Age Stereotypes and Compliance with Feedback in Elderly Drivers

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Abstract

In spite of their increased risk of causing traffic accidents, older drivers often overestimate their own driving abilities. To develop a realistic assessment of driving abilities, as well as proper self-regulation, feedback from relatives or friends who point out dangerous driving situations is often helpful. However, an open question remains as to how older car drivers respond to such feedback. We conducted a telephone (Study 1, $n = 281$) and an online survey (Study 2, $n = 285$) and asked older drivers how they would respond to feedback about their driving behavior. Because previous research has shown positive effects of age stereotypes on behavior in the area of health psychology, we assumed that elderly people with positive age stereotypes see themselves as able to improve and change their behavior and, thus, are open to feedback on their driving behavior. In line with this hypothesis, we found overall a strong positive relation between positive age stereotypes and openness to feedback on driving behavior. The positive effect of positive age stereotypes on openness to feedback was not offset by the fact that older drivers with positive age stereotypes perceive themselves as being less vulnerable than other older drivers, and not moderated according to different feedback givers.

Keywords: driving abilities, older drivers, feedback, age stereotypes, self-regulation

1. Introduction

Many elderly people regard the opportunity to drive with their own car as an important aspect of a self-determined life (Berg, Levin, Abramsson, & Hagberg, 2015; Hassan, King, & Watt, 2015; Luiu, Tight, & Burrow, 2017; Musselwhite & Haddad, 2010; Shergold, Lyons, & Hubers, 2015), and the maintenance of this opportunity does not lose its importance when mental and physical abilities decline (Adler & Rottunda, 2006; Johnson, 2002; Whitehead, Howie, & Lovell, 2006). However, the decline of mental and physical abilities in the elderly leads to an increased risk that they will cause a traffic accident (e.g., Karthaus & Falkenstein, 2016), which makes the application of self-regulation strategies and the use of alternative forms of mobility necessary. Because older drivers tend to overestimate their driving skills (De Raedt & Ponjaert-Kristoffersen, 2006), feedback from people who observe their driving behavior in everyday life is highly important for the elderly to develop a realistic assessment of their driving abilities and effective self-regulation strategies, such as changing driving patterns or finding alternatives to driving when driving abilities tail off.

Importantly, feedback from relevant others—such as partners, family members, or friends—can only be effective if older drivers are open to feedback and comply with the recommendations given by these relevant others. Since research on the determinants of openness to feedback on declining driving abilities has received scant attention in the literature on traffic safety, we examined the openness to feedback on driving behavior in drivers aged 65 years or older. Because positive age stereotypes have been shown to have positive effects on behavior in the area of health psychology, we assumed that older drivers with positive age stereotypes might be more open to feedback on driving behavior. If positive age stereotypes were related to openness to feedback, this would point to a possible route to support feedback that might, rather than drawing a negative image of old age, highlight the positive aspects of elderly life. However, studies on the effects of positive age stereotypes on openness to feedback are important at this stage of research in the area of traffic safety,

because age stereotypes might affect the openness to feedback via two opposing mechanisms. First, positive age stereotypes might strengthen perceived self-efficacy and the perception that change is possible, but might also come along with a perception of reduced risk vulnerability and a dissociation from "other" older people regarded as more vulnerable.

2. Theoretical Background

Older people are the proportionally fastest growing part of the population, and for many older people their cars are their preferred mode of transport (Collia, Sharp, & Giesbrecht, 2003; Rosenbloom, 2001). Indeed, in many countries more elderly than ever before possess a driver's license and use their car frequently (Hakamies-Blomqvist, Wiklund, & Henriksson, 2005; Schlag, 1993). At the same time, older drivers represent a group with a high vulnerability for causing or being involved in traffic accidents due to physical and cognitive constraints (e.g., Anstey, Wood, Lord, & Walker, 2005; Fraade-Blanar et al., 2018; Karthaus & Falkenstein, 2016). To cope with the declining abilities and maintain a high level of traffic safety, older drivers inevitably have to adapt their driving behavior (Schlag, & Engeln, 2001; Molnar et al., 2015). For example, they can execute risk-reducing behavior during driving (Fofanova & Vollrath, 2012; Siren & Meng, 2013), avoid driving under difficult conditions or in unfamiliar areas (Molnar & Eby, 2008), and/or use driver assistance systems (Davidse, Hagenzieker, van Wolffelaar, & Brouwer, 2009). They can also self-regulate their life goals by moving to a new location to be closer to common destinations or to have additional options for getting around (Molnar et al., 2013).

Interestingly, previous research has shown that older drivers can successfully apply such self-regulatory strategies to maintain traffic safety (Fofanova & Vollrath, 2011; Gwyther & Holland, 2012; Jones, Cho, Abendschoen-Milani, & Gielen, 2011; Meng & Siren, 2015). However, overconfidence in driving or self-serving attributional biases still impede a proper assessment of the own driving abilities (Freund, Colgrove, Burke, & McLeod, 2005).

2.1 Biases in self-assessment of driving abilities, and feedback received from others

When negative incidents occur, individuals often do not see the cause of the incidents in themselves, but attribute these events to causes that serve to protect their self-image (Mezulis, Abramson, Hyde, & Hankin, 2004). A driver who hits another car, for instance, might attribute the cause to his or her not having slept well the night before (unstable cause), to the other driver having caused the accident (external cause), or to the fact that the view was restricted (specific cause). Self-serving attributional biases have been observed for both the elderly and for younger individuals in various domains (Aldridge & Islam, 2012; Kriss, Loewenstein, Wang, & Weber, 2011; Montemayor & Ranganathan, 2012; Yehudah, 2002). However, a meta-analysis conducted by Mezulis et al. (2004) illustrated that such self-serving attributional biases are most strongly expressed in elderly people and young children.

