IV RESULTS

Results are reported in three main sections. The first section reports analyses carried out to identify and describe the range of heterogeneity of functioning and its correlates in the 6-year longitudinal BASE sample of older adults. This includes results from the two-stage clustering procedure to identify subgroups in the present sample, linking the newly extracted subgroups to those previously identified in the total BASE sample (Smith & Baltes, 1997), and subgroup differences in psychological profile characteristics and external correlates at baseline assessment. In a second step, differential development in old age and its underlying mechanisms are examined by determining subgroup differences in change of their psychological profile characteristics over time and the role of external correlates in accounting for these differences. Specifically, analyses of stability and change are carried out both at the level of the subgroups and at the level of the subgroup-defining measures, and demographic characteristics as well as biological and environmental factors are explored as predictors of subgroup change over time. In a final step, potential outcomes of heterogeneity and differential development in old age are investigated. To do so, it is examined whether differences between the subgroups in profiles and change over time has predictive strength for key outcomes selected from the successful aging literature, well-being and survival.[1]

4. 1 Identification and Description of Heterogeneity and Its Correlates: Subgroup Differences in Psychological Profiles and External Correlates at Baseline

4. 1. 1 2-Stage Clustering Procedure at Baseline Assessment of the 6-Year BASE Sample

One general objective of the present study was to determine meaningful subgroups among the 6-year longitudinal BASE sample by using a set of measures that broadly represent central psychological characteristics of old age. Specifically, a two-stage clustering procedure was applied which represents the methodological standard in the literature (for review, see Hair & Black, 2000; Milligan & Cooper, 1987; for recent applications in research on personality, see Asendorpf, Borkenau, Ostendorf, & van Aken, 2001; Costa, Herbst, McCrae, Samuels, & Ozer, 2002; Schnabel, Asendorpf, & Ostendorf, 2002). The CLUSTER procedure from the SAS software package was used to implement WARD's method (1963; SAS, 1997) and the QUICK CLUSTER option from the SPSS software package was utilized for the *k*-means procedure (SPSS, 1990).

[1] Section C.1.4 in Appendix C gives an overview of analyses carried out to check the assumptions of statistical tests used in this study.

First, Ward's (1963) minimum-variance technique was used to obtain information about the ideal number of clusters in the final solution. Starting with each participant forming his or her own cluster, Ward's method adjoins those clusters whose combination leads to a minimum increase in the within-cluster sum of squares (the residual is calculated as the sum of squares over all variables), while maximizing the between-cluster sum of squares. Ward's method has been reported to be superior in detecting subgroups as compared with other clustering logarithms (Milligan & Cooper, 1985, 1987). Second, using the output from Ward's procedure as initial subgroup seeds, the *k*-means algorithm was applied to determine the final case location in the separate subgroups. The *k*-means clustering is an iterative partitioning procedure that reproduces the *k* number of disjoint (non-overlapping) clusters through minimizing the sum of the squared distances from the cluster centroid means. In contrast to hierarchical methods (e.g., Ward's method), assigned group membership can be revised in subsequent steps.

In analogy to previous publications from BASE (e.g., P. B. Baltes & Mayer, 1999), each participant's score was standardized before the cluster analysis by using the *T* metric to the mean and standard deviation of the total cross-sectional BASE sample aged 70 to 103 ($N = 516$) with lower values indicating lower functional/desirable status. If unstandardized measures were used, those variables with larger standard deviations would contribute stronger to the Euclidean Distances[2] and thus be given more weight in defining the groups (Cronbach & Gleser, 1953). To circumvent this problem, all variables were standardized prior to cluster analysis. Standardizing to the total BASE sample (rather than within the 6-year longitudinal sample) was done to arrive at a metric that is directly comparable to a heterogeneous and locally representative sample of individuals in old and very old age as well as to previous BASE publications. For example, a group mean above 50 indicates that the mean functional level of group members was higher as compared with the average level of functioning in the total BASE sample. Also before the clustering, each psychological measure was screened for the presence of extreme outliers, which may disrupt the clustering procedure (Bergman, 1988). Two participants were found to show a pattern of multivariate extremeness. Eliminating these participants from further analyses resulted in a sample size of 130 persons (for excluding $n = 6$ outliers from their analyses, see Smith & Baltes, 1997). Table 9 gives the means, standard deviations, and zero-order intercorrelations among the 11 profile-defining psychological constructs that were entered into the cluster analysis. It has to be noted that

[2] The Squared Euclidean Distance (SED) is a standard measure of similarity in cluster analysis. In a two-dimensional case, the SED for two objects is calculated as follows: $(x_2 - x_1)^2 + (y_2 - y_1)^2$.

data for one subgroup-defining measure used in the Smith and Baltes study (1997) was not available longitudinally (i.e., perceived receipt of physical and emotional comfort) and was thus not used to extract subgroups from the longitudinal BASE sample.

Table 9
Means, Standard Deviations, and Intercorrelations Among the 11 Profile-Defining Psychological Constructs Entered Into the Cluster Analysis: 6-Year BASE Longitudinal Sample at Baseline Assessment

Construct	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Speed	57.6	*7.4*	–									
2. Memory	55.6	*9.7*	**.43**	–								
3. Knowledge	54.9	*8.1*	**.39**	**.39**	–							
4. Neuroticism *	51.3	*9.0*	.13	.03	**.18**	–						
5. Extraversion	52.6	*8.9*	**.29**	**.20**	-.02	.03	–					
6. Internal Control	49.1	*9.0*	-.07	-.06	**-.24**	.08	**.24**	–				
7. External Control *	53.8	*8.3*	.16	**.22**	.09	**.23**	.12	-.10	–			
8. Goal Investment	52.1	*8.4*	**.24**	.06	.16	.08	**.25**	**.28**	-.11	–		
9. Emotional Loneliness *	53.3	*9.5*	.16	**.18**	.15	**.52**	**.19**	.10	.12	**.25**	–	
10. Social Loneliness *	51.9	*9.3*	.06	.11	.13	**.30**	**.22**	**.21**	**-.21**	**.36**	**.51**	–
11. Close Others	51.2	*9.2*	.04	-.03	-.04	.09	.00	**.26**	-.04	**.34**	**.21**	**.25**

Note. $N = 130$. * Scores on these dimensions were reverse-coded to calculate the desirability (functional status) score. Factor analysis indicated that at minimum two factors represented the 11 dimensions. The two strongest factors can be called a cognitive resource factor and a social-personality resource factor. Significant intercorrelations at the $p < .05$ level or below in bold.

From Table 9 can be seen that the 11 measures show, at maximum, moderate intercorrelations. There were only two intercorrelations, which were minimally above $r = .50$: The association of $r = .52$ between neuroticism and emotional loneliness and the correlation of $r = .51$ between emotional loneliness and social loneliness. From this patterning follows that the 11 constructs entered into the cluster analysis represent sufficiently distinct measures of psychological functioning. Because there were no extraordinarily high intercorrelations, it is unlikely that the generation of clusters was weighted in favor of any of the clustering dimensions. The correlations also indicate that (a) the three measures of intellectual abilities (i.e., perceptual speed, memory, and knowledge) showed relatively high interrelationships; (b) intellectual abilities showed relatively few strong relationships to other domains of psychological functioning; and (c) social and personality dimensions also revealed relatively few strong intercorrelations (e.g., neuroticism-emotional loneliness, emotional loneliness-social loneliness).

A number of different strategies have been put forward in the literature to determine empirically the optimal number of subgroups in a given data set (for review, see Aldenderfer & Blashfield, 1984; Hair & Black, 2000; Milligan & Cooper, 1987). Because there is no standard internal statistical criterion available for this decision, the present study used multiple criteria as 'stopping rules.' First, a peak in Sarle's *cubic clustering criterion* (*CCC*; Sarle, 1983). The criterion is derived from two terms: The first term refers to the proportion of variance accounted for by the clusters, and the second term refers to the dimensionality of the between-cluster variation (for details, see Milligan & Cooper, 1985; Sarle, 1983). Second, an atypical decrease in overall between-cluster variance (R^2) and an increase in within-cluster variance (*root mean squared standard deviation)* with no reverse trend in subsequent steps (which is similar to a scree-plot in Factor Analysis). The average within-cluster distance can be used as a measure of overall similarity and a large increase indicates that two clusters were joined, which were quite dissimilar. Third, a local (rather than global) peak in Pseudo F combined with a small Pseudo T^2 and a larger Pseudo T^2 in the next fusion step (i.e., graphically speaking, an elevation of Pseudo F combined with a drop in Pseudo T^2). If one were to assign priority to any of these criteria, the *CCC* would be recommended (Milligan & Cooper, 1985, 1987). Table 10 reports the statistical criteria from an application of Ward's procedure to baseline assessment data from the 6-year longitudinal BASE sample.

Table 10
Statistical Criteria to Determine the Optimal Number of Subgroups: Subgroup Solutions from Cluster Analysis Using WARD's Procedure at Baseline Assessment

	CCC	R^2 / RMS *SD*	Pseudo F / Pseudo T^2
3 Subgroups	**-6.9**	.19 / 7.7	**14.9 / 10.3**
4 Subgroups	-7.6	.25 / 8.4	13.7 / 10.4
5 Subgroups	-7.6	**.30 / 7.6**	13.3 / 9.4
6 Subgroups	-7.3	.35 / 8.1	**13.0 / 6.1**
7 Subgroups	-7.2	.38 / 7.2	12.5 / 8.1

Note. *CCC* = Cubic Clustering Criterion, RMS *SD* – Root Mean Squared Standard Deviation for each cluster. Optimal number of subgroups as suggested by the given criterion in bold.

In the context of the present study, these criteria did not converge and indicated different cluster solutions to be ideal. For example, the *CCC* indicates a three-subgroup solution to optimally represent the structure within the data set, whereas the *R squared* criterion would suggest a five-subgroup solution, and the Pseudo F versus PseudoT^2 criterion advocates either a three- or a six-subgroup solution. Across all three measurement occasions (see Section 4.2.1), a three- or a four-subgroup solution were most consistently suggested by these statistical criteria, and the *CCC* consistently suggested a three-subgroup solution.

To complement such strictly empirical evaluations, theoretical considerations and prior research findings also play an important role in deciding about an optimal number of clusters. Given that the nine subgroups from the Smith and Baltes study (1997) were derived from a locally representative sample (P. B. Baltes & Mayer, 1999), the correspondence of these subgroups to those identified in the longitudinal sample was used as an additional criterion. This approach offers at least two advantages. First, cluster analysis is used in a more confirmatory way rather than restricting it to the common atheoretical and descriptive analyses. Second, acknowledging the small size of the 6-year longitudinal BASE sample ($n = 130$), it was not possible to split the sample into two random halves (stratified by age and gender; Bergman, personal communication, 2002). Such procedure is typically used to compare independently identified cluster solutions across the two halves for consistency (for discussing the problem of sample size in replicating prototypes and subtypes in personality research, see Schnabel et al., 2002). In a three-subgroup solution, 70% of the Smith and Baltes subgroups were grouped together again. This percentage dropped down to 60% in the four-subgroup solution, 59% in the five-subgroup solution, and 56% in the six-subgroup solution.

Taken together, there were four reasons why a three-subgroup solution was favored in the present study. First, this solution can be considered robust because it assures sufficient sample sizes within each group. A first subgroup was found to be the largest comprising almost half of the sample ($n = 61$). The other two subgroups were also reasonably large ($n = 28$; $n = 41$). These different subgroup sizes indicate that one of the concerns about Ward's method (i.e., tending to result in equal-sized subgroups; Bortz, 1999) does not hold in its present application. In the four-subgroup solution, the mid-size subgroup ($n = 41$) was split up, which resulted in a very small subgroup ($n = 13$). It was only in the five-subgroup solution that the large-size subgroup ($n = 61$) was broken up.

Second, taking the three-subgroup solution is in line with the Cubic Clustering Criterion. It provides a reasonable balance between the two opposing poles of parsimony (i.e., as few subgroups as possible) and homogeneity within the subgroups.

Third, to further cross-validate the groups, discriminant analysis was used to determine the reliability of cluster assignment. Discriminant analysis of baseline data revealed a very high degree of correspondence to cluster analysis in subgroup assignment of BASE participants (95%).

Finally, using three subgroups also showed the largest degree of an overlap with the desirable profiles among the nine subgroups identified in the Smith and Baltes study. The following section describes the findings of analyses that compared the communalities in subgroup membership and psychological profiles for the subgroups identified here versus those previously identified by Smith and Baltes (1997).

