Robustness of Personality and Affect Relations Under Chronic Conditions: The Case of Age-Related Vision and Hearing Impairment

Hans-Werner Wahl, Vera Heyl, and Oliver Schilling

Objectives. Relations between personality and affect are generally regarded as robust. Extraversion is closely linked to positive affect (PA), but not to negative affect (NA), whereas neuroticism is closely linked to NA, but not to PA. We argue in this work that the stress experience associated with age-related vision and hearing impairment may alter this commonly found pattern as compared with sensory unimpaired (UI) older adults.

Method. We analyzed data from a sample of severely visually impaired (VI; N = 121), severely hearing impaired (HI; N = 116), and a control condition of sensory UI (grand age mean: 82 years; N = 150).

Results. Based on a structural equation modeling approach, we found that the relationship between extraversion and PA was higher in the UI as compared with the sensory impaired groups. In contrast, the strong linkage between neuroticism and NA was not affected by sensory status. Furthermore, we observed a meaningful negative relation between extraversion and NA only in the VI group.

Discussion. Findings support the argument that the relationship between personality and affect deserves qualification when chronic vision and hearing impairment is present.

Key Words: Extraversion—Negative affect—Neuroticism—Positive affect—Vision and hearing impairment.

The relationship between personality, particularly the “Big Two” traits of extraversion and neuroticism, and positive affect (PA) and negative affect (NA) is well established (Costa & McCrae, 1980; DeNeve & Cooper, 1998; Heady & Wearing, 1989; Watson, Wiese, Vaidya, & Tellegen, 1999). For example, Watson and colleagues (1999) pooled data from 12 samples totaling 4,457 respondents without further qualification in terms of age, showing support for the view that NA is far more closely related to neuroticism than PA (r = .58 vs. −.33). In contrast, extraversion was far more closely related to PA as compared with NA (r = .51 vs. −.25). There is also substantial evidence that a similar correlational pattern exists in heterogeneous samples of older adults (Costa & McCrae, 1980; Kunzmann, 2008; Staudinger, Freund, Linden & Maas, 1999). For example, Staudinger and colleagues (1999) found in the Berlin Aging Study (BASE) that among those in advanced old age, extraversion correlated r = .46 with PA and only r = −.10 with NA, whereas neuroticism correlated r = .64 with NA and only r = −.10 with PA.

In this study, we question whether this “classic” pattern of relations between personality and affect persists under conditions of pronounced functional impairment. We will refer to the exemplary case of age-related vision and hearing loss in order to provide emerging support that full generalization of the classic pattern to older adults with chronic functional loss may be unwarranted and deserves qualification. Both sensory impairments come with chronic stress due to significant person–environment mismatch, which may reduce the potential of autonomous and efficient day-to-day functioning to elicit positive emotions, even if extraversion is high. Age-related vision impairment comes with significantly lower competence in exerting basic activities of daily living because visual capacity is a critical prerequisite for safely accessing and using the physical environment autonomously (Burmed, Becker, Heyl, Wahl, & Himmelsbach, 2002; Rudberg, Furner, Dunn, & Cassel, 1993; Wahl, Schilling, Oswald & Heyl, 1999). In some contrast, the most dramatic impact of hearing impairment is the undermining of “normal” social communication in day-to-day life (Wahl & Tesch-Römer, 2001). Thus, both vision and hearing impairment are associated with more negative outcomes as compared with unimpaired (UI) older adults, although the source of stress is different, that is, failure to optimally use interactions with the physical–spatial versus the social environment (Wahl & Tesch-Römer, 2001). As we will argue, such chronic stress and day-to-day failure experiences in vision and hearing impaired older adults’ interaction with the external world may change to some extent the “normal” dynamic between personality and affect. In particular, we assume that extraversion’s key role as a resource to elicit PA is weakened under the condition of aging with significant sensory impairment.
Note also that both vision and hearing impairment are strongly associated with chronological age and frequently used as important markers of awareness of age-related change (Diehl & Wahl, 2010). Severe vision impairment has been found in 20% of those 65 years and older and 25% of those 75 years and older (Schieber, 2006; Wahl & Heyl, 2003). The prevalence of severe hearing impairment is also significant, ranging from 20% to 30% in those aged 75 years to about two thirds of those aged 80–89 years (Fozard & Gordon-Salant, 2001; Wahl & Heyl, 2003). That is, if support for an altered relationship between personality and affect is found for these conditions as compared with the general population, this would include rather large subgroups of individuals. In addition, it should also be mentioned in this context that subsamples of individuals with severe vision and hearing impairment in heterogenous samples of older adults typically are too small for substantial testing of personality and affect relationships. In this paper, due to the unique opportunity to have access to large enough samples, we use the case of vision and hearing impaired older adults in comparison to sensory UI older adults to help fill this void.