Moreover, even in the absence of negative incidents a belief might arise that oneself is not exposed to the same risk as other drivers (Svenson, 1981). Freund et al. (2005), for example, asked drivers aged 65 years or older to evaluate their driving performance compared to others of the same age. Of these drivers, 65% rated themselves as performing better than others. In a study by De Raedt and Ponjaert-Kristoffersen (2006), the performance of drivers aged between 65 and 96 was directly assessed using a driving simulator. In this study, more than half of the participants overestimated their performance. Similarly, other studies have indicated that older drivers tend to perceive their driving abilities to be at least equal to, or even better than, those of same-age drivers (Holland, 1993; Marottoli & Richardson, 1998), and sometimes even better than the driving abilities of younger drivers (Groeger & Brown, 1989).

To overcome such biases of overconfidence and self-serving attributions, appropriate feedback from relevant others who regularly observe the driving abilities of the elderly in everyday life is crucial (Ackerman et al., 2011; Anstey et al., 2005; Levasseur et al., 2016; Lindstrom-Forneri, Tuokko, Garrett, & Molnar, 2010; Mårdh, 2016; Söllner & Florack, 2019). Previous studies on feedback behavior in the context of driving behavior of older

drivers has mainly focused on the importance of feedback (Anstey et al., 2005; Linstrom-Forneri et al., 2010) or on the characteristics or motivations of the feedback giver (Coughlin, Mohyde, D'Ambrosio, & Gilbert, 2004; Söllner & Florack, 2019); to our knowledge, research on the determinants of openness to feedback is rare or nonexistent. Because positive age stereotypes have been shown to positively impact health maintenance behavior of older individuals (Levy & Myers, 2004), we assumed in the present research that positive age stereotypes might also affect traffic safety behavior of older drivers, and, in particular, these drivers' openness to feedback.

2.2 Age stereotypes as a determinant of openness to change behavior

Age stereotypes are mental representations that characterize individual or societal ideas and expectations about older people or old age (Wentura & Rothermund, 2005). According to stereotype embodiment theory (Levy, 2009), age stereotypes become internalized by individuals starting at an early age, are reinforced across their lifespan, and become self-relevant when age stereotypes are directed at oneself in later life. As shown in several studies, positive and negative age stereotypes can be automatically activated and influence functioning on an unconscious level (e.g., Levy, 2003) by generating expectations that act as self-fulfilling prophecies (Levy & Leifheit-Limson, 2009; Levy, Slade, Kunkel, & Kasl, 2002).

Previous research has provided evidence that positive age stereotypes facilitate behavioral change in the elderly. A variety of experimental and longitudinal studies have demonstrated that positive age stereotypes positively affect psychological, physiological, and behavioral outcomes of the elderly. Accordingly, it has been shown that an automatic activation of positive aging self-stereotypes in the elderly leads to an increase in various types of memory recall (Hess & Hinson, 2006; Levy, 2003) and self-efficacy (Levy, 1996; Levy, Hausdorff, Hencke, & Wei, 2000; O'Brien & Hummert, 2006). Longitudinal studies have shown that elderly people who hold age stereotypes that are more positive are less likely to

have a cardiovascular event (e.g., congestive heart failures, heart attacks, and strokes) over the next 38 years (Levy, Zonderman, Slade, & Ferrucci, 2009), recover faster from disease and trauma (Levy & Myers, 2005; Levy, Slade, May, & Caracciolo, 2006) and take part in more physical activity (Levy & Myers, 2004; Wurm, Tesch-Römer, & Tomasik, 2007; Wurm, Tomasik, & Tesch-Römer, 2010). In addition, elderly people with positive age stereotypes are more likely to seek new activities than those with negative age stereotypes (Carstensen & Hartel, 2006; Levy & Myers, 2004; Levy et al., 2002). By contrast, holding age stereotypes that are more negative leads to undesired effects such as a reduction in well-being, physical and cognitive performance, health, and longevity (Levy, 2009; Rothermund & Kornadt, 2015).

Most important for the present research, studies have shown that positive age stereotypes are related to self-efficacy (Levy, 1996; Levy et al., 2000; O'Brien & Hummert, 2006) and perceived recovery expectations (Levy et al., 2006), and that the effects of age stereotypes on physical recovery are mediated by positive expectations (Levy et al., 2006). We therefore assumed that positive age stereotypes provide older drivers with the view that feedback helps them to assess their driving abilities and thereby improve their behavior. We further supposed that the perception of self-efficacy resulting from a positive self-perception of the person's own age group facilitates their compliance with recommendations from the feedback giver. However, we also expected, based on research on health promotion, a direct effect of age stereotypes on the intention to comply with feedback on driving behavior (Levy et al., 2006). Hence, we hypothesized:

H1: The more positive the age stereotypes, the higher the intention to follow recommendations from the feedback giver (*compliance intention*).

H2: The more positive the age stereotypes, the higher the perception that feedback will be helpful in improving self-assessment and driving abilities (*feedback-related self-efficacy*).

H3: The higher the feedback-related self-efficacy, the higher the intention to comply with feedback.