4. 1. 2 Results of Cluster Analysis: Comparison to Previous Systemic-Wholistic Work From the Berlin Aging Study

To characterize and interpret the newly extracted subgroups from the 6-year longitudinal BASE sample, a first strategy linked these subgroups to those identified by Smith and Baltes (1997) in the larger total cross-sectional BASE sample. To do so, consistencies in subgroup membership as well as in the psychological profiles were determined. Both steps provide the basis for a better understanding of communalities and differences between the subgroups from the longitudinal sample. The prediction was that, because of differential sample attrition, the subgroups primarily represent different desirable profiles of psychological functioning rather than less desirable profiles (Q_{1a}).

A description of the three subgroups identified in the 6-year longitudinal BASE sample in terms of the desirability profile status that was established for subgroups from the total BASE sample revealed support for this prediction: The three subgroups extracted from the longitudinal sample primarily reflect the more functional/desirable profile subgroups from the Smith and Baltes study (1997). Figure 6 shows the description in more detail. It can be seen, for example, that 97% (n = 59) of the 61 participants in subgroup 1 were allocated among the four desirable profile subgroups from the total BASE sample (Smith & Baltes, 1997). Similarly, the majority of both other subgroups extracted from the longitudinal BASE sample was also constituted by participants from the high-functioning subgroups of the total cross-sectional sample (61% or n = 17 for subgroup 2 and 73% or n = 30 for subgroup 3).[3] It has to be acknowledged that Smith and Baltes (1997) identified four subgroups in the total BASE sample that were classified into the desirable category. Having identified three subgroups in the longitudinal BASE sample suggests that heterogeneity among the desirable profile subgroups was preserved in the smaller longitudinal sample.

[3] The interested reader may refer to Appendix C (see Section C.1.1) for linking the three subgroups from the longitudinal BASE sample to the nine subgroups from the total cross-sectional BASE sample.

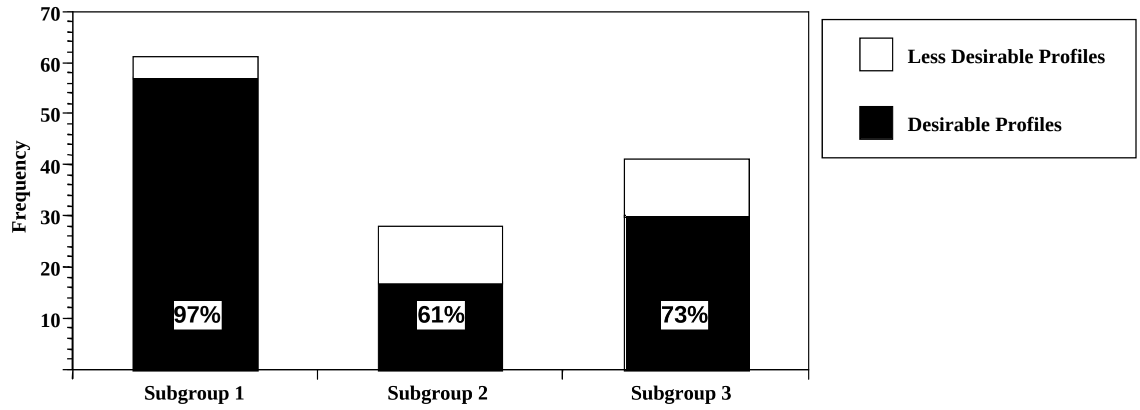

Figure 6 Description of the three subgroups identified in the 6-year longitudinal BASE sample in terms of the desirability profile status established for subgroups from the total BASE sample.

Note. In Subgroup 1, 97% of the 61 participants were among the desirable profile subgroups identified in the total BASE sample. Within both other subgroups, the large majority of participants was as well among the desirable profiles. Note that Smith and Baltes (1997) identified four subgroups with desirable profiles and five subgroups with less desirable profiles. For clarity, these subgroups were pooled.

A second approach to interpret the three newly extracted subgroups from the longitudinal sample is to link their psychological profile to the profile of the subgroups from the total cross-sectional sample. To do so, Cattell's r_p pattern similarity coefficient (1949) was used. This coefficient is based on the squared Euclidean distance (SED), which is defined as the sum over variables of the squared deviations in each variable divided by the number of variables. The index is sensitive to all three properties of profiles: Shape (pattern of high and low scores across elements in a profile), scatter (degree of variability of the elements around the profile average), and elevation (overall level of the profile).[4] Cattell's index has the nice feature that it transforms the SED to a correlation metric in that the obtained index ranges from –1 to +1. The coefficient is defined as follows: $r_p = (2k - \sum \text{SED}) / (2k + \sum \text{SED})$ where "*…k is the median for χ^2 on a sample of size n*" (Cattell, 1949; p. 292). In practice, *k* receives a value that is slightly less than the number of dimensions itself (see also Horn, 1961). The index approaches unity when agreement is perfect, zero when agreement is no greater than chance, and –1 with increasing dissimilarity.

Table 11 shows how the psychological profiles of the subgroups identified in the longitudinal BASE sample correspond to the profiles of subgroups from the total cross-sectional sample. As can be seen, each of the newly extracted subgroups most closely resembles one of the more functional/desirable subgroups from the Smith and Baltes study (1997). Specifically, subgroup 1 from the longitudinal sample showed highest profile similarity to the cog-

[4] If the researcher is only interested in profile form and not in level, a measure of (dis-)similarity is the correlation coefficient (each subject is regarded a variable and each variable is treated as a case).

nitively very fit and vitally involved subgroup in the total sample (Subgroup 1; r_p = 93). Similarly, subgroup 2 from the longitudinal sample most closely resembled the large group from the total sample that was cognitively fit, well-balanced, and at ease (Subgroup 3; r_p = .80). It has to be acknowledged, though, that profile similarity for this subgroup also was relatively high in relation to the subgroups from the total sample that were cognitively impaired, dependent, but well-balanced (Subgroup 7; r_p = .71) and cognitively impaired, disengaged, but content (Subgroup 8; r_p = .72), respectively. These profile similarities likely represent the fact that some participants who were allocated in the less desirable profile subgroups in the Smith and Baltes analyses (1997) have now been re-allocated in the present analyses (see Figure 6 and the Note in Table 11). Subgroup 3 from the longitudinal sample showed highest similarity in their psychological profile to the cognitively fit, but reserved loner subgroup from the total sample (Subgroup 4; r_p = .90).

Table 11
Cattell's Pattern Similarity Coefficients: Comparison Between Subgroups Identified by Smith and Baltes (1997) in the Total Cross-Sectional BASE Sample and Subgroups Identified at Baseline Assessment of the 6-Year Longitudinal Sample

	Subgroups in the Present Study: 6-year Longitudinal Sample		
Subgroups in Total BASE Sample (Smith & Baltes, 1997)[1]	1 (*n* = 61)	2 (*n* = 28)	3 (*n* = 41)
Desirable Profiles			
(1) Cognitively very fit, vitally involved (*n* = 50)	**.93****	.41*	.44*
(2) Socially oriented and engaged (*n* = 29)	.60**	.46*	.18
(3) Cognitively fit, well-balanced, at ease (*n* = 119)	.84**	**.80****	.69**
(4) Cognitively fit, reserved loner (*n* = 42)	.34	.49*	**.90****
Less Desirable Profiles			
(5) Fearful lonely, but supported (*n* = 75)	.27	.65**	.44*
(6) Anxious, lonely, holding on to control (*n* = 44)	.25	.62**	.67**
(7) Impaired, dependent, but well-balanced (*n* = 64)	.15	.71**	.24
(8) Cognitively impaired, disengaged, but content (*n* = 55)	.17	.72**	.35
(9) Cognitively impaired, withdrawn, in despair (*n* = 32)	–.23	.23	.18

Note. *N* = 130. [1] Tentative heuristic labels used here were published in Smith & Baltes (1997). Highest index values in bold. At the last measurement occasion, examining profile similarity for subgroup 2 from the present study revealed that the similarity index for Subgroup 3 from the total sample was higher (r_p = .86) and the similarity indices for subgroups 7 and 8 from the total sample were much lower (r_p = .61 for both comparisons).
* $p < .05$ ** $p < .01$.

It seems safe to conclude that the newly extracted three subgroups from the 6-year longitudinal BASE sample could meaningfully be linked to subgroups identified in the total cross-sectional sample (Smith & Baltes, 1997). Analyses were unequivocally in line with the prediction that subgroups identified in the 6-year longitudinal BASE sample primarily represent different desirable profiles from the total BASE sample (Q_{1a}). This findings again illustrates the amount of positive selection of the longitudinal sample. Analyses regarding consistencies in subgroup membership as well as psychological profiles suggest that the groups in the longitudinal sample represent different variants of aging successfully. Embedding the newly extracted subgroups into those previously identified helps to better understand their psychological profile characteristics, which are presented in the following section.

4. 1. 3 Subgroups Extracted From the 6-Year Longitudinal BASE Sample: Profile Characteristics on Psychological Measures at Baseline Assessment

A third approach to validate and interpret the newly extracted subgroups from the longitudinal BASE sample is to investigate their psychological profile characteristics at baseline assessment. Analyses reported so far have demonstrated that the longitudinal sample was positively selected and that the subgroups extracted represent various desirable rather than less desirable profiles from the total BASE sample. Therefore, it was an open question whether the newly extracted subgroups represent sufficiently separate entities. However, because very different constellations can be regarded functionally effective and socially desirable, heterogeneity was expected to prevail so that the psychological profiles of the subgroups were predicted to be distinctly different from one another.

Figure 7 illustrates the psychological profile characteristics of the three subgroups extracted from the 6-year longitudinal BASE sample. It can be seen that subgroup 1 was approximately half a standard deviation above the mean of the total cross-sectional BASE sample across all profile-defining domains of psychological functioning. Subgroup 2 showed a profile of consistent average performance across the three domains. Subgroup 3 was found to show a disparate psychological profile with high levels of cognitive functioning, but relatively lower functioning on measures of personality and self-related functioning, and social integration. For ease of communication, the three subgroups were labeled. Labeling of the profiles was based on particular properties of the psychological profiles including overall level of functioning/desirability (mean), scatter (score variation), and shape (pattern of high and low scores on the functional/desirable and less functional/desirable dimensions). Based on this, subgroup 1 was labeled as 'Overall-Positive Profile', subgroup 2 as 'Average Profile', and subgroup 3 as 'Disparate Profile.'

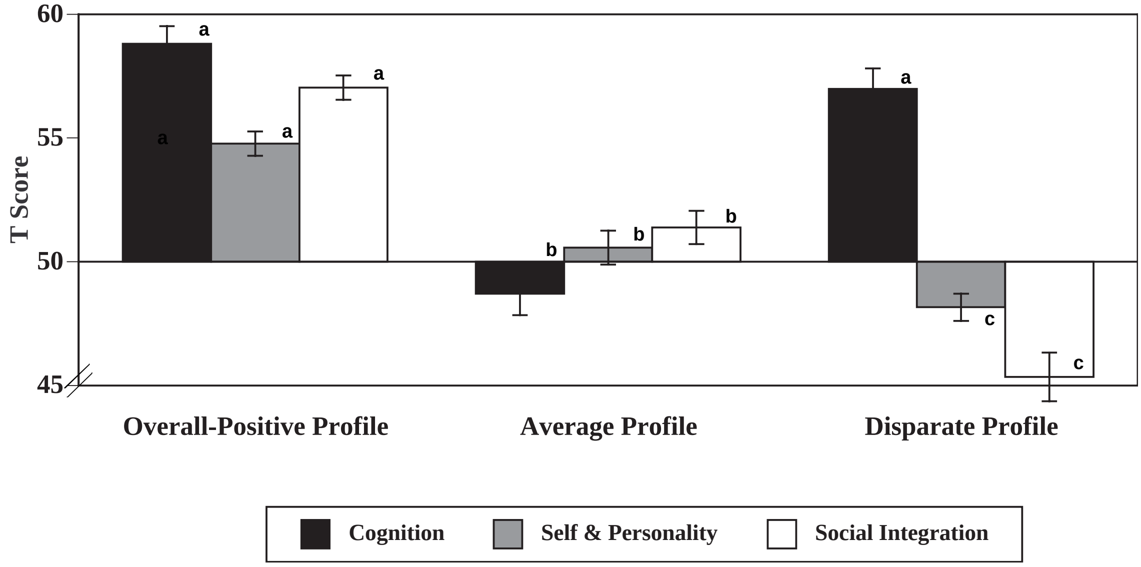

Figure 7 Psychological profile characteristics on the domain composite measures for the three subgroups identified at baseline assessment of the 6-year Longitudinal BASE sample.
Note. T-scores were standardized to the total BASE sample (N = 516), M = 50, SD = 10. Error bars = *se*. Within measures, groups with different superscripts are significantly different from one another at the p < .05 level or below.