Impact of Age-related Vision and Hearing Impairment on Relationships Among Extraversion, Neuroticism, PA, and NA

Both PA and NA have been considered as part of distinct motivational systems, which could be seen as motivational counterparts of the behavioral expression of the traits of extraversion and neuroticism. That is, PA reflects the operation of a behavioral activation system (also coined behavioral facilitation system, behavioral engagement system), which promotes individuals’ engagement in activities that yield pleasure and reward. In contrast, NA is a subjective component of a behavioral inhibition system, serving to avoid negative stimuli (Depue, Krauss, & Spoons, 1987; Fowles, 1987; Quilty & Oakman, 2004; Watson, 2000; Watson et al., 1999). Elliot and Thrash (2002, 2010) proposed the constructs of approach temperament and avoidance temperament, meaning a general neurobiological sensitivity to positive (approach temperament) versus negative (avoidance temperament) stimuli, that provides a genetically driven predominance of perceptions, behaviors, and affective reactions directed to the respective class of stimuli. Thus, approach and avoidance temperament may be seen as core constructs underlying the associations between the behavioral activation system, PA, and extraversion, and between the behavioral inhibition system, NA, and neuroticism, respectively.

However, extraversion—commonly described in terms of high sociability, activity, and optimism as a behavioral disposition due to the approach temperament—rests upon the implicit assumption that striving for positive stimulation implies engagement with the outside world, such that introverted behavior would generate less rewarding experiences to the individual. Consequently, Kunzmann (2008) proposed the concept of outward focus as kind of a mediating variable explaining how the dispositions of an approach temperament “translate” into the generation of everyday PA. According to this reasoning, individuals with an approach temperament, highly extroverted and behaviorally activated, would under normal conditions of living largely focus on interactions with their outward environment to “gain” PA from these activities. In contrast, if an avoidance temperament promotes behavioral inhibition and neuroticism (e.g., proneness to health worries, shyness, low self-esteem), this may lead to what Kunzmann (2008) considered as an inward focus on evaluations of the self and “internal” perceptions (such as perceptions of illness and functional impairment).

Concluding from these theoretical propositions with regard to the relations among extraversion and PA, a full “syndrome” seems in place, in which extraversion and PA go hand in hand with social involvement, objective competence (Clark & Watson, 1988; Watson, 2000), and goal tenacity (Heyl, Wahl, & Mollenkopf, 2007). That is, PA is generated largely via individual activities, which provide positive hedonic tone from the satisfaction of individual needs and wants. However, we argue that there is a need for qualification of such an outward focus based pattern when it comes to sensory impaired older adults. In particular, both vision and hearing impairment come with enduring difficulties and failure experiences in day-to-day life due to problems in successfully accessing and using the external physical and social world to attain important goals. For example, the reduced capability of VI older adults to navigate through their outside environment or using public transport undermines meaningful “external” activities for many VI adults and thus challenges autonomous functioning and mental health at large (Heyl & Wahl, 2010; Horowitz & Reinhardt, 2000). Similarly, a diminished capability to efficiently communicate with family members or friends is a major threat to life satisfaction and a potential risk for feeling socially excluded or being socially avoided (Hetu, 1996; Wallhagen, 2010). As a consequence, the normally strong role of extraversion to generate PA via outward focused activities in the everyday interaction with the external physical–spatial and social world may be significantly undermined. Under sensory impairment conditions, the meaning of prohedonic activities that require less extroverted behavior (such as appreciation of music or literature, enjoyment of good meals, etc.) could become increasingly important sources of PA. Therefore, the relationship between extraversion and PA may be significantly attenuated under the condition of age-related vision and hearing impairment as compared with older adults without such chronic difficulties in accessing the external world.