A potential disadvantage of age stereotypes according to driving behavior could be that, due to their positive age-related self-image, older drivers with positive age stereotypes might feel less vulnerable than other elderly. Indeed, they might dissociate themselves from more vulnerable peers to protect their self-concept from negative consequences linked to the elderly in general (Weiss & Freund, 2012; Weiss & Kornadt, 2018; Weiss & Lang, 2012). Hence, it is conceivable that the perception of reduced vulnerability might counteract the general positive effect of age stereotypes on compliance with the feedback. Hence, we hypothesized:

H4: The more positive the age stereotypes, the lower the perceived vulnerability of elderly drivers.

H5: The lower the perceived vulnerability of elderly drivers, the lower the intention to comply with the feedback.

3. Study 1

An overview of the proposed model resulting from these hypotheses is depicted in Figure 1. We tested our hypotheses in Study 1 via a telephone survey with elderly drivers aged 65 or above. We assessed age stereotypes, feedback-related self-efficacy, perceived vulnerability, and intention to comply with feedback. We decided to collect our data via telephone survey in order to include participants with a diverse set of socio-demographic characteristics in the sample. Internet-based surveys for this age group have the disadvantage of relying on a strongly biased sample of internet users (Destatis, 2017); however, it is important to note that using telephone interviews also means that the applied questions had to be very focused and that extensive scales with many items could not be used.

3.1 Materials and methods

3.1.1 Participants

The criteria for the search and selection of participants were that potential participants had to be 65 years or older, had to possess a driver's license, and had to be active drivers. We recruited most participants out of a pool of the German Senior League e.V., which is a nonprofit association representing the interests and goals of senior citizens and their relatives in Germany. Furthermore, we increased the sample through additional recruitment activities (e.g., using a database from the department). Finally, we conducted telephone interviews with 305 older drivers. However, 24 participants did not complete the interview or did not want to answer the questions. Hence, the sample for data analysis was based on 281 participants (80 (28.5%) female; 201 (71.5%) male). The age of participants was between 65 and 94 years (M = 74.3 years; SD = 5.79); 85 (30.2%) of the participants lived in villages with a population of fewer than 20,000, 96 (34.2%) lived in a small town (20,000 to 100,000 residents) and 65 (23.1%) lived in a bigger city (between 100,000 and 500,000 residents). The remaining 35 (12.5%) lived in a large city (over 500,000 residents). All participants had a valid driver's license and were active car drivers.

3.1.2 Measures

The questionnaire included demographic and mobility-related information; questions on age stereotypes and the participants' awareness of readiness to comply with feedback on their driving behavior; and questions to measure their perceived vulnerability and feedback-related self-efficacy. The descriptive statistics and composite reliability of the items are depicted in Table 1.

To measure *age stereotypes*, we used four items on a six-point scale (1 = *do not agree at all*, 6 = *fully agree*) adapted from Kornadt and Rothermund (2011): "Older people are calm and prudent when dealing with problems;" "It is easy for older people to maintain friends and acquaintances;" "Older people find the right solution for important life issues;" "Older people can deal with everything well on their own." High values indicate positive age stereotypes.

We measured *vulnerability* with two items: "I consciously pay attention to whether my driving abilities change with age;" "I have been thinking that my driving ability could decline in older age." Participants answered the items on a six-point scale (1 = *do not agree at all*, 6 = *fully agree*). High values indicate that participants were strongly mindful about age-related changes in their driving abilities.

We used two items to measure the belief that feedback on driving behavior enhances self-efficacy beliefs (*feedback-related self-efficacy*): "If another person gives me some advice on my driving abilities, I can better assess my own abilities;" "If another person gives me some advice on my driving abilities, I can improve them." Participants answered both items on a six-point scale (1 = *do not agree at all*, 6 = *fully agree*). High values indicate that participants believe feedback helps them to successfully cope with declining driving abilities.

We measured their intention to comply with feedback on driving behavior (*compliance intention)* using three items: "I would take advice if I considered the person giving it to be competent;" "I would take advice if I realized I had been making mistakes while driving;" "I would take advice if I had caused an accident." Participants answered the three items on a six-point scale (1 = *do not agree at all*, 6 = *fully agree*). High values indicate that participants would comply with feedback on their driving behavior.

3.1.3 Data analysis

We conducted structural equation modeling (SEM) using Stata 15 software (StataCorp., 2017) and maximum likelihood estimation. In order to test the fit of our hypothesized model, we calculated model fit indices including chi-square (χ^2), root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TLI) and standardized root mean square residual (SRMR). In accordance with Hu and Bentler (1999), cutoff values close to .06 for RMSEA, .95 for TLI and CFI, and .08 for SRMR are needed to conclude that there is a relatively good fit between the hypothesized model and the observed data.