Multiple range tests on the 11 profile-defining psychological constructs were used to describe that each group represented a sufficiently distinct entity. Table 12 reports the scores of the three subgroups on each of these constructs. With the exception of external control beliefs, the subgroups differed significantly from each other on all clustering variables: Perceptual speed, F (2,127) = 20.0, p < .000; memory, F (2,127) = 7.7, p < .001; knowledge, F (2,127) = 46.3, p < .000; neuroticism, F (2,127) = 13.3, p < .000; extraversion, F (2,127) = 13.3, p < .000; internal control, F (2,127) = 18.0, p < .000; goal investment, F (2,127) = 23.8, p < .000; emotional loneliness, F (2,127) = 34.2, p < .000; social loneliness, F (2,127) = 31.8, p < .000; and close others, F (2,127) = 19.2, p < .000. None of these subgroup differences vanished after the effects of age, multimorbidity, and life-history variables (occupational prestige, income, education) were partialed out. Post-hoc analyses suggested that all three subgroups differed from one another significantly on four out of 11 clustering variables: Perceptual speed, neuroticism, emotional loneliness, and social loneliness (based on Student-Newman-Keuls tests). The statistical significance of the omnibus test on extraversion and goal investment was due to the Overall-Positive Profile Subgroup reporting both higher extraversion and higher goal investment than both other subgroups, which in turn did not differ from one another significantly. On the cognitive variables of memory and knowledge, both the Overall-Positive Profile Subgroup and the Disparate-Profile Subgroup outperformed the Average-Profile Subgroup. Finally, the Overall-Positive Profile Subgroup and the Average-Profile Subgroup reported more internal control and number of close others as compared to the Disparate-Profile Subgroup.[5]

Table 12
Characteristics on the 11 Profile-Defining Psychological Constructs Entered into the Cluster Analysis: Three Subgroups Identified at Baseline Assessment of the 6-Year Longitudinal BASE Sample

	Subgroups					
	Overall-Positive Profile (*n* = 61)		Average Profile (*n* = 28)		Disparate Profile (*n* = 41)	
Construct	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. Perceptual Speed	$\underline{60.7}_a$	5.6_a	51.3_c	7.2_a	$\underline{57.5}_b$	7.4_a
2. Memory	$\underline{58.3}_a$	10.0_a	50.0_b	7.4_a	$\underline{55.5}_a$	9.2_a
3. Knowledge	$\underline{57.5}_a$	5.9_a	$\underline{44.9}_b$	8.3_b	$\underline{57.9}_a$	5.0_a
4. Neuroticism *	54.9_a	6.8_a	51.0_b	9.2_a	46.2_c	9.5_a
5. Extraversion	$\underline{56.5}_a$	8.7_a	50.3_b	8.0_a	48.5_b	7.5_a
6. Internal Control	51.7_a	7.8_a	52.6_a	6.1_a	$\underline{42.9}_b$	9.5_a
7. Other Control *	54.2_a	8.1_a	52.3_a	8.4_a	54.1_a	8.6_a
8. Goal Investment	$\underline{56.6}_a$	6.9_a	46.7_b	7.3_a	49.0_b	7.6_a
9. Emotional Loneliness *	$\underline{58.8}_a$	6.7_a	52.0_b	7.4_a	46.1_c	9.2_b
10. Social Loneliness *	$\underline{57.2}_a$	5.6_a	50.5_b	6.7_a	$\underline{44.9}_c$	10.5_b
11. Close Others	$\underline{55.2}_a$	10.1_a	51.6_a	6.1_b	45.1_b	5.5_b
Overall Desirability	$\underline{56.5}_a$	2.5_a	50.3_b	2.7_a	49.8_b	2.8_a

Note. * Scores on these dimensions were reverse-coded to calculate the desirability (functional status) score. T-scores were standardized to the total BASE sample (*N* = 516), *M* = 50, *SD* = 10.
Scores underlined were more than 0.5 *SD* above or below the mean of the total cross-sectional BASE sample. Means (*M*) and standard deviations (*SD*), respectively, in the same row that do not share subscripts differ at the $p < .05$ level or below.

To be in analogy to the Smith and Baltes study (1997), an overall measure of functioning/desirability was also computed that simply represents the mean across all profile-defining measures. Again, the subgroups were found to differ significantly from one another, $F(2,127) = 96.7$, $p < .000$, and Table 12 also reports the means for the three subgroups on this measure. Follow-up analyses indicated that the Overall-Positive Profile Subgroup was significantly higher on the overall composite of functioning/desirability than both other sub-

[5] For analyses of subgroup differences in within-subgroup homogeneity and the contribution of single profile-defining measures to overall group separation, the interested reader may refer to Appendix C for Section C.1.2.

groups. The differences amounted to more than half a standard deviation. Interestingly, the Average-Profile and the Disparate-Profile Subgroup did not differ significantly from one another suggesting that the peaks and lows in the miscellaneous pattern of the Disparate-Profile Subgroup cancel each other out at the level of the overall measure of functioning/desirability.

Despite the positive selection of the 6-year longitudinal sample, the above results demonstrate extensive evidence that subgroups could be identified, which reflected various desirable profiles of psychological functioning and, at the same time, differed substantively from one another. Having identified a subgroup showing a disparate profile of psychological functioning also indicates that the methodological tool of cluster analysis does not only group people into categories that consistently refer to high, medium, and low levels of functioning, but also allows the identification of diverse and non-linear profiles. The finding that low functioning on measures of personality and self-related functioning, and social integration were, at least with regard to the overall functioning/desirability measure, counterbalanced by high cognitive functioning once again illustrates the usefulness of a systemic-wholistic perspective to study issues of differential development in old age. The profile differences also provide convergent evidence about the positive selection of the 6-year longitudinal BASE sample. The overall functioning/desirability score for all subgroups was above or around the mean for the total sample, but not below. The fact that this overall mean was brought about by very different constellations of psychological factors evinces that the longitudinal BASE sample contained subgroups that reflect different variants of successful aging.

The above sections reported analyses to identify subgroups of individuals in the 6-year longitudinal BASE sample, linked these groups to previous research, and described psychological profile characteristics on measures that defined the groups. In the next step, it is examined whether the subgroups also show meaningful and interpretable relations to measures that were not part of the subgroup-defining procedure.

4. 1. 4 Subgroups Extracted From the 6-Year Longitudinal BASE Sample: Profile Characteristics on Cross-Disciplinary Measures at Baseline Assessment

In a last set of analyses at baseline assessment, subgroup differences in cross-disciplinary factors that signify past and current developmental contexts are examined. Based on lifespan scripts about developmental co-constructivism (P. B. Baltes, 1997) and in analogy to life course theories and research findings of differences in life conditions and functional profiles (Elder, 1998; Mayer, Maas et al., 1999), it is expected that the subgroups can be differentiated by demographic characteristics such as age and gender as well as by biological and environmental factors (Q_{1b}).

In the total cross-sectional BASE sample, age and gender were found to play a major role in determining subgroup composition: The relative risk of a less desirable profile was highest among the oldest old and among women (Smith & Baltes, 1997). In the present study, it was examined whether subgroups identified in the smaller and positively select longitudinal sample revealed similar trends. To be in analogy to the Smith and Baltes study (1997), the Average-Profile Subgroup and the Disparate-Profile Subgroup were pooled to represent the less desirable profiles, relative to the present sample. This was done because both groups did not differ from one another on the overall measure of functioning/desirability (see Section 4.1.3 for Table 12). The pooled subgroup was then contrasted against the Overall-Positive Profile Subgroup that represented the more functional/desirable profile. Using this strategy, one has to keep in mind that the present less desirable profiles were indeed much better functioning as compared to the less desirable profiles previously reported from the total BASE sample (Smith & Baltes, 1997). Using the pooled subgroups is primarily restricted to examining subgroup differences in demographic characteristics (and outcome variables of subgroup membership; see Section 4.3). Subsequent analyses considered the three subgroups one by one because there were some interesting differences between the three groups that justify to look at them separately.

As Panel A of Figure 8 demonstrates, Smith and Baltes (1997) found in the total BASE sample that the relative risk of a less functional/desirable profile was about 2.5 times higher for persons older than age 85 (oldest old) than for people between the ages of 70–84 years (young old), risk = .75 vs. risk = .31; χ^2 (1, N = 510) = 102.3, $p < .001$. Age 85 was selected as a heuristic threshold between participants in the Third Age and those in the Fourth Age. Panel B of Figure 8 indicates that the subgroups from the 6-year longitudinal BASE sample showed the same pattern, χ^2 (1, N = 130) = 8.7, $p < .01$. The estimated risk of membership in a less desirable profile group was 1.8 times higher for longitudinal BASE participants who were older than age 85 (risk = .88) compared to younger participants (risk = .48). It has to be acknowledged that only 16 participants older than age 85 remained in the study over time.[6] Such a small group size in the oldest-old category makes the age differences even more drastic: Although these 16 persons can be regarded to be positively selected, they were among the lower-functioning subgroups.

[6] The same results were found when contrasting participants who were in the oldest-old category over the study period plus those who transited into that age period over time (n = 48; risk = .65) against those who were in the young-old category throughout the study (n = 82; risk = .46), χ^2 (1, N = 130) = 4.0, $p < .05$.

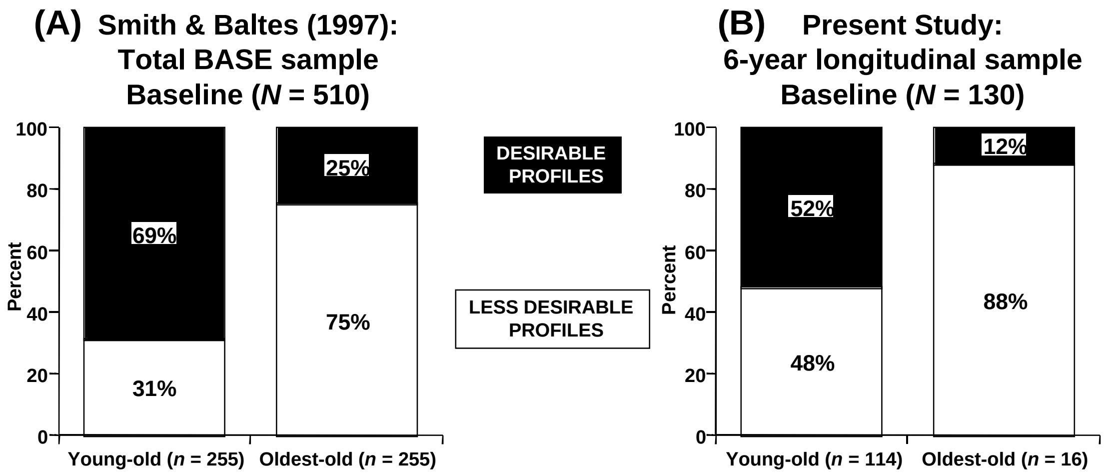

Figure 8 Subgroup differences in age distribution between subgroups identified in the total BASE sample (A) and those identified at baseline assessment of the 6-year longitudinal sample (B): In both samples, the relative risk of a less functional/desirable profile is higher among the oldest old than among the young old.

Panel A of Figure 9 shows that Smith and Baltes (1997) also found in the total BASE sample that women were about 1.25 times more likely than men to be among the less functional/desirable profiles, risk = .59 vs. risk = .47; χ^2 (1, N = 130) = 7.1, p < .01. In the context of the 6-year longitudinal sample, however, the subgroups were not found to differ in their gender distribution, χ^2 (1, N = 130) = 0.2, p > .10, and this was the case among the young-old as well as among the oldest-old.