Turning to the relationship between neuroticism and NA, research shows that NA is less dependent on changing situational influences (e.g., L. A. Baker, Cesa, Gatz, & Mellins, 1992; Clark & Watson, 1991; Schilling & Wahl, 2006) and largely driven by “internal” individual conditions (Kunzmann,
2008). Whereas the generation of PA is crucially bound to individual activities, the NA generating mechanisms seem independent from behavioral activation but unfold by means of an inward focus, which evolves from biologically driven behavioral and motivational dispositions. However, we see no principal reason why behavioral inhibition and a person’s inward focus should be crucially affected by sensory impairments. Therefore, a comparable and very substantial relationship between neuroticism and NA among sensory impaired as well as sensory UI older adults can be expected. Low neuroticism remains the major source for keeping NA down across various degrees of competence (and vice versa) even under the condition of severe sensory impairment.

Regarding cross-linkages between extraversion, neuroticism, PA, and NA, we cannot state any directed expectation regarding differences between the sensory impaired and UI groups. It seems that under conditions of UI sensory functioning, neuroticism and PA as well as extraversion and NA, are only weakly linked (Costa & McCrae, 1980; DeNeve & Cooper, 1998; Heady & Wearing, 1989) and hence have been rarely considered in the reasoning about common dispositional sources of personality traits and affect (Elliot & Thrash, 2010; Kunzmann, 2008). However, if the mainstream pathways “translating” the genetic dispositions of an approach versus avoidance temperament into high extraversion versus high neuroticism and into related preferences to generate high PA versus high NA operate differently under conditions of sensory loss, an empirical test of cross-linkages is appropriate. Thus, we check in an exploratory manner for such linkages, which are expected to be weak under normal UI sensory conditions.

**METHOD**

**Sampling Strategy**

The study was approved in 2004 by the Ethics Committee of the German Psychological Society. The VI sample was generated by drawing from pools of outpatients from regional university eye clinics. In addition to the general inclusion criteria of age (75–94 years), private household, and cognitive health, the best-corrected distance and/or near visual acuity of participants in this group had to be 0.30 or less in the better eye (corresponds roughly to the 20/70 metric used in the United States), and duration of vision impairment had to be at least 2 years. In total, 833 patients were identified in the clinical settings. From this pool of patients, 246 (29.5%) contacted the project either directly or via family members and data collection sessions took place in 148 cases. Reasons for attrition were 34 active refusals (23 “too ill”; 11 “no interest”; 10 “too effortful”; 2 “no time”; 5 “no reason”), 118731 (9.5%) died, and 30 did not fulfill our inclusion criteria. From the 148 cases being assessed, 5 cases were excluded because of cognitive problems (6-item Cognitive Impairment Test, 6CIT; Brooke & Bullock, 1999) and 22 cases due to additional severe hearing impairment. The final VI sample was N = 121 (49.2% of those contacting the project).

The hearing impaired (HI) sample was generated by drawing from pools of outpatients from regional university Ear, Nose, and Throat clinics. In addition to the general inclusion criteria of age, private household, and cognitive health, the average hearing impairment in decibel (db HL) frequencies of 500, 1000, and 2000 Hz had to be 35 db HL or more in the better ear, and duration of hearing impairment had to be at least 2 years. In total, 413 patients were identified in the clinical settings. From this pool of patients, 216 (52.3%) contacted the project either directly or via family members and data collection was completed in 141 cases. Reasons for attrition were 57 active refusals (20 “too ill”; 21 “no interest”; 5 “too effortful”; 6 “no time”; 5 “no reason”), 10 dead, and 8 did not fulfill our inclusion criteria. From the 141 assessed cases, 4 were excluded after passing the 6CIT cutoff score and 21 due to additional severe vision impairment. The final HI sample was N = 116 (53.7% of those contacting the project).

Sensory UI participants were enrolled from randomly generated addresses drawn from the city register of Heidelberg and Mannheim, targeting those aged 75–94 years. Of the 950 persons contacted by project staff, 27 were reported deceased and 16 did not fulfill our inclusion criteria, resulting in 907 individuals. From these, 158 agreed to participate in the study, but 8 were excluded due to passing the 6CIT cutoff score. The final comparison sample was N = 150 (15.8% of total pool of older adults). Reasons for nonparticipation were 124 (16.6%) could not be contacted; 206 (27.5%) “too ill”; 181 (24.2%) “no interest”; 10 (1.3%) “too effortful”; 33 (4.4%) “no time”, and 195 (26.0%) “no reason.”

