern of effects of Threat and Contact on anxiety and on performance, it seemed reasonable to test this hypothesis. For this analysis, we followed the procedures outlined by Baron and Kenny (1986). We repeated the regression analysis on test performance, described previously, but included anxiety as an additional predictor prior to entering the remaining terms (see Figure 3). We first examined the simple mediation of threat by anxiety, prior to inclusion of the Threat × Contact interaction term. With anxiety included in the regression, the previously reported effect of threat, $\beta = -.42$, was reduced, but remained significant, $\beta = -.30$, $t(94) = 3.27$, $p < .005$, and the effect of anxiety was also significant, $\beta = -.40$, $t(94) = 4.27$, $p < .001$. The Baron and Kenny (1986) version of the Sobel test revealed that the reduction in the main effect of threat on performance was significant ($Z = 2.58$, $p < .01$), indicating that anxiety partially mediated the effect of Threat on performance. More important for our hypothesis is the effect of including anxiety on the impact of the Threat × Contact interaction term. Whereas the effect of anxiety remained significant, $\beta = -.35$, $t(92) = 3.45$, $p < .001$, the Threat × Contact interaction term (formerly .27) became nonsignificant, $\beta = .14$, $t(92) = 1.35$. The Sobel test confirmed that the amount of mediation was significant ($Z = 2.61$, $p < .01$), and the fact that the interaction term was nonsignificant indicates that its effects were fully mediated by anxiety.⁴

We investigated the possibility that the mediation was reversed, that is, that the effect of the Threat × Contact interaction on anxiety was mediated by performance. The Threat × Contact interaction on anxiety (formerly $-.38$) remained significant, $\beta = -.31$, $t(92) = 3.13$, $p = .001$, and there was only partial mediation by test performance ($Z = 1.99$, $p < .05$). Overall, the finding that the interaction affected variance uniquely in anxiety but not in performance is consistent with the idea that anxiety mediates effects on performance more than performance mediates effects on

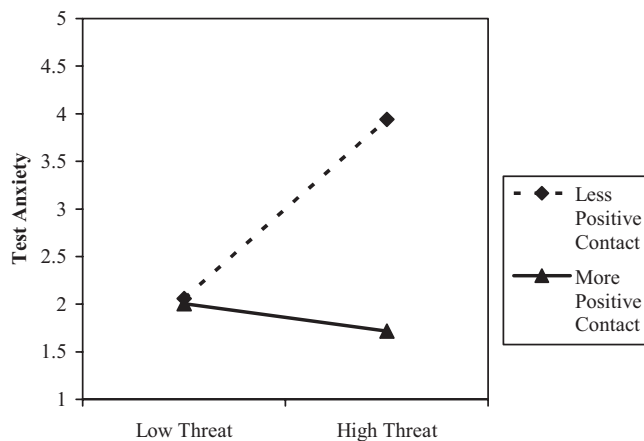


Figure 2. Test-related anxiety as a function of threat and amount of positive intergenerational contact.

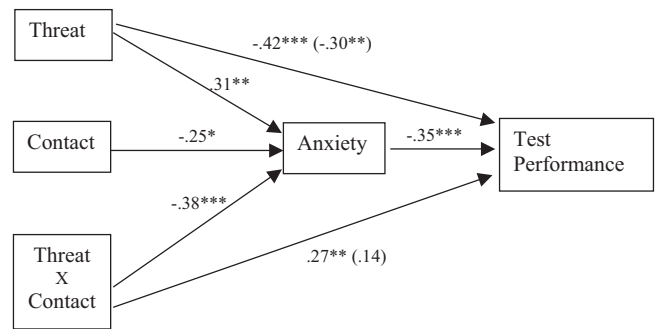


Figure 3. Mediated moderation effect of anxiety on test performance. Numbers are standardized regression coefficients. Main effects are tested prior to interactions. Figures within parentheses are direct effects, once the effect of anxiety is partialled out. * $p < .05$. ** $p < .01$. *** $p < .001$.

anxiety. Finally, we repeated the preceding analyses including time as a covariate. This did not change the pattern of results but did affect their magnitude. Specifically, whereas anxiety still fully mediated the Threat × Contact interaction on performance ($Z = 2.13$, $p = .03$) performance no longer partially mediated the Threat × Contact interaction on anxiety ($Z = 1.57$, $p = .12$).