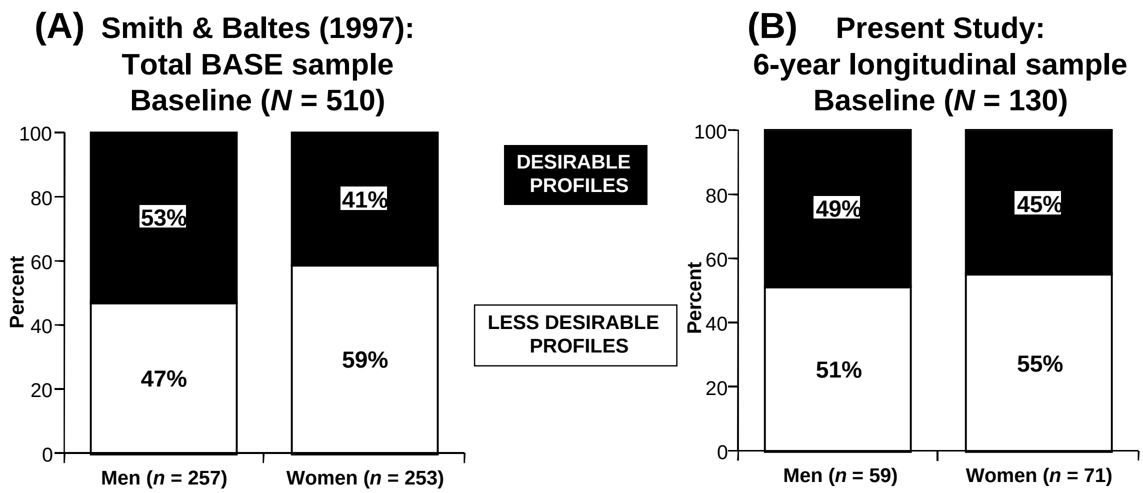

Figure 9 Subgroup differences in gender distribution between subgroups identified in the total BASE sample (A) and those identified at baseline assessment of the 6-year longitudinal sample (B): In the total sample, the relative risk of a less functional/desirable profile is higher among women than among men. No Gender differences in the longitudinal sample.

When the three subgroups identified in the 6-year longitudinal sample were considered separately, multiple range tests indicated substantive differences in age composition, $F(2,127) = 6.0$, $p < .01$; multimorbidity, $F(2,127) = 4.8$, $p < .01$; sensory functioning, $F(2,127) = 8.9$, $p < .001$; Instrumental activities of daily living, $F(2,127) = 4.7$, $p < .05$; and life-history status, $F(2,127) = 9.1$, $p < .001$. Post-hoc analyses revealed that the Disparate-Profile Subgroup (80.7 years) was significantly older than the highest-functioning Overall-Positive Profile Subgroup (76.6 years). When controls were introduced for age, group differences on measures of multimorbidity, sensory functioning, and life-history status remained significant, whereas the difference on IADL vanished. Group differences in other potentially interesting measures were not considered because the base rates were too low in the 6-year longitudinal sample (e.g., dementia: $n = 3$; institutionalization: $n = 3$). Subgroup differences on measures of biological and environmental factors are shown in Figure 10. For a more detailed analysis on subgroup differences in cross-disciplinary factors, the interested reader may refer to Appendix C for Section C.1.3.

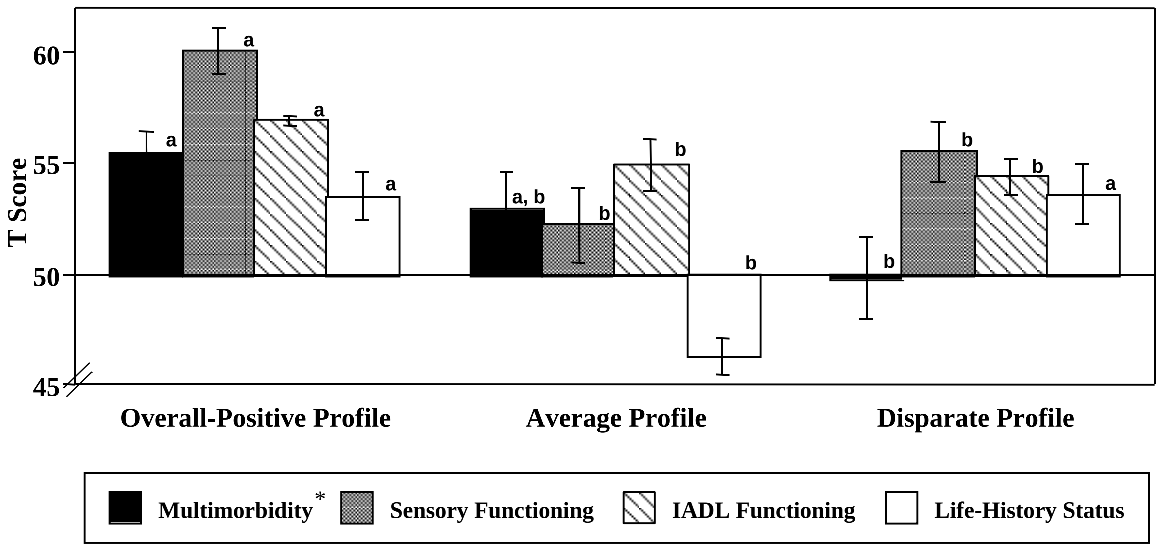

Figure 10 Cross-disciplinary characteristics of the three subgroups identified at baseline assessment of the 6-year longitudinal BASE sample.

Note. * reverse-coded. T-scores were standardized to the total BASE sample ($N = 516$), $M = 50$, $SD = 10$. Error bars = *se*. Within measures, groups with different superscripts are significantly different from one another at the $p < .05$ level or below.

The above analyses are consistent with the proposed expectation (Q_{1b}): Despite the positive selection of the 6-year longitudinal BASE sample, subgroups identified using psychological profile information can also be differentiated by a set of cross-disciplinary constructs (age, gender, biological, and environmental factors) that were external to the definition of the subgroups. Subgroup differences in the longitudinal BASE sample more or less converged with the previous cross-sectional work from BASE (Smith & Baltes, 1997). The functioning/desirability ranking found on the psychological measures was paralleled by subgroup differences in biological factors. For example, the Overall-Positive Profile Subgroup was not only top ranked with regard to their psychological profile (see Section 4.1.3 for Figure 7), but also on measures of sensory functioning and health. Two qualifications appear to be appropriate in this context.

First, the Average-Profile Subgroup clearly was socio-economically disadvantaged as compared to both other subgroups. The difference amounted to approximately one standard deviation and the life-history composite measure was about half a standard deviation below the mean of the total BASE sample, which indicates that the macro-structural burden was substantive. A second qualification relates to the Disparate-Profile Subgroup, which was found to be relatively constrained in their objectively diagnosed health. The presence of chronic moderate to severe illnesses may be linked to their relatively high levels of neuroticism and loneliness, and low functional levels on measures of personal control and social contacts. These differences in conjunction with the differences in psychological profiles illustrate that it is well justified to look at the three groups separately.

To close the section on subgroup differences at baseline assessment, the above analyses clearly demonstrated that heterogeneous profiles of functioning can be identified in a sample of positively selected individuals in old age. Despite the positive selection, there were substantive differences between the subgroups in terms of functioning on both psychological measures and cross-disciplinary factors. Although the positive selection of the sample may make it difficult to thoroughly examine proposals about qualitative transitions in old age, it is expected that the differences between the subgroups at baseline assessment are associated with differences in subsequent change trajectories over six years. For example, the Disparate-Profile Subgroup might be most at risk to show functional decline over time because the miscellaneous psychological profile may be more vulnerable to perturbations than even profiles. The forthcoming section reports results from analyses to examine subgroup differences in development of their psychological profiles over time and its underlying mechanisms.

4. 2 Differential Development Over Time and Its Underlying Mechanisms: Subgroup Differences in Change of Psychological Profiles Over Six Years and the Role of External Correlates

The ensuing section summarizes analyses carried out to examine differential development in old age of the subgroups and its underlying mechanisms. In a first step, it was asked whether or not the subgroups showed patterns of differential change trajectories in their psychological profiles over a period of six years. For a thorough investigation, this set of questions was addressed at two levels. At a first level, stability in subgroup membership over time is determined. At a second level, subgroup differences in the direction and amount of change in the different profile-defining domains are examined. The prediction is that subgroup membership is relatively stable over time, but that the subgroups evince different patterns of stability and decline in the profile-defining measures (Q_{2a}). In a second step, potential mechanisms underlying differential change are examined. It is expected that subgroups with less functional psychological profiles are most at risk for functional decline and age, gender, and biological factors predict subgroup change over time (Q_{2b}).

4. 2. 1 Stability and Change at the Level of the Subgroups

To examine questions about stability and change over time in subgroup membership, the results of separate cluster analyses at each measurement occasion in BASE were linked with one another. The expectation was that the majority of persons who were grouped together at baseline assessment would remain in their subgroups rather than being re-assigned to a different subgroup at later measurement occasions. Follow-up analyses consider more specific information than typically used in this context such as variables that distinguish participants who remained in their subgroups from those who showed subgroup transition.

To examine stability in subgroup membership over time, the criteria established at baseline assessment to identify the subgroups (i.e., two-stage clustering procedure) were again applied using data from the second wave and the third wave of measurement occasions. In the *Ward's* procedure, the Cubic Clustering Criterion again indicated that a three-subgroup solution was the optimal grouping of individuals at both occasions. In the *k*-means procedure, the psychological profiles from the respective previous occasion were used as starting values. For example, when cluster-analyzing data from the second wave, the psychological profiles for the three groups from baseline assessment were used as initial starting seeds in the *k*-means procedure.

Table 13 shows how membership in the various subgroups is linked over time. For example, 61% of the participants in the Overall-Positive Profile Subgroup remained in this subgroup between over the four-year period between baseline assessment and the second wave, 15% went to the Average-Profile Subgroup, and another 21% went to the Disparate-Profile Subgroup. Similarly, 78% remained in the Overall-Positive Profile Subgroup over two years between the second wave and the third wave, 18% went to the Average-Profile Subgroup, and another 4% went to the Disparate-Profile Subgroup. Overall, the analyses suggest that between two occasions, about two thirds of the longitudinal BASE sample remained in the same subgroups, and *kappa*'s were higher for the two-year period between the second wave and the third wave ($\kappa = .61$; $p < .001$) than for the four-year period between baseline and the second wave ($\kappa = .45$; $p < .001$) and for the six-year period between baseline and the third wave ($\kappa = .41$; $p < .001$).

Table 13
Stability in Subgroup Membership over Time: Results of Separate Cluster Analyses From Three Measurement Occasions in BASE

	4-Year Stability (Baseline – 2nd Wave)			6-Year Stability (Baseline – 3rd Wave)		
	% of Subgroups					
Subgroup Assignment at Baseline	1	2	3	1	2	3
(1) Overall-Positive Profile	**61**	15	24	**61**	20	19
(2) Average Profile	21	**75**	4	14	**71**	14
(3) Disparate Profile	15	24	**61**	10	36	**54**
Subgroup Assignment at 2nd wave				2-Year Stability (2nd Wave – 3rd Wave)		
(1) Overall-Positive Profile				**78**	18	4
(2) Average Profile				3	**80**	17
(3) Disparate Profile				15	14	**71**

Note. Same subgroups in bold.

It also has to be acknowledged that close to 30% of the 6-year longitudinal BASE participants changed their group membership status. Stability in subgroup membership over time was, of course, influenced by the test-retest stability of the single profile-defining constructs. It seems as if membership stability parallels the construct stability of the psychological measures (see Section 3.2.1.3 for Table 6). It is an open question then to what extent the 30% 'subgroup movers' represent actual change or unreliability. Another way to evaluate the stability, which to some extent takes the reliability of assignment into account, is to define subgroup stability as being in the same subgroup at two out of three occasions (e.g., being in the same subgroup at baseline assessment and at either follow-up). Selecting this criterion increased overall subgroup stability to 72% (Overall-Positive Profile Subgroup: 69%; Average-Profile Subgroup: 86%; Disparate-Profile Subgroup: 68%).

To determine the statistical significance of stability and change in subgroup membership, a cross-tabulation of individual's group membership over time was used and it was examined whether the cell frequencies in the different combinations of groups between two occasions were significantly higher or lower than expected by chance. The EXACON procedure in the statistical package SLEIPNER provides an exact hypergeometric test that was used for this purpose (Bergman & El-Khouri, 1987). Each of the same-subgroup pairs over time shows significant individual stability over time. For example, if an individual was assigned to the Average-Profile Subgroup at baseline assessment, he or she was 2.44 times more likely than expected by chance to belong to the very same group at the second wave. Each of the hypergeometric probability statistics for the same-subgroup pairs was below or equal to an alpha level of $p < .0001$. The lowest probability ratio as compared with chance was 1.61 (baseline – second wave for participants of the Overall-Positive Profile Subgroup), whereas most other ratios were around or above a factor of 2.0. In addition, all but three out of 18 other transition possibilities (e.g., transition from the Average-Profile Subgroup at baseline to the Disparate-Profile Subgroup at the second wave) were significant 'antitypes' suggesting that these developmental paths were very unlikely to occur. With the exception of transiting from the Disparate-Profile Subgroup to the Average-Profile Subgroup over the six-year period between baseline and the third wave, the non-antitypes were relatively close to the probability level of being an anti-type. If one adjusts for the mass significance fallacy through multiple comparisons by applying an alpha at $p < .001$ for all cells, 10 out of 18 other transitions were antitypes in this descriptive sense.