**Sample Description**

Table 1 shows that we were able to gather comparable groups in terms of sociostructural variables, though gender distribution revealed a significantly higher percentage of women in VI. As expected, the VI and HI groups appeared unique both in objective as well as perceived vision and hearing performance, respectively, as compared with the remaining groups. Duration of vision and hearing impairment roughly varied on average between 7 and 12 years. No significant differences were observed in terms of our cognitive screening measure.

**Measures**

Vision and hearing.—In addition to the global clinical inclusion information regarding the VI, gaining more differentiated information on visual performance from each participant was warranted for two primary reasons: First, the clinical information only indicated that participants had passed the inclusion threshold, and more fine-tuned
information on their current visual performance was needed. Second, we wanted to objectively confirm that our UI and HI samples did not reveal serious visual problems. Therefore, a screening measure of best-corrected near vision was applied to all participants based on an assessment device suggested by Radner and colleagues (1998). Higher scores indicate better near vision performance. Also, a classic clinical screening distance visual acuity chart was shown to all participants. Participants had to read different series of digits depicted in different sizes at a 5-m distance and received the visual acuity score according to the last digit series that was read with fewer than 50% errors. Higher scores indicate better distance vision performance. We also assessed subjective vision capacity with a 5-point Likert-type scale ranging from 1 (very good) to 5 (very bad). Finally, we asked the VI participants for the duration of the vision impairment.

In addition to the global clinical information regarding the HI, we also made an attempt to gain a maximum of additional information on the hearing performance of all participants for the reasons indicated earlier. First, we aimed to conduct a state-of-the-art audiometric assessment of both ears in the majority of participants. However, because the use of a mobile audiometer system was not available, the major reason for missing data is the participants’ inability or unwillingness to visit the acoustic specialist of a hearing aid shop placed in the neighborhood of our research center. Second, we asked participants whether or not they had a hearing aid. Further, we assessed subjective hearing capacity with a 5-point Likert-type scale ranging from 1 (very good) to 5 (very bad). Finally, we asked the HI participants for the duration of the hearing impairment.

Extraversion and neuroticism.—Extraversion and neuroticism were assessed by means of the German version of the NEO-Five-Factor Inventory (NEO-FFI; Borkenau & Ostendorf, 1993; Costa & McCrae 1992) with 12 items per scale answered with a 5-point Likert-type scale varying between 1 (does not apply at all) and 5 (does completely apply), leading to a score range between 12 and 60. The assessment of extraversion and neuroticism based on the Costa/McCrae psychometric approach has been extensively tested across many subpopulations including vision and hearing impaired old and very old adults (Marsiske et al., 1999). We trained our interviewers intensively, so that the item presentation was optimal. For example, all items were read as clearly as possible to those visually impaired always in a very quiet atmosphere; for those with hearing impairment, all items were both read and presented visually. Cronbach’s alpha was \( \alpha = .65 \) (extraversion) and \( \alpha = .79 \) (neuroticism) in the V1 group. Respective values were \( \alpha = .70 \) and \( \alpha = .82 \) in the HI and \( \alpha = .71 \) and \( \alpha = .75 \) in the UI group.

PA and NA.—PA and NA were assessed with the PANAS (Positive and Negative Affect Schedule; Watson, Clark, & Tellegen, 1988), which consists of 10 PA items (interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, and active) and 10 NA items (distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid). Participants rated the items with reference to the past month on a 5-point Likert-type scale from 1 (not at all) to 5 (very frequently) leading to a score range between 10 and 50 in each scale. The assessment of PA and NA based on the Watson and colleagues psychometric approach has been extensively tested across subpopulations including
vision and hearing impaired old and very old adults (Marsiske et al., 1999; Schilling & Wahl, 2006; Wahl, Becker, Burmedi, & Schilling, 2004). Interviewer training and interview procedures occurred as described for extraversion and neuroticism. Cronbach’s alpha in the current study was \( \alpha = .79 \) (PA) and \( \alpha = .78 \) (NA) in the VI group. Respective values were \( \alpha = .78 \) and \( \alpha = .79 \) in the HI and \( \alpha = .75 \) and \( \alpha = .81 \) in the UI group.