3.2 Results

We assumed that willingness to comply with feedback would be directly influenced by age stereotypes. In particular, we believed that age stereotypes would indirectly influence the intention to comply with feedback through perceived feedback-related self-efficacy, on the one hand, and perceived vulnerability, on the other (Figure 1). The first-order correlation coefficients are depicted in Table 2; with the exception of a nonsignificant negative correlation of age stereotypes with perceived vulnerability, the correlations are in line with the hypotheses. The estimation of the hypothesized path model resulted in a good model fit, $\chi^2(39) = 52.53$, $p > .07$, RMSEA = .035, CFI = .970, TLI = .957, and SRMR = .051. The standardized path coefficients are depicted in Figure 2. As expected, age stereotypes had a strong direct effect on feedback compliance (H1). The more positive the age stereotypes, the higher the participants' intention to comply with feedback ($\beta = 0.34$, $p < .001$). Furthermore, the results provide support for H2 and H3—the more positive the age stereotypes, the higher participants' perceived feedback-related self-efficacy ($\beta = 0.17$, $p = .045$), and the lower their perceived vulnerability ($\beta = -0.21$, $p = .008$). In addition, the higher the participants' self-efficacy in dealing with feedback ($\beta = 0.45$, $p < .001$), and the higher their vulnerability, the more likely they were to comply with feedback ($\beta = 0.55$, $p < .001$) (H4 + H5). An overview of the direct, indirect, and total effects is presented in Table 3.

3.3 Discussion

In Study 1, we asked active car drivers aged 65 or older to indicate how they would respond to feedback about their driving behavior, and examined age stereotypes as one possible driver of compliance with the feedback. In line with our expectations, we found that positive age stereotypes were positively related to the intention to comply with the feedback. Moreover, we observed that this effect of age stereotypes was partly mediated by increased feedback-related self-efficacy, and was not completely offset by a reduced vulnerability. The findings of Study 1 provide a first hint that the positive effect of positive age stereotypes on

behavior intentions is not limited to the area of health, but also relevant for traffic-related behavior.

In Study 1, we conducted telephone interviews to reach also those elderly who usually do not use the internet or would not take part in online studies. This procedure helped to increase the ecological validity of the study. However, telephone interviews do not allow the application of complex scales. Hence, Study 1 applied only short scales for age stereotypes and compliance intentions. To address this limitation, we conducted Study 2 with an online sample of elderly drivers allowing the measurement of differentiated aspects of age stereotypes and compliance intention. Indeed, Kornadt and Rothermund (2011) argued that age stereotypes are not only related to physical and mental fitness, but also to different aspects of life such as leisure activities (e.g., social commitment) and personality (e.g., rigidity). Furthermore, it seems plausible that compliance intention might differ for different feedback givers (e.g., Coughlin et al., 2004). An elderly driver might be more open to accept feedback from a medical doctor compared to feedback from a neighbor.

4. Study 2

The aim of study 2 was to replicate the impact of age stereotypes on compliance intentions to feedback on driving behavior applying a stereotype measure that included questions according to three different aspects (physical and mental fitness, leisure activities and social commitment, personality) and questions to assess compliance intentions according to different categories of feedback givers (medical doctors, partners, acquaintances, friends, children). In addition, we tested whether information about research findings on positive aspects of old age compared to no such information already could increase specific compliance intentions. We expected that positive age stereotypes as well as the positive information on research findings increase specific intentions to comply with the feedback.

4.1 Materials and method

4.1.1 Participants and design

Our sample for data analysis was based on 285 older active drivers who had a valid driver's license (108 (37.9%) female; 177 (62.1%) male). Participants' age ranged between 65 and 89 years (M = 69.5 years; SD = 3.72). 45 (15.8%) of the participants mentioned to drive less than 5.000 kilometers per year, 115 (40.4%) between 5.000 and 10.000 kilometers, 98 (34.4%) between 10.000 and 20.000 kilometers and 27 (9.5%) more than 20.000 kilometers per year. We applied a design with the provided information as a between subjective variation (short information about research findings: provided vs. not provided) and the feedback giver as a within subject factor (feedback giver: medical doctor, partner, acquaintance, friend, child).

4.1.2 Information about research findings (positive aspects of old age)

Participants received either information about research findings about positive aspects of old age or no additional information. The information about the research findings included five different aspects: learning (Grawe, 2004), memory (Kruse & Lehr, 1996), intelligence (Schaie, 1983), life satisfaction (Wolff & Tesch-Römer, 2017) and interpersonal relationships (Birditt & Fingerman, 2005). For example, participants read "Research on conflict behaviors has shown that people can handle interpersonal conflicts more successfully as they grow older in comparison to younger people (Birditt & Fingerman, 2005)." We used one sentence for each research finding. We also asked participants regarding each aspect whether they were surprised or not when they read the statement (1 = *does not surprise me at all*, 6 = *surprises me very much*) and whether they thought that most people would be surprised reading this scale (1 = *would surprise most people*, 6 = *would not surprise most people*). We averaged the scales into an individual unexpectedness (Cronbach alpha = .67) and general unexpectedness (Cronbach alpha = .77).

4.1.3 Measures

Besides demographic and mobility-related information our questionnaire included three scales from the questionnaire of Kornadt and Rothermund (2011) to measure *age*

stereotypes according physical and mental fitness (5 items; e.g., "Old people…are often ill vs. … are rarely ill"; Cronbach's alpha = .83), leisure and social commitment activities (4 items; e.g., "Old people…show little commitment to others vs. show a lot of commitment to others"; Cronbach's alpha = .81), and personality (3 items; e.g., "Old people…have a lot to complain about vs. are open and tolerant"; Cronbach's alpha = .73). Participants had to rate the items on six-point scales between a positive and a negative statement (1 = *negative statement*; 6 = *positive statement*). Because the three sub-scales were highly correlated (*r*s between .43 and .54, *p*s < .001), we averaged the items into a single scale (Cronbach's alpha = .87). High values indicate positive age stereotypes.