One further way to determine subgroup stability over time is to consider the stability of the subgroup-defining psychological profiles of the subgroups identified by separate cluster analyses at the three measurement occasions in BASE. To do so, Cattell's r_p pattern similarity coefficient (1949) was used and results are summarized in Table 14. It is evident that the profiles were reasonably stable over time. For example, profile similarity between baseline assessment and the third wave for the Disparate-Profile Subgroup amounted to $r_p = .89$, which represented the lowest coefficient for a given profile over time. It has to be acknowledged that the coefficients reported in Table 14 were calculated on the basis of the profiles for the different subgroups identified at each occasions and thus include, to some extent, different members. Put differently, the profiles were compared over measures rather than over persons. In addition, analyses were also carried out that (a) compared the psychological profiles over time for the three subgroups identified at baseline assessment (i.e., having the same members within each subgroup), and (b) considered profile stability for each psychological domain separately. Findings were similar to those already reported. In sum, there was quite a considerable degree of stability in the psychological profiles over time.

Table 14
Cattell's Pattern Similarity Coefficients: Comparison Between Profiles of Three Subgroups Identified by Separate Cluster Analyses at the Three Measurement Occasions of BASE

	4-Year Stability (Baseline – 2nd Wave)			6-Year Stability (Baseline – 3rd Wave)		
	Subgroup Profiles					
Subgroup Assignment at Baseline	1	2	3	1	2	3
(1) Overall-Positive Profile	**.99****	.50*	.53*	**.96****	.52*	.54*
(2) Average Profile	.40*	**.95****	.54*	.31	**.89****	.58**
(3) Disparate Profile	.38	.61**	**.94****	.36	.63**	**.89****
Subgroup Assignment at 2nd wave				2-Year Stability (2nd Wave – 3rd Wave)		
(1) Overall-Positive Profile				**.97****	.48*	.51*
(2) Average Profile				.37	**.98****	.62**
(3) Disparate Profile				.48*	.60**	**.98****

Note. Same subgroups in bold. * $p < .05$, ** $p < .01$.

4. 2. 1. 1 Follow-Up Analyses on Subgroup Changers

Because it is unclear whether 'subgroup movers' represent a component of differential development in old age or mere unreliability, follow-up analyses were carried out that explicitly considered potential differences between those people who were stable in subgroup membership and those who showed subgroup transition. These analyses first indicated that neither age nor gender played a role in subgroup stability.

Another question was whether members who were less similar to the subgroup they were assigned to at baseline were more likely to move to a different subgroup over time. To adjust for multicollinearity in this specific analysis, the Mahalanobis distance was used as a similarity measure between the individual profile and the subgroup profile. BASE participants who were in the same subgroup at two out of three occasions ($n = 79$) were contrasted against those who were not (*n* = 51). A univariate analysis of variance using the similarity measure as dependent variable and subgroup stability over time as independent variable revealed a significant effect, 9.72 vs. 12.34, F (1,128) = 7.68, $p < .01$.[7] This suggests that one characteristic of participants who changed group membership status over time was that they were less similar to their baseline subgroups than their stable counterparts. One may take this result to indicate that subgroup reallocation seemed to follow meaningful and interpretable patterns.

To conclude this first set of longitudinal analyses, it was found that the subgroups were fairly stable over time in their participants composition (Q_{2a}). It was demonstrated that the majority of participants remained in the subgroups to which they were assigned to initially at baseline assessment. The psychological profiles of these groups considered across all measures remained fairly stable over time as well. That differential change was also possible is supported by the fact that close to 30% in each subgroup changed their membership status. Follow-up analyses suggested that subgroup transition of individuals occurred in meaningful ways rather than representing unreliability only. Overall, it seems safe to conclude that subgroup membership was more than just a momentary phenomenon, but was relatively persistent over time.

The above results also support the decision to use subgroup membership at baseline assessment to examine subgroup differences in patterns of stability and change across the different profile-defining domains of psychological functioning as well as its underlying mechanisms. The next sections report findings from these analyses. The primary focus of this dissertation is on using subgroup differentiation as the entry point for examining heterogeneity and differential change in old age. To illustrate that there are additional facets of differential change in the present data set, I also present a brief overview of the kind of change observed in individuals whose subgroup membership was not stable. In this instance, subgroup membership is still used as a classificatory procedure. But it is used to identify those who are potentially change-salient because they leave a given subgroup. To exploit subgroup changers as an aspect of differential development in old age, follow-up analyses further explore factors that may distinguish participants who were stable in group membership from those who were not.

[7] Employing Cattell's pattern similarity index revealed the same results.

4. 2. 2 Stability and Change at the Level of the Subgroup-Defining Measures

One key issue of the present study was to examine the proposal that the subgroups show differential patterns of stability and decline in the profile-defining psychological domains (Q_{2b}). Analyses are aimed at demonstrating that the subgroups can not only be differentiated from one another by mean-level differences at baseline assessment, but also by differential change patterns. In an attempt to explore ideas about qualitative transitions in old age, it was expected that subgroups with less functional psychological profiles would be most at risk to show functional decline over time (Q_{2b}). To examine these questions, subgroup membership at baseline assessment was used to define the group status. Accordingly, the Disparate-Profile Subgroup most closely resembled this feature so that members of that subgroup were expected to show stronger decline on the profile-defining measures as compared to both other subgroups.

Several strategies were used to compare the change trajectories of the subgroups' psychological profiles with one another. The ensuing section reports results of a series of repeated measures analyses of variance (ANOVA). To guard against regression artifacts, two further independent methodological approaches were applied and the findings were compared to the repeated measures ANOVAs. Results of these additional analyses are reported in Appendix C (see Section C.2.1). In the end, results of the three independent methodological approaches to examine individual and subgroup differences in change over time converged and presented the same pattern of findings, which indicates that differential change over six years was reliable and robust. Results of the repeated measures ANOVAs are reported first. After that, follow-up analyses are presented that addressed (a) the effects of sample attrition on longitudinal change statistics and (b) systemic change among those participants who changed in group membership over time.

4. 2. 2. 1 Results of a Series of Repeated Measures ANOVA

In the context of the repeated measures ANOVA's, change on a given measure was used as within-subject factor (3 occasions) and Subgroup membership at baseline assessment was employed as between-subject factor (3 groups). Three sets of repeated measures ANOVA's were specifically carried out: Subgroup differences in change over time were determined in (a) overall functioning/desirability, (b) domain-specific composite measures of psychological functioning, and (c) specific profile-defining psychological measures. Table 15 shows descriptive characteristics from each measurement occasion for the three subgroups identified at baseline assessment, sorted in the way they were entered into the series of repeated measures ANOVA's.

To test for subgroup differences in change over time, a repeated measures ANOVA on the overall functioning/desirability measure was carried out as a first omnibus test. The between-subjects analysis revealed a significant main effect of the subgroups on the overall composite measure of functioning/desirability, F (2,126) = 59.04, $p < .001$, $\eta^2 = .48$. In line with the results reported in previous sections, this indicates that the subgroups differed substantively from one another. According to Cohen's (1977) classification of effect sizes, this effect can be considered large. The most important findings relate to the *within-subject* factors. Here, a significant interaction of Time by Subgroup membership was found, which indicates differential subgroup change over time, Wilk's $\lambda = .86$, F (4,252) = 4.82, $p < .001$, $\eta^2 = .07$.[8] According to Cohen (1977), the effect was rather small.

[8] When restricting the sample to those who were continuously assigned to the same subgroups ($n = 79$), the same results were found, Wilk's $\lambda = .84$, F (4,150) = 3.48, $p < .01$, $\eta^2 = .09$. Similarly, the effect also remained when using subgroup membership at the last occasion as between-subject factor, Wilk's $\lambda = .86$, F (4,252) = 5.01, $p < .001$, $\eta^2 = .08$.

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Table 15
Change Over 6 Years on the Profile-Defining Psychological Constructs for the Three Sub-groups Identified at Baseline Assessment of the 6-Year Longitudinal BASE Sample

Figure 11 graphically illustrates subgroup differences in change over six years. In line with the expectation (Q_{2a}), the subgroups showed differential change trajectories over six years on the measure of overall functioning/desirability. It can be obtained that the direction of functional change was characterized by stability (Average Profile, Disparate Profile) and decline (Overall-Positive Profile) rather than increase. That is, in contrast to expectation (Q_{2b}), it was not the Disparate-Profile Subgroup that showed strongest decline over time, but the Overall-Positive Profile Subgroup. Both the Average-Profile Subgroup and the Disparate-Profile Subgroup remained relatively stable over time at their average levels of overall functioning/desirability, whereas decline for the Overall-Positive Profile Subgroup amounted to a quarter of a standard deviation and primarily occurred between baseline assessment and the second wave over a period of four years rather than the two-year period between the two follow-up occasions, F (2,127) = 32.45, $p < .001$, $\eta^2 = .20$.[9] For clarity, Figures 11 to 16 omit the 2 wave and show data from baseline assessment and the third wave.

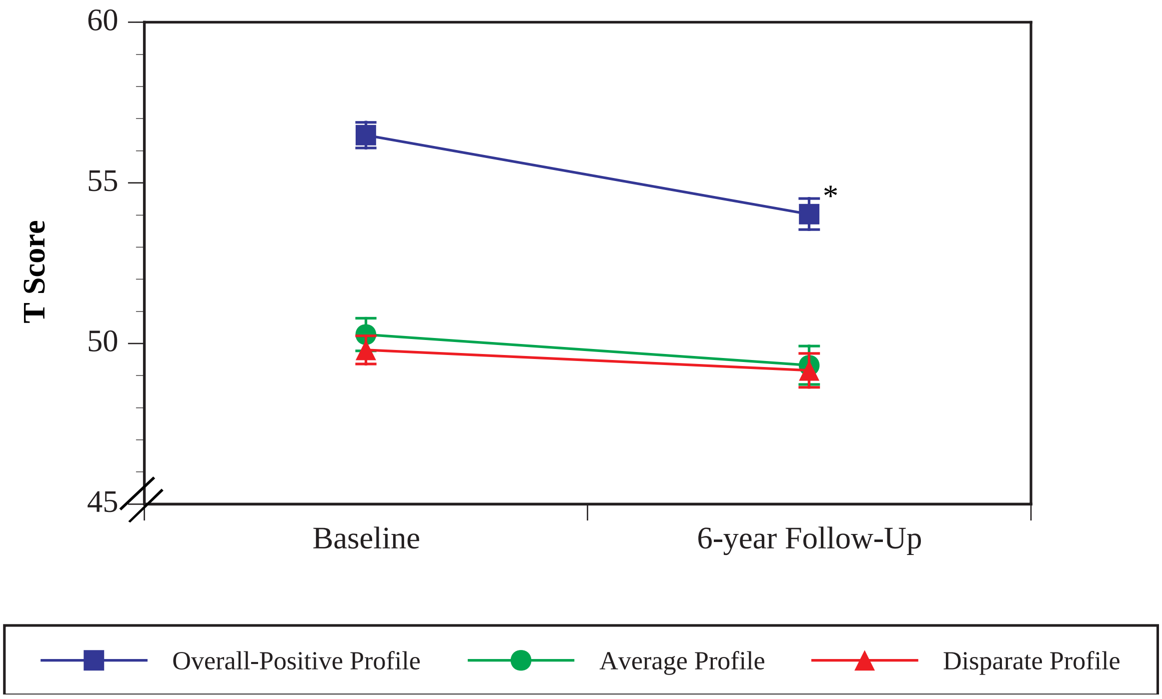

Figure 11 Differences in change over six years between the three subgroups identified at baseline assessment of BASE: Overall psychological functioning/desirability.

Note. Members of the Overall-Positive Profile Subgroup declined significantly over time; both other subgroups remained relatively stable over time at their average levels of functioning. Error bars = *SE*. * $p < .05$.