Procedure

Data collection took place both in our lab and in participants’ homes. The percentage of interviews done at home was highest in the UI (30.0%), followed by the VI (26.4%) and the HI (7.8%) groups. Interviews were conducted by eight intensively trained research assistants with a background in psychology. The variables used in the present study were part of a more intensive psychological measurement program. Mean duration of full interviews averaged 96.06 min (VI), 91.97 min (HI), and 91.72 min (UI).

Data Analysis

Our expectations regarding relationships among extraversion, neuroticism, PA, and NA for VI, HI, and UI older adults were tested by structural equation modeling. Data analysis was conducted by using the full information maximum likelihood (FIML) estimation procedure from AMOS 16.0 (Arbuckle, 1996, 2007). FIML is a state-of-the-art missing data estimation approach for structural equation modeling. Parceling was employed to constitute the latent constructs regarding personality and affect, reducing the number of parameters to be estimated in the measurement model (West, Finch, & Curran, 1995). Models were specified separately for each sample, but model fit was evaluated simultaneously (multiple-group modeling approach).

The traditionally used model fit index, chi-square (\( \chi^2 \)), has some strong disadvantages (e.g., sample size and model size dependent, in that bigger samples and models with more variables have an increasing effect on \( \chi^2 \) values). Thus, despite reporting \( \chi^2 \) values for the sake of completeness, model fit evaluation was primarily based on alternative fit indices (McDonald & Ho, 2002). By convention, the comparative fit index (CFI) should be at least 0.90 to accept the model (Hu & Bentler, 1999). Hu and Bentler (1999) have suggested RMSEA values below 0.06 as the cutoff for a good model fit. Within this study, only models fulfilling both CFI values above 0.90 and root mean square error of approximation (RMSEA) values below 0.06 were accepted.

To test for between-group differences in the associations of extraversion and neuroticism with PA and NA according to our theoretical expectations, we applied the \( \Delta \gamma \) test described by Kunzmann, Little, and Smith (2000, see footnote 5, p. 518). In particular, we used \( \Delta \gamma \) to test between-group differences in standardized path coefficients. With regard to our hypothesis, the paths should be compared in terms of the contribution of the respective latent personality predictor to account for the variation in the latent affect variable. However, as the unstandardized estimates of the path coefficients depend on the variances of the latent constructs involved, these are comparable only under the assumption that both the variances of the latent predictor and the latent dependent variable are invariant across the study groups. In contrast, standardized coefficients can be compared directly in terms of relative predictive strength of the respective path. In addition, for comparing the amount of explained variance in affect due to personality across groups, we refer to Cohen’s (1988, p. 413) effect size logic, according to which effects accounting for at least 2%, 10%, and 25% of variance are regarded as small, medium, and large, respectively (which means, in terms of \( R^2 \), thresholds of .02, .13, and .26).

RESULTS

Table 2 shows the sample means and standard deviations of extraversion, neuroticism, PA, and NA. The VI scored significantly lower in extraversion than the UI, whereas there were no group differences in neuroticism. There were no group differences in PA and NA.

The zero-order and latent correlation matrix of personality and affect is provided in Table 3 for each group. In general, extraversion was more strongly related to PA than to NA (except for the VI group), whereas neuroticism was more strongly related to NA than to PA. Moreover, the correlation coefficients between neuroticism and NA were large and of comparable magnitude in all groups. However, because extraversion was significantly related to NA only among the VI, the bivariate correlation coefficients also provide first evidence for differential relationships between personality and affect in the study samples. All correlations were in the expected directions. Going further, zero-order correlations were generally in line with our hypothesis of a weaker relationship between extraversion and PA in both VI and HI groups, but the effect seems to be of limited size. However, at the latent correlation level (not weakened by measurement error), the difference appeared as more pronounced, particularly in case of the contrast between the VI and UI group (.33 vs. .54).

<table>
<thead>
<tr>
<th>Table 2. Personality and Affect, Depending on Sensory Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory impairment group</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Personality</td>
</tr>
<tr>
<td>Extraversion (12–60)</td>
</tr>
<tr>
<td>Neuroticism (12–60)</td>
</tr>
<tr>
<td>Affect</td>
</tr>
<tr>
<td>Positive affect (10–50)</td>
</tr>
<tr>
<td>Negative affect (10–50)</td>
</tr>
</tbody>
</table>

Notes. Different subscripts indicate statistically different means at the .05 level.