Intergroup Bias and Identification

Intergroup contact theory holds that intergroup bias should decrease as a function of positive contact. Moreover, according to the idea that positive contact should have most impact if intergroup differences are more salient, we anticipated that the largest impact of Threat on bias should be observed when contact had been more positive. The main effect of Threat was nonsignificant, but the main effect of Contact was significant. In line with the hypothesis, the Threat × Contact interaction was also significant, overall $F(3, 93) = 8.05$, $p < .001$.

For identification, the main effect of Threat was nonsignificant, but there was a significant main effect of Contact, and the Threat × Contact interaction was marginally significant ($p < .07$), overall $F(3, 93) = 4.09$, $p < .01$.

Simple slopes analysis of the effects of Contact and Threat on bias and identification show a similar pattern (see Figures 4 and 5). The effect of Threat was nonsignificant for those who had relatively less positive contact, $\beta = .16$, $t(93) = 1.20$, and $\beta = .03$, $t(93) = 0.20$, for bias and identification, respectively, but significant for those who had relatively more positive contact, $\beta = -.51$, $t(93) = 3.53$, $p < .001$, and $\beta = -.38$, $t(93) = 2.50$, $p < .01$.

⁴ With time as the dependent variable a similar pattern of mediation was observed. The effects of Threat and Threat × Contact were reduced to marginal significance, $\beta = .19$, $t(94) = 1.97$, $p < .06$, and $\beta = .18$, $t(93) = 1.67$, $p > .09$, respectively, whereas the effect of anxiety remained significant, $\beta = .36$, $t(94) = 3.59$, $p < .001$, and $\beta = .30$, $t(94) = 2.71$, $p < .01$, respectively and significantly mediated both the main effect of Threat ($Z = 2.41$, $p < .05$) and the Threat × Contact interaction ($Z = 2.24$, $p < .05$). In the light of Yzerbyt et al.'s (2004) observations, we also checked for the presence of covariate interactions. However, because none were significant and because we were specifically testing a predicted mediated moderation effect, we do not report these in the present article.

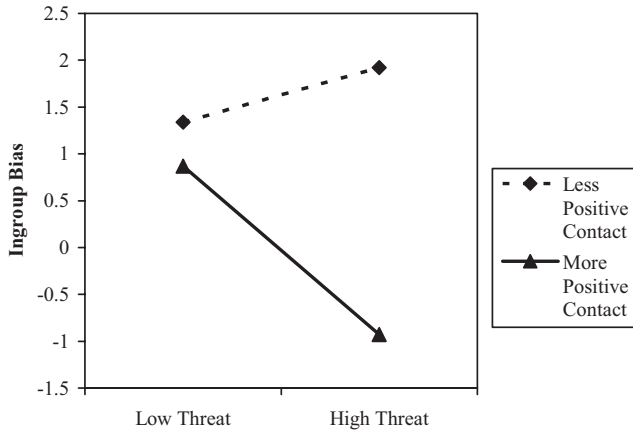


Figure 4. Ingroup bias as a function of threat and amount of positive intergenerational contact.

.05, respectively. Thus, participants who had experienced more positive contact reduced their levels of bias and identification when they believed they were being compared with outgroup members.