We measured *general openness to feedback* with three items ("If a person pointed me to a mistake while driving, I would respond calmly."; "I am always open for feedback on my driving behavior."; "If a person pointed me to a mistake while driving, I would stay calm and relaxed.". Participants answered on a six-point scale (1 = *do not agree at all*, 6 = *totally agree*). We averaged the items into a single scale (Cronbach's alpha = .90). High values indicate strong general openness to feedback.

We measured *specific compliance intentions* in relation to five different feedback partners on a four items scale ("If I received feedback on my driving abilities from a medical doctor / partner / acquaintance / friend / child, I would be open to talk about it. / I would adopt this advice. / I would consider how to implement this advice in practice. / I would adapt my driving behavior accordingly."). Participants answered on six-point scales (1 = *do not agree at all*, 6 = *totally agree*). We averaged the items referring into separate single scales for each category of feedback givers (Cronbach's alphas between .88 and .96). High values indicate that the person would comply with the feedback given.

4.2 Results

4.2.1 Preliminary analyses

Participants indicated that they were not surprised when reading the information about the research findings (M = 1.61, SD = 0.71; scale from 1 to 6), but assumed that others would be more surprised if they read the information (M = 3.24, SD = 1.04; scale from 1 to 6), $t(143) = -18.10$, $p < .001$. The provided information had no effect on the measured age stereotypes, $t(283) = .73$, $p = .466$, and thus the information condition and the measured age stereotypes could be included in the model specified below as independent factors.

4.2.1 Effects of age stereotypes and information on general openness to feedback and specific compliance intentions

First, we tested the hypotheses that age stereotypes and information were positively related to general openness to feedback. We computed a multiple regression analysis with age stereotypes and information (provided vs. not provided) as predictors and general openness to feedback as dependent measure. The analyses yielded that, as expected, general openness to feedback increased with the age stereotypes being more positive, $\beta = .252$, $t(251) = 4.11$, $p < .001$. However, the effect of the information on general openness to feedback was not significant, $\beta = .056$, $t(251) = .92$, $p = .361$.

Second, we tested the effects of age stereotypes and the information conditions on the specific compliance intentions according to the five different categories of feedback givers. To account for the repeated measure of the specific compliance intentions for the different categories of feedback givers, we applied a linear mixed model analysis (LLM). We used age stereotypes, information (information provided vs. not provided), category of feedback giver (medical doctors / partners / acquaintances / friends / children) as fixed main effects and the compliance intentions as dependent measure. We included a random intercept per participant to account for by participant variation. In line with our hypothesis, we obtained a significant main effect of age stereotypes, $F(1, 1381) = 72.689$, $p < .001$. The more positive the age stereotypes were the higher were the compliance intentions, $b = 0.27$, $SE = 0.03$, $t(1381) = 8.53$, $p < .001$. Further, the analysis yielded a significant main effect of the categories of

feedback givers on compliance intentions, $F(4, 1381) = 37.053$, $p < .001$. The estimated means are depicted in Table 4. Participants indicated that they would comply more to the feedback from medical doctors than to feedback from their partners, their children or friends. Least likely they would intend to accept feedback from acquaintances. In contrast to our hypothesis, we found no significant effect of information (information provided vs. not provided) on compliance intentions, $F(1, 1381) = 2.769$, $p = .097$.

Third, we tested whether the effects of the age stereotypes and information on compliance intentions were moderated by the categories of feedback givers. Therefore, we added the interaction between age stereotypes and the categories of feedback givers as well as the interaction between information and the categories of feedback givers to the linear mixed model. However, the interaction between age stereotypes and the categories of feedback givers, $F(4,1373) = 0.595$, $p = .666$, as well as the interaction between information and the categories of feedback givers, $F(4,1373) = 0.164$, $p = .957$, were not significant.

Adding age and gender as covariates to the regression model and the linear mixed models did not change the reported patterns of effects (whether the effects were above or below the threshold of .05).

4.3 Discussion

In Study 2, we again found that age stereotypes were related to compliance intentions when elderly drivers receive feedback to their driving behavior. We observed this relationship with a measure of age stereotypes that included items according to physical and mental fitness, leisure activities and social commitment, and personality. We averaged the items according to these three aspects, because they were highly correlated. Hence, the applied measure can be considered a broader measure of age stereotypes compared to the one applied in Study 1, and obviously the relationship between age stereotypes and compliance intentions did not differ for the different measures of age stereotypes.

Furthermore, Study 2 showed that the elderly drivers distinguished strongly between feedback givers. They were much more likely to accept feedback given by medical doctors in comparison to feedback provided by friends. However, the correlation of age stereotypes with compliance intentions was not moderated by the different categories of feedback givers. Obviously, positive age stereotypes are related to a general openness to feedback. However, the present study did not provide any evidence for the assumption that simple information about research findings on positive aspects of old age is sufficient to increase openness to feedback or compliance intentions. In contrast to our expectation, participants indicated that they were not surprised by the research findings, even if they thought other individuals would be surprised.