\( \ast p < .05 \) \  \ast \ast p < .01 \  \ast \ast \ast p < .001 \)
Table 3. Correlations Between Personality and Affect

<table>
<thead>
<tr>
<th>Variable</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually impaired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>5.97</td>
<td>-0.15</td>
<td>0.33**</td>
<td>-0.34**</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>7.99</td>
<td>-0.16</td>
<td>-0.36**</td>
<td>0.70***</td>
<td></td>
</tr>
<tr>
<td>Positive affect</td>
<td>6.24</td>
<td>0.32***</td>
<td>-0.26*</td>
<td></td>
<td>-0.11</td>
</tr>
<tr>
<td>Negative affect</td>
<td>5.87</td>
<td>-0.28**</td>
<td>0.55***</td>
<td>-0.02</td>
<td></td>
</tr>
<tr>
<td>Hearing impaired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>6.48</td>
<td>-0.20</td>
<td>0.39**</td>
<td>-0.11</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>8.26</td>
<td>-0.16</td>
<td>-0.28*</td>
<td>0.78***</td>
<td></td>
</tr>
<tr>
<td>Positive affect</td>
<td>6.03</td>
<td>0.28**</td>
<td>-0.22*</td>
<td></td>
<td>-0.11</td>
</tr>
<tr>
<td>Negative affect</td>
<td>5.90</td>
<td>-0.13</td>
<td>0.66***</td>
<td>-0.09</td>
<td></td>
</tr>
<tr>
<td>Sensory unimpaired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>6.08</td>
<td>-0.22</td>
<td>0.54***</td>
<td>-0.15</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>6.83</td>
<td>-0.22**</td>
<td>-0.45***</td>
<td>0.73***</td>
<td></td>
</tr>
<tr>
<td>Positive affect</td>
<td>5.53</td>
<td>0.40***</td>
<td>-0.35***</td>
<td></td>
<td>-0.14</td>
</tr>
<tr>
<td>Negative affect</td>
<td>5.76</td>
<td>-0.13</td>
<td>0.57***</td>
<td>-0.11</td>
<td></td>
</tr>
</tbody>
</table>

Notes. Correlations between observed variables are shown below the diagonal; correlations between latent variables are shown above the diagonal.

*p < .05, **p < .01, ***p < .001.

Discussion

Relationships Among Extraversion, Neuroticism, PA, and NA

Structural equation model testing was conducted according to the following steps: First, model M1 was specified for the VI, HI, and UI groups. M1 consists of four latent variables (extraversion, neuroticism, PA, NA) and assumes paths between the “Big Two” (exogenous latent variables) and PA as well as NA (endogenous latent variables). As shown in Table 4, this model had good fit.

Subsequently, in model M2, measurement error variances as well as factor loadings were restricted to equality across groups to test for invariance of measurement models. Model M2 fit the data well and did not differ significantly from the unconstrained model M1. Thus, measurement models are considered as equal across groups.

Δχ² tests confirmed some of our expectations: Regarding the path from extraversion to PA, the difference between path coefficients from the VI and UI groups passed the statistical significance threshold (βVI = .27, βUI = .51, Δz = 2.11, p < .05), yet the difference in path coefficients from the HI and UI groups was not statistically significant (βHI = .35, βUI = .51, Δz = 1.40, n.s.). The path from neuroticism to NA was not significantly different between groups (βVI = .65, βHI = .70, Δz = 0.51, n.s.; βHI = .65, βUI = .80, Δz = 1.44, n.s.; βHI = .80, βUI = .70, Δz = 0.97, n.s.). Likewise, there were no significant differences between groups with respect to the path from neuroticism to PA (βVI = -.27, βHI = -0.33, Δz = -0.59, n.s.; βVI = -.27, βHI = -0.21, Δz = -0.56, n.s.; βHI = -0.21, βUI = -0.33, Δz = -1.16, n.s.). The effect of extraversion on NA was however significantly stronger in those with VI compared with the other two groups (βVI = -.25, βUI = -.01, Δz = -2.74, p < .05; βVI = -.25, βHI = .04, Δz = -2.25, p < .05).

Because the path between extraversion and NA was statistically significant only in the VI group, in the following model M3, this path was restricted to zero for the UI and the HI group (see Figure 1). M3 had a good model fit and did not differ significantly from the unconstrained model (Δχ² = 43.267; df = 34; p < .132) nor from M2 (Δχ² = 0.197; df = 2; p < .006).