Discussion

This experiment tested the idea that stereotype threat would interact with intergenerational contact to affect variables central to research on effects of both threat and contact. First, the main effects of each independent variable were largest, and significant only on the dependent variables that have traditionally been the focus for research in each domain. Specifically, in line with stereotype threat theory (Steele, 1997) there was a significant main effect of stereotype threat, but not contact, on task performance and time. Conversely, in line with intergroup contact theory (e.g. Pettigrew, 1998) positive intergenerational contact, but not threat, had a significant main effect on intergroup bias and ingroup identification. These results are consistent with both of the primary approaches guiding our research, and help extend both literatures to older people. More importantly, we found that positive intergroup contact and stereotype threat can moderate one another's effects in theoretically predictable ways on each dependent variable.

Performance

Using different and broader measures of performance, and a subtle manipulation of threat (cf. Stricker & Ward, 2004), we replicated Hess et al.'s (2003) finding that stereotype threat impairs the cognitive performance of older people. Merely stating that the possibility of youthful superiority is under investigation was sufficient to induce stereotype threat effects among some older people. The theoretically novel hypotheses concerned the interactive effects of intergenerational contact and the manipulation of stereotype threat. Among people who have experienced less positive contact, intergroup comparison may more readily evoke awareness of societally pervasive negative evaluations of the ingroup by the outgroup, and hence the possibility of stereotype

threat. We hypothesized that the potential for stereotype threat would be ameliorated for people who had relatively more positive intergenerational contact. The significant Contact \times Threat interactions on measures of test performance and anxiety supported this idea. Stereotype threat affected anxiety, test time, and performance levels only among participants who had experienced relatively less positive intergenerational contact.

The effect of threat on performance was mediated by anxiety during the test. This finding matches nonexperimental evidence from Osborne (2001), who used a very similar measure of anxiety but did not manipulate threat directly. Moreover, the interactive effect of contact and threat on performance was fully mediated by anxiety, representing a case of mediated moderation.

Hess et al. (2003, 2004) and Schmader (2002) measured anxiety prior to performance but found that it did not mediate between threat and performance. In addition, studies that have included posttest measures of state anxiety may not have asked participants to report on their feelings during the test (Schmader & Johns, 2003; Spencer et al., 1999). It is possible that participants in those studies may have reported posttest feelings of relief even if they had been anxious during the test itself. This suggests that to detect the mediating role of anxiety it may be important to assess state anxiety experienced during the test rather than prior, anticipated, or posttest anxiety. Given our finding that anxiety was affected by the same variables, and in the same way, as performance, it may be useful for future research to focus on other variables that may determine whether anxiety is likely to arise in response to a potential stereotype threat (cf. Wheeler & Petty, 2001).

The direction of mediation we propose is theory driven, but there are also statistical and procedural reasons to support it. Whereas anxiety fully mediated the effects of contact and threat on performance, performance did not fully mediate their effects on anxiety. The size of the Contact \times Threat interaction was larger for performance, making it unlikely that anxiety was caused by performance (e.g., as a self-presentational strategy, cf. Bosson et al., 2003). Procedurally, participants did not receive performance feedback prior to the anxiety measures, so it is unlikely that participants could have related their performance strategically to

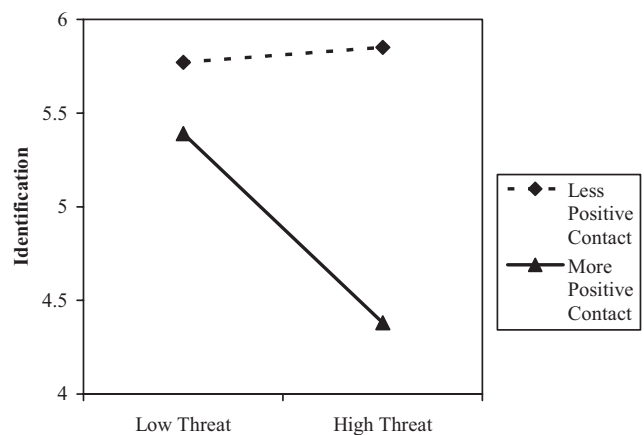


Figure 5. Group identification as a function of threat and amount of positive intergenerational contact.

their self-reported anxiety. However, the role of self-presentational processes may be an interesting avenue for future investigation.