As a second omnibus test, a repeated measures ANOVA was used with Subgroup membership at baseline assessment as between-subject factor (3 groups) and two within-

[9] It has to be acknowledged that unequal time intervals in-between occasions are a threat to the assumption of repeated measures ANOVA that the covariances between repeated assessments are homogeneous. Section C.4.1 in Appendix C specifically addresses this concern.

subject factors: Time (3 occasions) and Psychological Domain (cognition, personality and self-related functioning, and social integration). Again, the between-subject effect for the subgroups was highly significant, F (2,126) = 59.47, $p < .001$, $\eta^2 = .48$, suggesting that they substantively differed from one another across the domains considered. Of primary interest were, of course, the within-subject effects. Significant main effects were found for domain, Wilk's $\lambda = .72$, F (2,126) = 24.25, $p < .001$, $\eta^2 = .28$, and time, Wilk's $\lambda = .81$, F (2,126) = 14.6, $p < .001$, $\eta^2 = .19$, indicating that the psychological domains differed from one another and that there was change over time. Significant two-way interactions were found for Domain by Subgroup, Wilk's $\lambda = .66$, F (4,252) = 14.47, $p < .001$, $\eta^2 = .19$, and Time by Subgroup, Wilk's $\lambda = .88$, F (4,252) = 4.10, $p < .01$, $\eta^2 = .06$, which suggest that the subgroups differed from one another in the psychological domains and in their change over the six-year observation period. Most importantly, the three-way interaction of Time by Subgroup by Domain was also found to be significant, Wilk's $\lambda = .76$, F (8,248) = 4.58, $p < .001$, $\eta^2 = .13$.[10] This finding shows that the subgroups differed from one another in their change trajectories across the domains of cognition, personality and self-related functioning, and social integration. According to Cohen's terminology (1977), each of these effects can be referred to as a small effect with the exception of the main effect for domain, which was large.

Follow-up analyses of the three-way interaction revealed a patterning of domain-specific change trajectories over time for the three subgroups, which is illustrated in Figure 12. The Overall-Positive Profile Subgroup was found to maintain their high levels of cognitive functioning over time, but members of this subgroup showed considerable decline on measures of personality and self-related functioning, F (2,127) = 22.40, $p < .001$, $\eta^2 = .15$, and social integration, F (2,127) = 22.40, $p < .001$, $\eta^2 = .11$. Functional decline in this subgroup amounted to 0.28 *SD* units on measures of personality and self-related functioning and 0.34 *SD* units on measures of social integration. Members of the Average-Profile Subgroup maintained their level of functioning over time in all three domains. In contrast, members of the Disparate-Profile Subgroup declined on cognitive measures, F (2,127) = 14.94, $p < .001$, $\eta^2 = .11$, but they maintained their low levels of functioning on personality and self-related functioning, and social integration. Their cognitive decline also amounted to 0.33 *SD* units. Most of the decline observed in the 3-wave longitudinal BASE data set occurred between the

[10] When restricting the sample to those who were continuously assigned to the same subgroups ($n = 79$), the same results were found, Wilk's $\lambda = .77$, F (8,146) = 2.56, $p < .05$, $\eta^2 = .12$. Similarly, the effect also remained when using subgroup membership at the last occasion as between-subject factor, Wilk's $\lambda = .87$, F (8,248) = 2.20, $p < .05$, $\eta^2 = .07$.

first and the second wave, which extends over a 4-year period as compared with the 2-year period between the last two occasions. All effect sizes were small according to Cohen (1977).

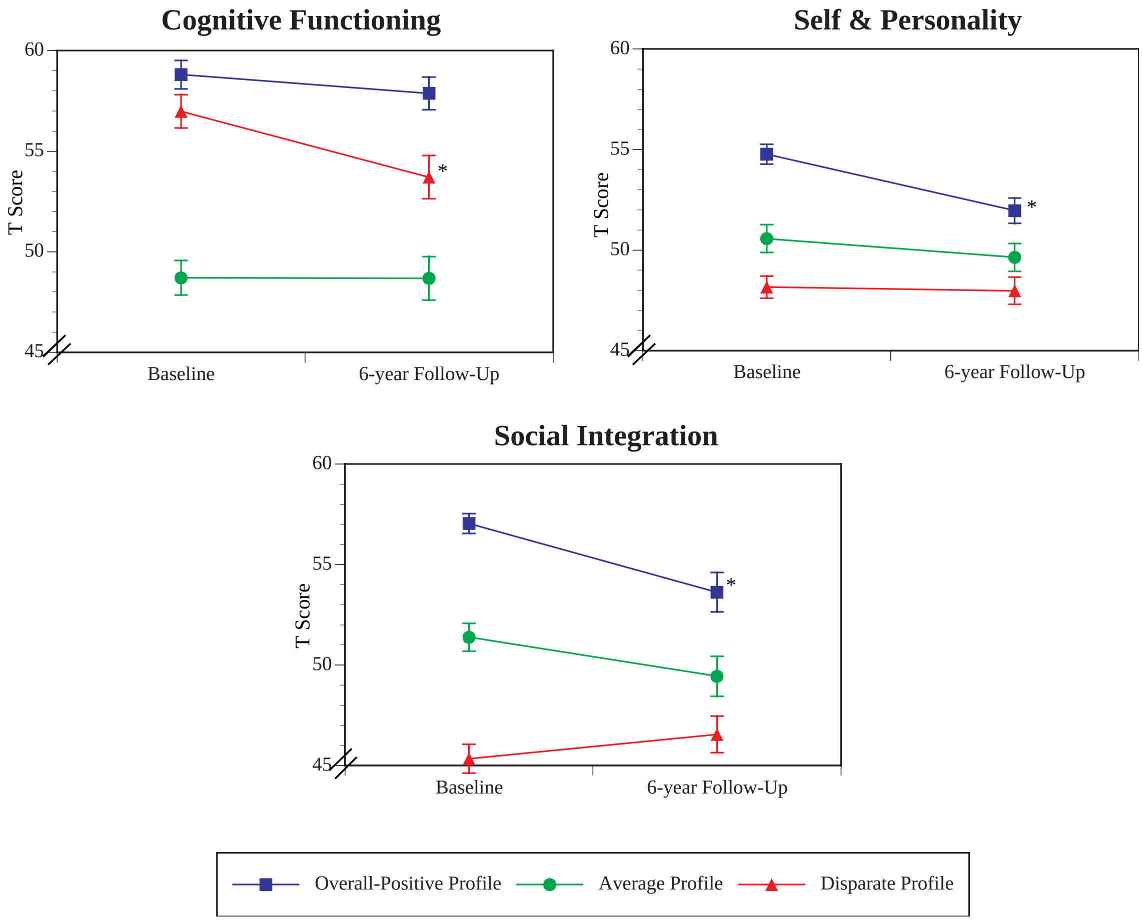

Figure 12 Differences in change over six years between the three subgroups identified at baseline assessment of BASE: Domain-specific composites.

Note. Members of the Disparate-Profile Subgroup declined significantly over time on measures of cognitive functioning. Members of the Overall-Positive Profile Subgroup declined significantly over time on measures of personality and self-related functioning, and social integration. Members of the Average-Profile Subgroup remained relatively stable over time at their baseline levels of functioning. Error bars = *SE*. * $p < .05$.

Figure 13 presents a graphical illustration of differential subgroup patterns of change over six years across the domains of cognitive functioning (y-axis) and personality, self-related functioning, and social integration (x-axis). Being in the center of the diagram would indicate that a given subgroup did not change at all over the observation period. The further the distance between a given subgroup and the center, the larger the change for the subgroup. For example, the Disparate-Profile Subgroup is about 4 T-score units below the center on the axis representing cognitive decline, which indicates that this subgroup experienced the strongest cognitive decline. Because there was less group differentiation between the domains of personality and self-related functioning on the one hand and social integration on the other hand, subgroup decline in both domains was pooled and contrasted against that found in the cognitive domain.

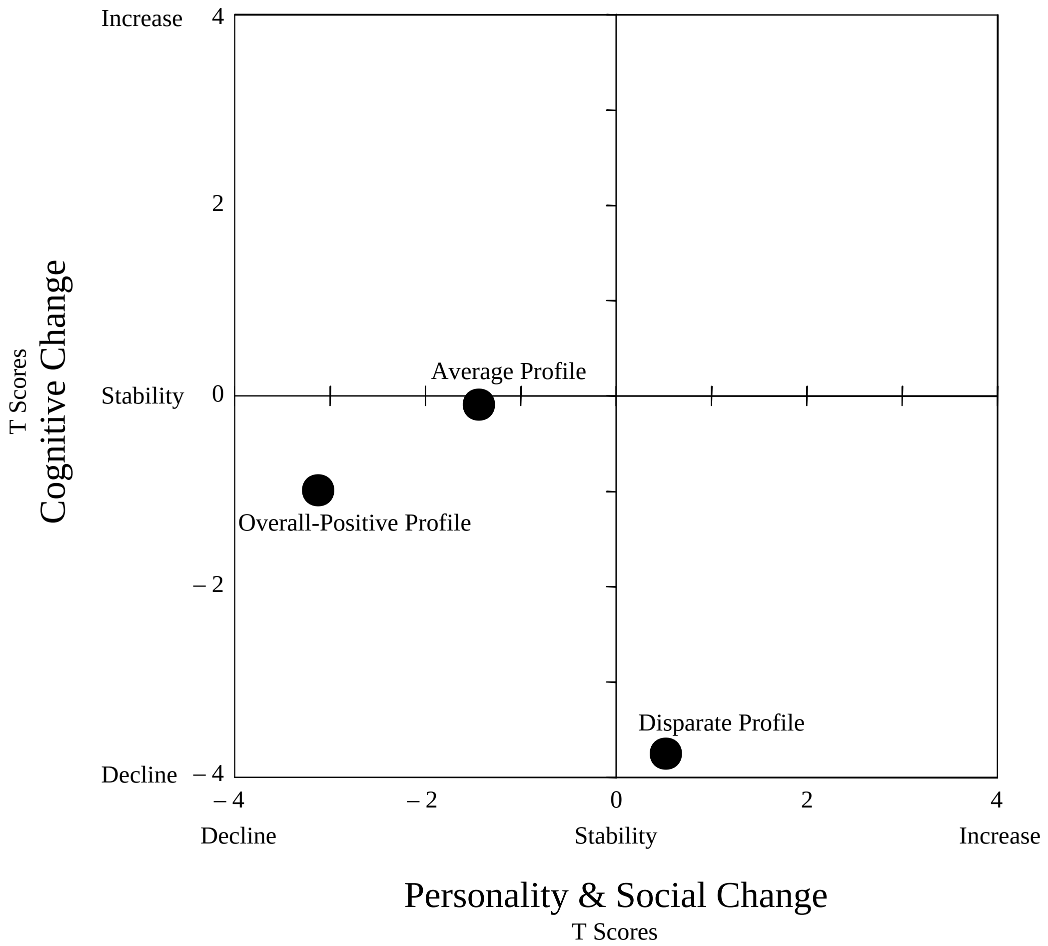

Figure 13 Illustration of differential subgroup patterns of change over six years across the domains of cognitive functioning (y-axis) and personality, and social integration (x-axis).

Note. Being in the center of the diagram would indicate that a given subgroup did not change at all over time. The further the distance between a given subgroup and the center, the larger the change for the subgroup. Subgroup decline amounted to 0.5 *SD* in several profile-defining measures (e.g., Disparate Profile: Perceptual speed; Overall-Positive Profile: Emotional loneliness).

To summarize the analyses so far, consistent evidence with the prediction was found in that the subgroups show differential patterns of stability and decline in the profile-defining domains (Q_{2a}). Contrary to expectation (Q_{2b}), it was not the subgroup with less functional psychological profiles (Disparate-Profile) that declined most over time. Instead, subgroup decline differed across domains of psychological functioning. In line with the expectation, the Disparate-Profile Subgroup showed strongest decline on measures of cognitive functioning. However, on measures of personality and self-related functioning, social integration, and overall desirability/functioning, it were participants in the Overall-Positive Profile Subgroup who showed strongest decline. This decline occurred at a relatively high functional level. On measures of social integration, for example, members of the Overall-Positive Profile Subgroup were at the last measurement occasion still considerably above a *T* score of 50, which represents the mean of the total BASE sample. At the same time, functional decline for these subgroups can be considered substantive in that it amounted to almost half a standard deviation over a period of six years.