Figure 1 shows statistically significant paths from extraversion to PA and from neuroticism to NA. As can be seen, the linkage between extraversion and PA appeared as seemingly closer in the UI group, as compared with both sensory impaired groups, but particularly pronounced in the VI participants (standardized path coefficients = .51 vs. .27 and .35). The explained variance of PA for UI (0.37) was approximately double that of VI and HI (0.15 and 0.17). Seen from Cohen’s (1988) effect size logic, the effect was medium both in VI and HI, but large in UI. The connection between neuroticism and NA was, as expected, the strongest of all relationships in all groups, varying between 0.65 and 0.80 at the latent model level. Moreover, the inverse relationship between extraversion and NA was statistically significant only in the VI group and could be fixed to zero without loss of model fit in the other groups. Finally, the inverse relationship between neuroticism and PA was significant in all groups, whereas the magnitude of the relationship was low and rather similar among the groups.

Table 4. Model Fit Indices

<table>
<thead>
<tr>
<th>Model</th>
<th>χ²</th>
<th>df</th>
<th>p</th>
<th>CFI RMSEA</th>
<th>Δχ² df p</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 (unconstrained)</td>
<td>159.682</td>
<td>93</td>
<td>0.947</td>
<td>0.043</td>
<td></td>
</tr>
<tr>
<td>M2 (invariance of measurement model)</td>
<td>202.752</td>
<td>125</td>
<td>.000</td>
<td>0.038</td>
<td>43.070 32</td>
</tr>
<tr>
<td>M3 (n.s. paths constrained to zero)</td>
<td>202.949</td>
<td>127</td>
<td>.000</td>
<td>0.040</td>
<td>43.267 34</td>
</tr>
</tbody>
</table>

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation.
the condition of severe sensory impairment. It supports our assumption that both vision and hearing impairment, despite different stress experiences related to problems accessing the physical (vision impairment) as compared with the social world (hearing impairment), reveal a similar overriding impact on the outward focus inherent in the operation of the extraversion and PA system. As a consequence, the role of extraversion for keeping PA high is meaningfully attenuated.

No group differences emerged for the relationship between neuroticism and NA, and the highest of all correlations were observed in this area already at the zero-order and latent correlation level. We interpret this finding as further support for the robustness of the linkage between neuroticism and NA, a mechanism that seems to work independently from any situational influence (Clark & Watson, 1991). Given our findings, clearly the strong relationship between neuroticism and NA holds not only for old and very old persons (our grand mean of age was 82 years and thus comparable to the BASE; Staudinger et al., 1999) but also for older individuals with particularly strong chronic functional impairment due to sensory impairment.

In our exploratory analyses of cross-linkages between extraversion and NA and neuroticism and PA, respectively, we found supporting evidence that high extraversion may become a major resource for keeping NA low only in those with vision impairment. In the VI group, extraversion and NA showed a negative zero-order correlation about double that of those with hearing impairment and those without sensory impairment. Moreover, in the structural equation analysis, the path between extraversion and NA could be constrained to zero only in the HI and UI groups. An explanation for this finding may be that in the situation of experiencing severe person–environment mismatches and external stress, being higher in extraversion may help to distract the inward focus and by this means may serve to reduce NA. Self-evaluations of one’s health could be regarded as major content of inward focus generating NA, as is evidenced by findings of self-reported physical symptoms and health complaints as strong predictors of NA (Brief, Butcher, George, & Link, 1993; Watson, 1988; Watson & Pennebaker, 1989). If so, vision impairment conditions may provide a high load of such content and in particular only when such a high load of negative health perceptions is present, an extraverted outward focus may affect NA generation, in that it simply distracts the individual from this high load of all possible inward focused negative health perceptions. However, this possible mechanism might work only in the case of unhindered interaction with the social world. Yet, due to communication impairment, social interaction is at risk in those being hearing impaired. Note also in this context that the social environment tends to react with high attention and a strong support component in interacting with a VI person, whereas this is not so much the case in regard to a HI individual, where stigmatizing has a higher likelihood (L. D. Baker & Reitz, 1978; Hetu, 1996; Wallhagen, 2010).