Intergroup Contact Identity and Bias

Intergroup contact research focuses largely on the evaluations of subordinate or lower status groups by members of majority or higher status groups (Tropp & Pettigrew, 2005). The present research illustrates that more positive intergroup contact also has positive consequences for the attitudes directed at a potentially threatening higher-status group. Although causal relations between intergroup contact and bias and identification are sometimes bidirectional (cf. Eller & Abrams, 2003, 2004; Levin, van Laar & Sidanius, 2003), there are procedural and empirical reasons for the causal ordering in our interpretation. The contact measure involved reports of actual contact in the past, which we believe would be unlikely to be reactive to (and were uncorrelated with) the threat manipulation. The identification and bias measures focused on current attitudes at the end of the experiment. More importantly, identification and bias were affected differently depending on the combination of the threat manipulation and prior contact, showing that the implications of contact for identification and intergroup attitudes may well vary according to different situational factors.

Schmader (2002) found that there were greater effects of stereotype threat on (gender-related) math performance among people whose pretested level of gender identification was higher. Pronin et al. (2004) used a similarity-based pretest measure of gender identity and found greater distancing between self and gender personality ratings following a stereotype threat manipulation. Such evidence suggests that people may adopt strategies to avoid stereotype threat by defensively disidentifying with their ingroup. In comparison with Schmader (2002) and Pronin et al. (2004), the present research used a more direct measure of group identification and measured intergroup evaluations (rather than personality ratings). In addition, our measure of identification was taken after performance, whereas Schmader's was taken prior to the threat manipulation.

There is no suggestion from our data that only high identifiers are susceptible to threat. Contrary to the defensive disidentification hypothesis, the relationship between threat and performance was the same among low identifiers ($r = .44$) and high identifiers ($r = .46$). Instead, we found that threat increased the effect of positive contact. Participants who had experienced positive intergroup contact seemed to respond to the potential threat by identifying less strongly with older people and by showing more positive intergroup attitudes. This suggests that people who have a more positive relationship with an outgroup may reinterpret potentially threatening comparisons as a process of inclusion ("we are all taking this test") rather than exclusion ("they may do better than us on this test").

One explanation for this effect may be an assimilation process in which participants regarded themselves and younger people as more similar (cf. Aarts & Dijksterhuis, 2002; Kawakami, Dovidio, & Dijksterhuis, 2003). Perceptions of aging can certainly differ according to perceivers' chronological age, particularly as age is a continuum that can be divided at many potentially arbitrary points. For example a recent United Kingdom general population representative survey of over 1,800 participants (Abrams et al., 2005;

Age Concern England, 2005) revealed that the average 24-year-old believed he or she would stop being young at 42, whereas the average 64-year-old man believed youth ended at 56. Thus, for some older people in the present research it seems likely that a superordinate identity with younger people was activated.

According to the common ingroup identity model (Gaertner & Dovidio, 2000), intergroup biases are most likely to be reduced when members perceive some common basis for shared identity (e.g., as participants in the same research). As applied to intergroup contact theory, this model predicts that positive contact experiences, particularly if framed by a common ingroup, should lead to perception of a common ingroup identity (see also Eller & Abrams, 2003, 2004; Pettigrew, 1998). However, there are likely to be limits to how far this can go. In particular, because older people cannot become younger, it is likely that even if they share common identity through various superordinate categories (e.g. political, clubs, locality), they are likely to retain distinctive age identity. This may be exactly the situation (a so-called dual identity) that can facilitate positive intergroup relations (Brown & Hewstone, 2005; Hornsey & Hogg, 2000). Even if different categories are salient, the extent to which age is the basis for antipathy can vary. Consistent with Brown and Hewstone (2005) and Harwood et al. (2005), the combination of positive contact and salient intergroup comparisons seems to promote a more positive intergroup orientation.