5. General discussion, conclusion, and limitations

When self-serving attributions, as well as biases of overconfidence, hamper realistic assessments of one's own driving abilities, feedback from an outside perspective could be an important nudge to change driving behavior and derive successful self-regulatory strategies (Söllner & Florack, 2019). While a number of studies have considered compliance in the area of health and medicine (Haynes, Ackloo, Sahota, McDonald, & Yao, 2008; Morris & Schulz, 1992; Osterberg & Blaschke, 2005), it is not clear how older drivers respond to such driving-related feedback and which factors affect whether older drivers will be open to feedback and willing to comply with the recommendations. In the present studies, we asked active car drivers aged 65 or older to indicate how they would respond to feedback about their driving behavior, and examined age stereotypes as one possible determinant of compliance intentions. In a telephone (Study 1) and an online survey (Study 2), we found that positive age stereotypes were positively related to the intention to comply with the feedback. Moreover, we observed in Study 1 that this relation between age stereotypes and compliance intention was partly mediated by increased feedback-related self-efficacy, and was not completely offset by a reduced perception of vulnerability. Moreover, Study 2 provided evidence that the

positive relation between age stereotypes and compliance intentions is not limited to specific feedback givers, even if the participants according to their self-reports are more likely to comply with the recommendations of medical doctors or their partners compared to recommendations from their children, friends, or acquaintances.

The finding that age stereotypes and compliance with feedback are positively related extends previous research in the area of health psychology (Horton, Baker, & Deakin, 2007; Levy, 2009; Levy & Myers, 2004; Madey & Chasteen, 2004). Levy and Myers (2004), for example, assessed positive self-perceptions of aging and health-related behaviors of elderly participants. They asked the participants, for instance, whether they attended regular physical examinations and complied with directions for taking medications. The authors found that participants with positive self-perceptions of aging were much more likely to show such health-related behaviors. The findings of the present study provide initial evidence that such positive effects of age stereotypes are not limited to the area of health prevention, but similarly apply to the area of traffic safety.

Interestingly, the present studies, in concert with previous studies on age stereotypes, suggest that the mechanisms supporting the effects of positive age stereotypes have a general validity. In her psycho-social approach to aging, Levy (2009) assumed that positive age stereotypes lead to the view that a decline in physical and mental abilities is not an inevitable consequence of growing old, and strengthen perceptions that positive adaptions are possible. Moreover, she argued that negative age stereotypes are linked to reduced self-efficacy and a reluctance to change the behavior. The results of Study 1 show that this reasoning can at least be partly applied to explain the link between positive age stereotypes and intention to comply with feedback on driving behavior. Indeed, we found in Study 1 an effect of positive age stereotypes on compliance intention which was mediated by feedback-related self-efficacy. This finding is congruent with results from Levy et al. (2006), who found, for example, that the effect of age stereotypes on physical recovery after an acute myocardial infarction was

partly mediated by positive expectations about the recovery. Similarly, many other studies have found that positive age stereotypes elicit positive expectations in the elderly and increase their motivation to pursue beneficial behavior (Carstensen & Hartel, 2006; Levy & Myers, 2004; Wurm et al., 2007; Wurm et al., 2010).

While it is plausible that a positive image of aging activates resources to successfully adapt to the challenges of later life, it has to be noted that such a positive image might reduce a person's perceptions of their own vulnerability. Individuals in older age might dissociate themselves from "other" older people who are different and more vulnerable (Weiss & Kornadt, 2018). Therefore, it was important for us to also examine in Study 1 whether positive age stereotypes are linked to a perception of reduced vulnerability, and whether this reduced perception of vulnerability might offset the positive effect of age stereotypes. Importantly, the results of Study 1 do not support this concern. Even though the negative indirect effect of age stereotypes on compliance intentions mediated by vulnerability was significant in our model, this effect was not strong enough to offset the positive effect of age stereotypes on compliance intention. Indeed, the first-order correlation between age stereotypes and decreased vulnerability did not even reach conventional levels of significance. Hence, the present findings do not support the assumption that the positive self-perception associated with positive age stereotypes in the sense of a lowered perception of vulnerability might decrease openness to feedback.

Furthermore, the results of Study 2 pointed out that the positive effect of age stereotypes on specific compliance intentions was not moderated by the feedback givers which is in line with the assumption that positive age stereotypes increase openness to changes in general, and, thus, are not limited to recommendations for changes in specific relationships. However, Study 2 also demonstrated that, independently of the age stereotypes, older drivers have preferences for specific feedback givers. Similarly to a previous study with older drivers in the US (Coughlin et al., 2004), we found that older drivers in Germany

strongly are more willing to respond to feedback with changes in behavior when the feedback is provided by a medical doctor or the partner in a relationship compared to when the feedback is provided by a child, a friend, or an acquaintance. Taken into account that medical doctors often do not have the opportunity to observe the driving behavior of an elderly driver directly and do not have the time to give extensive feedback on driving behavior, relationship partners might be the most relevant feedback givers. Relationship partners often observe the driving behavior directly, they can give immediate and concrete feedback based on specific incidents, and finally the elderly drivers are more likely to comply with the feedback according to the self-reports in our study.

Because research findings have repeatedly shown the potential of the elderly in many respects (Birditt & Fingerman, 2005; Grawe, 2004; Kruse & Lehr, 1996; Schaie, 1983; Wolff & Tesch-Römer, 2017), we also tested in Study 2 whether just mentioning such findings might nudge the elderly drivers to respond more positively to feedback and be more open to implement changes in their driving behavior. However, the results of Study 2 did not provide any evidence for the desired positive effect of information about relevant research findings on the general openness to feedback. Because older drivers have learned and internalized age stereotypes over a very long time, we had been aware when conducting the study that simply mentioning positive aspects of old age cannot immediately change age stereotypes. Though, we considered providing elderly drivers with such information as the first natural step to illustrate to elderly drivers that a negative picture of old age is not adequate. Indeed, manipulations of age stereotypes with subliminal priming that have been successful in other studies (Levy, 1996) might be problematic in practice because of ethical reasons and the difficulty to implement such procedures.