To further follow-up on subgroup differences in change over time, a third set of repeated measures ANOVA's was carried out that examined the specific profile-defining psychological measures. With regard to *between-subject factors*, there was a main effect of subgroup status on each profile-defining measure (except for external control) indicating that the subgroups differed substantially from one another. Group differences were as follows: Perceptual speed, F (2,127) = 19.58, $p < .001$, $\eta^2 = .24$; memory, F (2,127) = 7.08, $p < .01$, $\eta^2 = .10$; knowledge, F (2, 127) = 36.73, $p < .001$, $\eta^2 = .37$; neuroticism, F (2, 127) = 9.77, $p < .001$, $\eta^2 = .13$; extraversion, F (2, 127) = 6.64, $p < .001$, $\eta^2 = .10$; internal control beliefs, F (2, 127) = 12.01, $p < .001$, $\eta^2 = .16$; external control beliefs, F (2, 127) = 0.70, $p > 10$, $\eta^2 = .01$; goal investment, F (2, 127) = 13.93, $p < .001$, $\eta^2 = .18$; emotional loneliness, F (2, 127) = 20.11, $p < .001$, $\eta^2 = .24$; social loneliness, F (2, 127) = 29.96, $p < .001$, $\eta^2 = .32$; and close others, F (2,127) = 23.26, $p < .001$, $\eta^2 = .27$. Effect sizes amounted to 37% for knowledge, which represents a medium effect.

Again, the *within-subject* effects are most important for the present study. Significant Time by Subgroup interactions were found for 5 out of the 11 psychological clustering variables. More specifically, subgroup differences in change over time were found on two out of three cognitive variables, namely perceptual speed, Wilk's $\lambda = .90$, F (4,244) = 3.14, $p < .05$, $\eta^2 = .05$; and knowledge, Wilk's $\lambda = .91$, F (4,244) = 2.93, $p < .05$, $\eta^2 = .05$). Differences between the subgroups were also found on extraversion, Wilk's $\lambda = .87$, F (4,244) = 4.71, $p < .001$, $\eta^2 = .07$; internal control beliefs, Wilk's $\lambda = .89$, F (4,244) = 3.66, $p < .01$, $\eta^2 = .06$;

and emotional loneliness, Wilk's λ = .82, F (4,244) = 6.71, p < .001, η^2 = .10. Effect sizes ranged between 5% and 10%, which represent small effects according to Cohen (1977).

As an inspection of Figures 14 through 16 suggests, the following pattern of differential subgroup change was found. On both cognitive measures of perceptual speed and knowledge, participants from the Disparate-Profile Subgroup declined significantly from a high functional level to a level that was still above the mean of the total cross-sectional BASE sample (i.e., T = 50): speed, F (2,254) = 14.39, p < .001, η^2 = .10; knowledge, F (2,254) = 4.14, p < .05, η^2 = .03. Figure 14 shows that this decline was substantial (e.g., amounting to 0.53 *SD* units on perceptual speed over 6 years), but occurred at a relatively high functional level. The observed decline primarily occurred between baseline assessment and the second wave. Members of both the Overall-Positive Profile Subgroup and the Average-Profile Subgroup remained at their baseline levels of functioning over time.

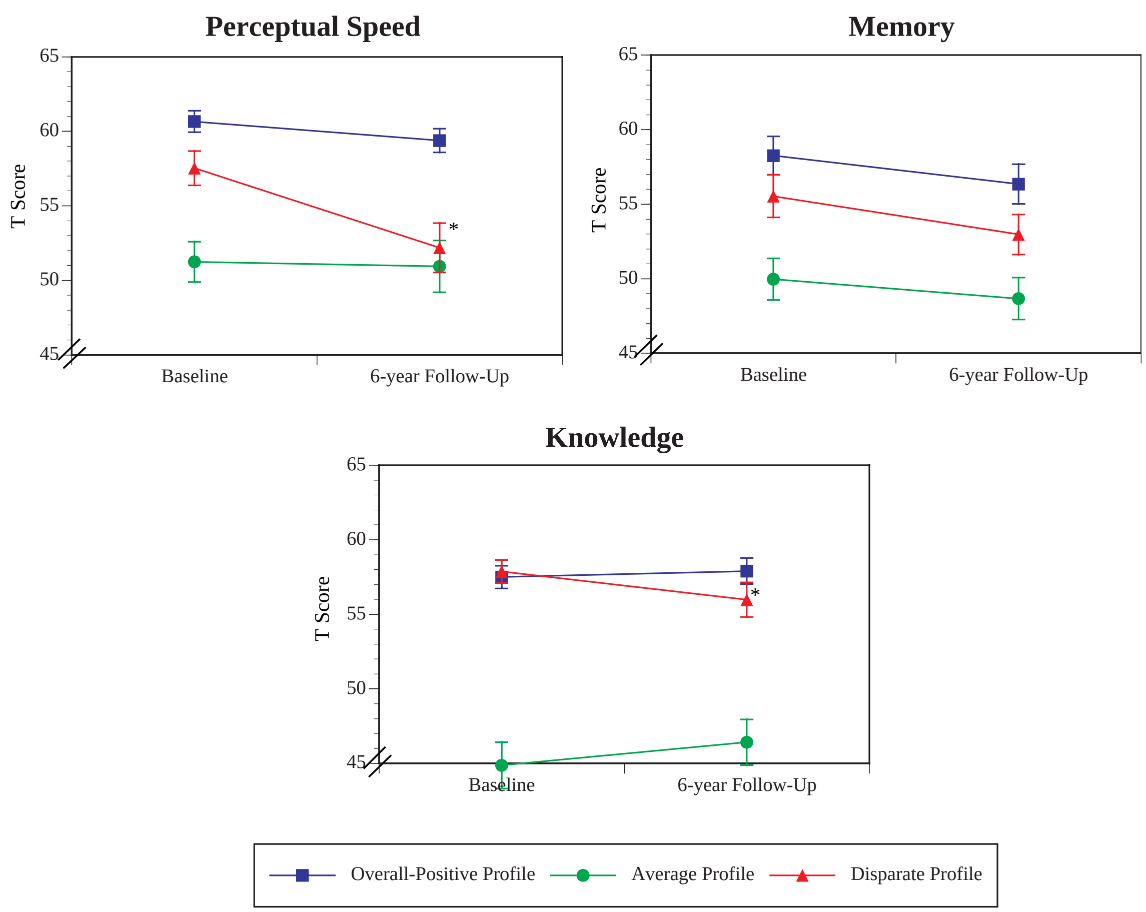

Figure 14 Differences in change over six years between the three subgroups identified at baseline assessment of BASE: Three cognitive measures.

Note. Members of the Disparate-Profile Subgroup declined significantly over time on measures of perceptual speed and knowledge. Members of both other subgroups remained relatively stable over time at their baseline levels of functioning. Error bars = *SE*. * p < .05.

Figure 15 shows subgroup differences in change over time on measures of personality and self-related functioning. On extraversion, it was found that the Overall-Positive Profile Subgroup showed substantial decline, F (2,254) = 17.72, $p < .001$, $\eta^2 = .12$. Decline amounted to 0.50 *SD* units over the 6-year period, and most of this decline again occurred during the first two waves. The Disparate-Profile Subgroup also declined on extraversion, but this occurred between the second wave and the third wave by 0.35 *SD* units from an average level to a below average level, F (2,254) = 6.19, $p < .01$, $\eta^2 = .05$. On internal control, the Disparate-Profile Subgroup increased between baseline assessment and the second wave, F (2,254) = 6.63, $p < .01$, $\eta^2 = .05$. This increase of 0.20 *SD* units occurred at very low functional level.

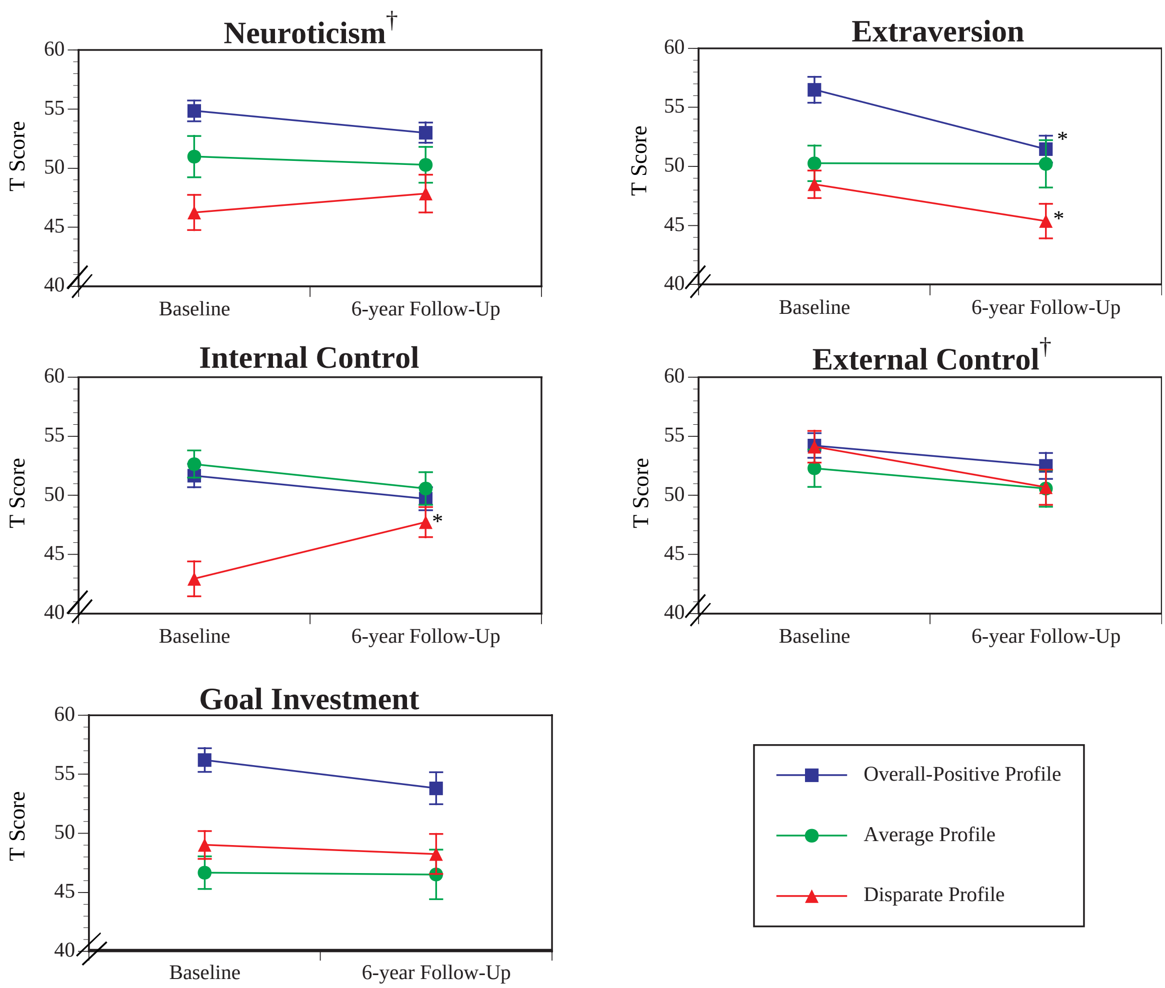

Figure 15 Differences in change over six years between the three subgroups identified at baseline assessment of BASE: Five measures of personality and self-related functioning.

Note. † reverse-coded. Members of the Overall-Positive Profile Subgroup declined significantly over time on extraversion. Members of the Disparate-Profile Subgroup also declined significantly on extraversion and increased significantly on internal control beliefs. Members of the Average-Profile Subgroup remained relatively stable over time at their baseline levels of functioning. Error bars = *SE*. * $p < .05$.

Finally, significant subgroup differences in change over time were also found for emotional loneliness. The Overall-Positive Profile Subgroup reported more feelings of emotional loneliness over time, F (2,254) = 15.83, p < .001, η^2 = .11, whereas both other subgroups remained stable at their baseline levels of functioning. Decline for members of the Overall-Positive Profile Subgroup amounted to 0.49 *SD* units over the 6 years of observation, but occurred at a high functional level. Subgroup patterns of stability and decline on measures of social integration are shown in Figure 16.