Seen on a larger scale of human development, our findings suggest the need for better consideration of the lifespan developmental dynamic of personality–affect relations as
people age. For one, an important personality development research issue may be the changing resource role of personality across the lifespan. That is, the classic stability of personality argument (Costa & McCrae, 1980) may be in need of a more dynamic qualification when it comes to connections between personality resources and affective states. In particular, our findings provide support for the assumption that the potential of extraversion to elicit positive emotions may gradually decrease across the lifespan because aging typically comes with a pronounced person–environment mismatch situation, which triggers stressful experiences and may override to some extent the extraversion–PA linkage. To our knowledge, however, this prediction has never been tested, and we ourselves are not able to test it due to our restricted age range. Second, our findings may contribute to the explanation of the empirically observed decline in positive emotions in very old age and in close to death situations (Kessler & Staudinger, 2010); extraversion may in this situation no longer be a strong enough resource to counteract the role of negative events occurring in the overall life context (see also Gerstorf et al., 2010).

A changed personality and affect dynamic in those with vision and hearing impairment may also have intervention-oriented implications. In particular, although it may be important for the psychosocial rehabilitation of both VI and HI older adults to provide them with the best of possibilities to restrengthen the potential of the extraversion–PA generating system, our findings and interpretations suggest differential intervention strategies in order to achieve this goal. In case of vision impaired older adults, promising strategies would be to use group instead of individual settings, as is increasingly done in group-based self-management programs because such a social setting together with additional intervention tools may optimally support the extraversion–PA system (e.g., Birk et al., 2004). In addition, it may be crucial to enhance the social interaction of VI older adults at large, for example, by providing opportunities to interact with the younger generation. In some contrast, it may be more promising in regard to the psychosocial rehabilitation of HI older adults to foster opportunities to explore and use the physical and spatial world and by this means increase PA, whereas intervention settings requiring social communication (such as group or other socially oriented intervention formats) may indeed be detrimental because they may further undermine the extraversion–PA system.

Although we were able to confirm a major portion of our hypothetical expectations, an obvious limitation of our study is that we had only cross-sectional data. In addition, the large difference in duration of sensory impairment (11.8 years in case of HI vs. 6.6 years in VI) may have affected our results, although major adaptational efforts seem to be complete after a few years at least in those with vision impairment (Schilling & Wahl, 2006). Furthermore, although our sample sizes were substantial, they may have not been large enough to warrant robust findings. Therefore, replication with larger samples would be meaningful. For future research, it may, for example, provide an interesting test case to follow personality–affect connections in cataract patients because after surgery everyday functioning is regained in most of those affected. That is, the linkage between extraversion and PA may decrease in parallel to the vision impairment but increase again to “normal” as time passes after the surgery.

Finally, regarding the application of our findings to other chronic conditions, we would be rather cautious because our argument was fully focused on vision and hearing impairment. Nevertheless, although it is true that vision and hearing impairment are specific due to the unique role the senses play in day-to-day interaction and coping, our findings suggest that it may be the overall stress experiences of other chronic conditions, which may alter to some extent the usual relationship between personality and affect. Thus, this assumption should be tested empirically in the future.

In sum, we strongly believe that putting a stronger research focus on changing personality–affect relations as people age adds an important component to the better understanding of the interlinkages of key psychological resources in old and particularly very old age.

Funding
This work was supported by the German Research Foundation with grant WA 809/7-1 awarded to H.-W. Wahl.

Acknowledgments
We would like to thank the German Research Foundation for supporting this research with a grant (WA 809/7-1) awarded to H.-W. Wahl. We would like to extend our appreciation to PD Dr. Ingo Baumann, Prof. Dr. Hans Hörmann, Prof. Dr. Jost Jonas, Prof. Dr. Peter Plinkert, and Prof. Dr. Klaus Rohrschneider, who all have provided tremendous support to the study through their investment to generate the sensory impaired samples. Furthermore, we are very thankful for the support we received from the company KIND Hörgeräte, Heidelberg, Germany, in terms of audiometric assessment of control group members. Finally, we would like to thank our project staff, in particular Nadine Langer and Christina Hunger, and last but definitely not least, also our study participants, who invested time and energy to serve our research.

Correspondence
Correspondence should be addressed to Hans-Werner Wahl, PhD, Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Bergheimer Strasse 20, 69115 Heidelberg, Germany. E-mail: h.w.wahl@psychologie.uni-heidelberg.de.

References
PERSONALITY, AFFECT, AND AGE-RELATED SENSORY IMPAIRMENT