At present, we can only speculate why providing positive information about old age was in Study 2 not sufficient to change general openness to feedback. First, it is possible that because of the rigidity of stereotypes single research findings are not effective. Individuals

could regard single pieces of information that are inconsistent to a stereotype as an exception (Richards & Hewstone, 2001). Also, they might respond with reactance to direct attempts to change their individual opinions and perceptions (Legault, Gutsell, & Inzlicht, 2011). Second, we cannot rule out that the positive information was not effective to change general openness to feedback, because it was not new to the participants. Indeed, most participants indicated that they were not surprised when they read the information. However, they also reported that most others would be surprised. Hence, it is not clear whether the answers are based on a hindsight bias (Roese, & Vohs, 2012) or the high level of education in our sample. But the finding that participants thought that others would be less surprised might impede the change of the stereotype. Research has shown that individuals base their own judgment very much on the presumed views of others, and that information that others have more positive beliefs might significantly change stereotypes (Stangor, Sechrist, & Jost, 2001).

While the impression that most others would be surprised by positive information about the elderly might have impeded the effects of the provided information in Study 2, presenting positive views of others about the old age would be a further possibility to change age stereotypes. Further promising alternatives to nudge a more positive view of the elderly could be the repeated presentation of positive role models (Dasgupta & Asgari, 2004), or the positive reframing of the stereotype (Wang, Whitson, Anicich, Kray, & Galinsky, 2017) to stress the strengths of the elderly over a longer period of time.

A limitation of the present studies is that the present studies did not vary the age stereotype experimentally in such a way and that we did not observe compliance behavior directly. To show the causal effect of experimental manipulations of age stereotypes on compliance to feedback in a context where real behavior can be measured (e.g., during a driving training), is an important task for future research which could then also provide a base for how a positive image about the life in older age can be communicated.

Because the present studies are, to our knowledge, the first to highlight the role of age stereotypes according to traffic safety behavior, we hope that they will stimulate future research to strengthen integration of this concept into research on the prevention behavior of older drivers both theoretically and practically. Indeed, in western societies a negative image of old age often prevails (Davies & Patel, 2005; Joanisse, Gagnon, & Voloaca, 2012; Nelson, 2004), and an immediate response to old age is to think about declining abilities. However, we often forget that the elderly can be highly effective in adapting to changes while at the same time maintaining a level of well-being that is often higher compared to younger age groups (Blanchflower & Oswald, 2008; Stone, Schwartz, Broderick, & Deaton, 2010; Wunder, Wiencierz, Schwarze, & Küchenhoff, 2013).

In conclusion, the present studies provide initial evidence that positive age stereotypes contribute to elderly drivers' general openness to feedback on driving behavior. While individuals that hold positive age stereotypes are more likely than individuals with negative age stereotypes to comply with feedback due to their higher self-efficacy, they also run the risk of underestimating their own vulnerability and therefore tend to ignore feedback. However, the latter effect does not seem to offset the positive effects of age stereotypes on openness to feedback. Future research should strive to examine how the influence of positive age stereotypes on feedback compliance can be utilized to encourage older drivers to properly assess their own driving abilities at an early stage. In this context, it would also be interesting to consider whether age stereotypes affect openness to other forms of feedback, such as technical feedback on driving behavior provided by advanced driver assistance systems, and whether this openness to feedback can help drivers mitigate overconfidence and self-serving attributional biases, thereby supporting them to successfully regulate their driving behavior.

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Table 1

Descriptive Statistics for the Applied Scales (*n* = 281)

Measure	*M*	*SD*	No. of items	CR
Age stereotypes	4.12	0.77	4	.62
Vulnerability	4.90	1.14	2	.48
Feedback-related self-efficacy	4.48	1.16	2	.69
Compliance intention	5.43	0.74	3	.64

Notes: CR = composite reliability

Table 2

Bivariate Correlations between All Measures in the Hypothesized Model (n = 281)

Measure	1	2	3	4
1. Age stereotypes	1.0			
2. Vulnerability	-.11	1.0		
3. Feedback-related self-efficacy	.13*	.11	1.0	
4. Compliance intention	.15*	.33**	.37**	1.0

*p < .05 **p < .01

Table 3

Direct, Indirect, and Total Effects (Standardized Coefficients)

Path	*Effect Estimate*		
	DE	*IE*	*TE*
Age stereotypes → Compliance intention	.34***	-.04	.28**
Age stereotypes → Feedback-related self-efficacy	.17*	–	.17*
Age stereotypes → Vulnerability	-.21**	–	-.21**
Vulnerability → Compliance intention	.55***	–	.55***
Feedback-related self-efficacy → Compliance intention	.45***	–	.45***

DE = direct effect; IE = indirect effect; TE = total effect. *$p < .05$ **$p < .01$ ***$p < .001$

Table 4

Estimated means for the intentions to comply to feedback from different feedback givers (Study 2)

Feedback giver			95% CI	95% CI
	M	*SE*	*LL*	*UL*
Medical doctor	4.93_a	.05	4.83	5.03
Partner	4.85_a	.05	4.75	4.95
Child	4.66_b	.05	4.56	4.76
Friend	4.57_b	.05	4.47	4.67
Acquaintance	4.14_c	.05	4.04	4.24

Note: CI = confidence interval, *LL* = lower limit, *UL* = upper limit; means with different subscripts differ significantly at $p < .05$.