Limitations and Implications

Positive contact per se was not associated with better performance or lowered anxiety, so it is not possible that older people with more positive contact happened to be more capable or less anxiety prone. However, positive contact might have other indirect effects in performance situations. For example, effects of contact on anxiety may stem from increased trust that younger people will not make judgments on the basis of age. More positive contact may also provide stereotype-disconfirming evidence about the ingroup (e.g., successfully completing challenging tasks with younger people), and these may be more readily available in memory. It would be useful to explore whether such variables may affect anxiety and performance generally or only when an intergroup comparison is implied by the situation.

We did not test directly whether the participants believed that negative stereotypes would be applied to themselves because this would have introduced a potential experimental demand. However, consistent with research using student participants, data from the United Kingdom general population (Abrams et al., 2005; Age Concern England, 2005) confirmed that the elderly are stereotyped as less capable than younger people (cf. Cuddy et al. 2005).

We cannot take for granted that domain identification was high in the present study, but it seems likely that most older people are concerned about how their cognitive abilities might be changing with age (Hess et al., 2003; Whitbourne & Sneed, 2002). It would be valuable to include a measure of domain identification in future research and to test, for example, whether it acts as an additional moderator of the effects of threat, or whether it might instead be related indirectly through other variables such as ingroup identification or might mediate effects of anxiety.

As people age, they may be more likely to encounter “high stakes” situations, such as being referred for neuropsychological assessment because a memory difficulty has been drawn to their attention. The implications of such assessments, often as part of a more comprehensive evaluation, may include a diagnosis, such as early Alzheimer’s disease. In these assessments, stereotype threat could interfere directly with working memory (Schmader & Johns, 2003). In addition, threat-induced anxiety could impair performance (Croizet, Desert, Dutrevis, & Leyens, 2001). The present findings show that performance might be especially impaired if this anxiety is compounded by the threat of ageist stereotypes. Therefore, if the circumstances involve potential for stereotype threat, performance of older people on cognitive tests should be treated with caution, and it may be wise to incorporate additional, indirect measures (cf. Helmes & Gee, 2000) and take into account anxiety levels in the testing situation, even if these might not be obvious to the observer.

Previous intergroup contact research has focused on anxiety about future interaction with outgroup members (e.g. Stephan & Stephan, 2000). The finding that more positive contact reduces vulnerability to anxiety in the face of stereotype threat extends the conceptual scope for linking intergroup contact and anxiety. An interesting issue for future research is how these two different types of anxiety are related and whether they are affected by contact in the same way.

A significant proportion of the relationships that serve affective and instrumental needs throughout our lives, are intergenerational (Williams & Nussbaum, 2001). This suggests that sustaining positive intergenerational relationships may have numerous societal benefits. For example, intergenerational programs have used joint intergenerational activities to facilitate learning about the other generation and therefore promote the development of more positive attitudes towards the outgroup (Griff, Lambert, Dellman-Jenkins, & Fruit, 1996). Pinquart, Wenzel, and Sorensen (2000) found that improvements in intergenerational attitudes during group activities were associated with increased frequency of intergenerational contact outside the group. The present evidence suggests a further benefit of intergenerational contact, through the reduction in stereotype-based underperformance among older people.

Of course, close intergenerational relationships within families may involve conflict as well as love, and it is obvious that positive contact per se may not be sufficient to generate positive effects if there are countervailing aspects of the contact (cf. Fingerman et al, 2004). However the present findings suggest that frequent positive contact across a range of intergenerational relationships, both kith and kin, may be important. As well as having the potential to reduce younger people’s acceptance of inappropriate negative stereotypes of older people, positive intergenerational contact has the potential to protect older people from some of the potentially damaging consequences of those stereotypes.

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Received August 23, 2005

Revision received March 15, 2006

Accepted March 27, 2006 ■