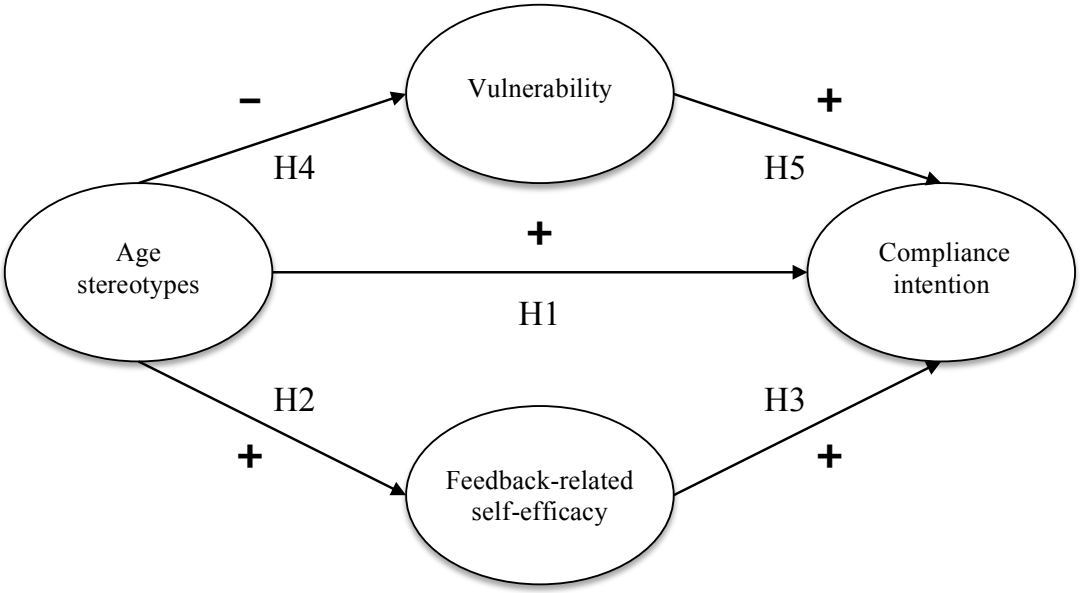

Figure 1

Hypothesized Structural Equation Model Illustrating the Direct and Indirect Effects of Age Stereotypes, Vulnerability and Feedback-Related Self-Efficacy on Compliance Intention.

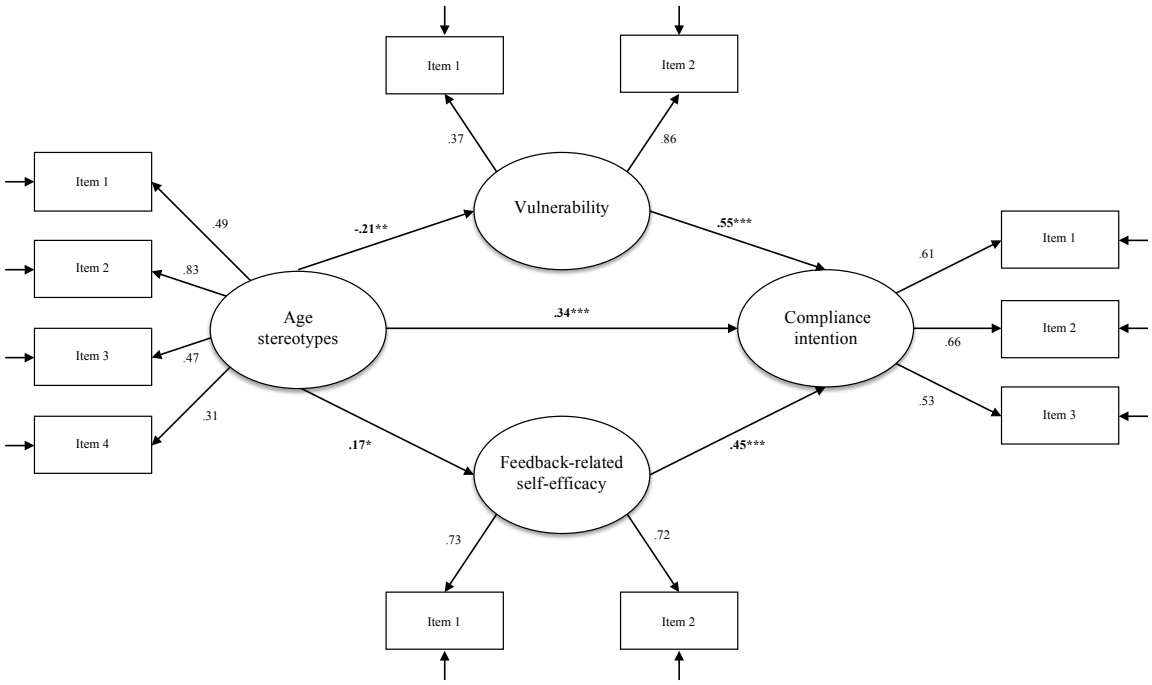

Figure 2. Structural equation model illustrating the direct and indirect effects of age stereotypes, vulnerability and feedback-related self-efficacy on compliance intention (n = 281). Circles represent latent factors, rectangles observed variables and arrows represent estimates of direct and indirect effects. Standardized coefficients are reported. *p < .05. **p < .01. ***p < .001.

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