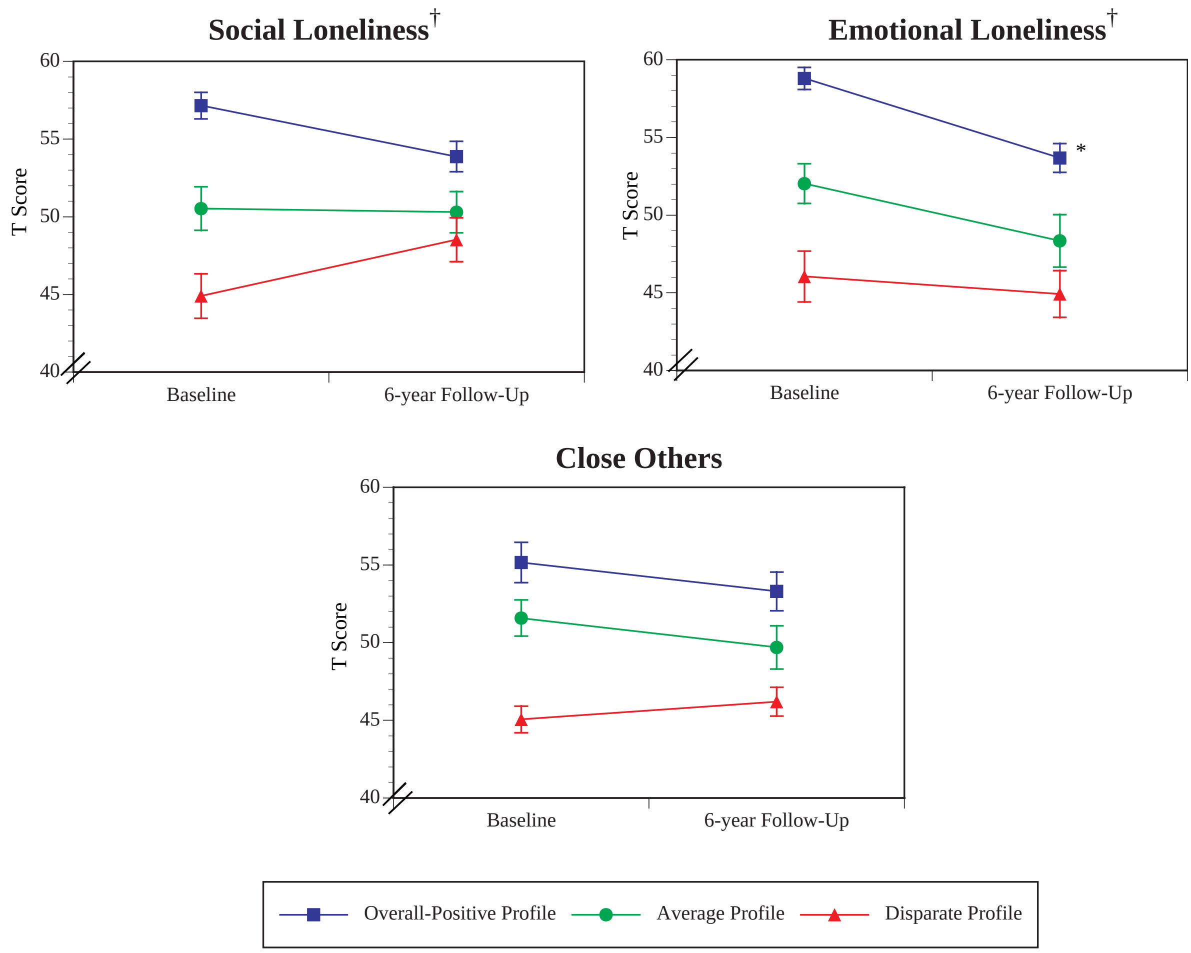

Figure 16 Differences in change over six years between the three subgroups identified at baseline assessment of BASE: Three measures of social integration.

Note. † reverse-coded. Members of the Overall-Positive Profile Subgroup declined significantly over time on emotional loneliness. Members of both other subgroups remained relatively stable over time at their baseline levels of functioning. Error bars = *SE*. * p < .05.

To guard against regression-to-the-mean artifacts, the repeated measures ANOVAs were complemented by two further methodological approaches, adjusting for error of measurement (Schaie, 1989, 1990) and Multilevel Growth Curve Modeling (for review, see Hertzog & Nesselroade, 2003; Ghisletta & Lindenberger, 2004). Section C.2.1 in Appendix C summarizes results from these analyses and also includes a description of the advantages of each method. The above patterning of subgroup differences in change over time was also found with these independent methods. Such convergent evidence suggests that the patterning found represents robust and reliable change over time rather than being a mere reflection of regression artifacts.

In sum, there was substantive evidence to indicate that the subgroups differed from one another in patterns of stability and decline over six years in the profile-defining measures (Q_{2a}). Specifically, the subgroups were found to differ in their relative risk for functional decline on all domain composite measures and on five out of 11 measures that defined the psychological profiles at baseline assessment. Hence, the present study provides evidence for the argument that psychological profile differences might not only reflect the conjoint outcomes of different biogenetics of aging as well as pathways and lifestyles *into* old age, but also are associated with differential development *during* old age. Follow-up analyses are presented next that examined sample attrition effects on longitudinal change statistics as well as systemic change among those participants who changed in group membership over time.

4. 2. 2. 2 Follow-Up Analyses

4. 2. 2. 2. 1 Sample Attrition Effects on Longitudinal Change Statistics

One reasonable post-hoc interpretation of the finding that the Overall-Positive Profile Subgroup showed strongest functional decline over time relates to the effects of differential sample attrition. One may argue that participants who dropped out of BASE over time can be expected to have experienced stronger functional decline than participants who stayed in the study. Based on previous work in BASE (Lindenberger et al., 1999, 2002; T. Singer et al., 2003), two follow-up analyses were carried out to specifically address this question.

A first set of analyses compared change information between participants from the 6-year longitudinal BASE sample (n = 130) and those who took part two times, but were not available for the third occasions (2-wave-only participants; n = 80). At baseline assessment, the only age- and gender-partialed level difference between both BASE subsamples was found for perceptual speed, F (1,206) = 6.20, p < .05). In analogy to T. Singer et al. (2003), difference scores between baseline assessment and the second wave were used to compare change over a four-year period between the two groups. Age- and gender partialed analyses indicated that BASE participants who dropped out after two waves, relative to the 6-year sample, declined stronger on a number of measures: Knowledge, F (1,206) = 5.72, p < .05; neuroticism, F (1,206) = 5.58, p < .05; external control beliefs, F (1,206) = 9.26, p < .01; and the overall measure of functioning/desirability, F (1,206) = 4.20, p < .05.

In a second set of analyses, a subsample of the 2-wave-only participants (n = 15) was selected to match the Disparate-Profile Subgroup (n = 41) in terms of cognitive fitness, but relatively low scores on measures of personality and self-related functioning, and social integration. Significant differences at baseline assessment were found for extraversion only, F (1,206) = 4.34, $p < .05$. Change analyses between baseline and the second wave indicated that the matched 2-wave-only participants showed stronger decline on extraversion, F (1,206) = 5.94, $p < .05$; social loneliness, F (1,206) = 9.28, $p < .01$; number of close others, F (1,206) = 4.27, $p < .05$; and on the composite measures of overall functioning/desirability, F (1,206) = 8.03, $p < .01$; and social integration, F (1,206) = 15.56, $p < .001$.

In analogy with previous work (e.g., T. Singer et al., 2003), both follow-up analyses suggest that BASE participants who took part two times, but were not available for a third occasion tended to show stronger decline on several profile-defining psychological measures as compared to 6-year participants. These differences highlight that differential sample attrition has largely shaped the type and amount of change that could be observed in the longitudinal BASE sample. This interpretation can be regarded to be particularly salient for the Disparate-Profile Subgroup that maintained their low baseline levels of functioning on measures of personality and self-related functioning, and social integration rather than showing additional decline. Such maintenance may have been associated with continued participation in BASE rather than showing additional decline and (therefore) dropping out of BASE either because of mortality or incapacity.

4. 2. 2. 2. 2 Subgroup Changers

A last set of follow-up analyses examined whether participants who changed subgroup membership status over time showed more systemic change over time. This is insofar very important as it would illustrate that those who changed group membership represent an aspect of differential change rather than lack of reliability in subgroup assignment. BASE participants who were in the same subgroup at two out of three occasions (n = 79) were contrasted against those who were not (n = 51). Systemic change was operationally defined as the overall change across all profile-defining measures over six years.

A univariate analysis of variance using functional change on a composite across all psychological measures as dependent variable and subgroup stability over time as independent variable revealed a significant effect, F (1,128) = 19.21, $p < .001$, ‘subgroup constants’: $M_{Change} = -0.76$, $SD_{Change} = 2.12$ vs. ‘subgroup movers’: $M_{Change} = -2.81$, $SD_{Change} = 3.22$. Differences were particularly strong in the domains of cognitive functioning, *F* (1,128) = 8.83, $p < .01$, and personality and self-related functioning, *F* (1,128) = 5.07, $p < .05$. A comparison of ‘movers’ and ‘constants’ within each subgroup evinced that differences were especially pronounced in the Overall-Positive Profile Subgroup. Results indicate that 6-year longitudinal BASE participants who changed group membership status over time showed more change over six years (i.e., decline) than their counterparts who remained in their subgroups. The patterning once again illustrates that subgroup reallocation seemed to follow meaningful and interpretable patterns and that individuals who change in group membership showed systemic-wholistic change in psychological functioning.

To conclude the section on subgroup differences in development of their psychological profiles over six years (Q_{2a}): A first set of analyses revealed evidence that subgroup membership was relatively stable over a the observation period of six years. At the same time, there were indications that differential change was possible in that up to 30% of the participants changed group membership over time. A second set of analyses used subgroup membership at baseline assessment to examine differential patterns of functional change at the level of the profile-defining measures and revealed that the subgroups distinctly differed from one another in their longitudinal change trajectories. Some subgroups evinced functional decline in some domains, but maintained their functional level in other domains, whereas other subgroups showed exactly the opposite pattern. In contrast to expectation, functional decline was not most pronounced in the subgroup with the less functional/desirable profile of psychological functioning (Disparate Profile). Instead, subgroup decline differed across the domains and the highest-functioning group (Overall-Positive Profile) showed strongest decline on most measures. Convergent evidence for such pattern across three different methodological approaches suggests that differential change was robust and reliable. Taken together, findings indicate the potential utility of a systemic-wholistic approach to examine questions about differential development in old age. The next section reports analyses to further elaborate on group differences in change over time by examining factors that may have acted as antecedents or correlates.

4. 2. 3 The Role of External Correlates For Subgroup Change Over Time

The ensuing section reports analyses to determine the role of age, gender, biological, and environmental factors in determining subgroup differences in change over time (Q_{2b}). Based on lifespan scripts about the contexts of developmental change and the evolutionary and ontogenetic foundations of change (P. B. Baltes et al., 1998), differences in age, gender, and biological factors were expected to play a major role in determining subgroup change over time, whereas environmental factors were expected to be of minor importance. Specifically, subgroups whose members were older and primarily women were expected to be most at risk for functional decline. It was also expected that biological factors, relative to environmental factors, account for greater amounts of variability in change over time. In a final section, differences in external correlates between BASE participants who remained in their subgroups over time and those who did not are also explored.

The Role of Age and Gender. To examine the role of age and gender in determining subgroup change over time, the series of repeated measures ANOVAs reported in Section 4.2.2.1 was carried out again. Change over six years on a given psychological measure was used as within-subject factor (3 occasions) and Subgroup membership at baseline assessment (3 groups), Age cohort (2 groups; cut-off: 85 years at the third occasion), and Gender were employed as between-subject factors. For descriptive information, the interested reader may refer to Appendix C for Section C.2.2.

In the first step, a repeated measures ANOVA on the overall functioning/desirability measure was used. The between-subjects analysis revealed, in addition to the subgroup effect,[11] a significant main effect of Age cohort, F (1,118) = 18.47, $p < .001$, $\eta^2 = .14$, suggesting that persons in the Fourth Age differed from those in the Third Age. The effect of gender was not statistically significant. To examine the role of age and gender in (subgroup) change over time, within-subject effects were again of primary interest. Within-subject analyses indicated a significant interaction between Time and Age cohort, Wilk's $\lambda = .92$, F (2,117) = 4.80, $p < .05$, $\eta^2 = .08$, suggesting that BASE participants in the Fourth Age, relative to those in the Third Age, were not only found to start out at lower levels of overall functioning/desirability (51.5 vs. 54.0 at baseline), but also to show stronger decline over time (49.1 vs. 52.8 at wave 3). No other interaction effect was found to be statistically significant, which indicates that gender did neither play a role in baseline differences nor in change over time.

[11] All effects reported for the subgroups in Section 4.2.2.1 remained statistically significant when using age and gender as additional between-subject factors in the repeated measures ANOVAs.

In a second step, a repeated measures ANOVA was used with Subgroup membership at baseline (3), Age cohort (2), and Gender (2) as between-subject factors and two within-subject factors: Time (3 occasions) and Psychological Domain (cognition, personality and self-related functioning, and social integration). Between-subject effects were found for Age cohort, $F\ (1,118) = 20.31$, $p < .001$, $\eta^2 = .15$, but again not for gender. In addition to the within-subject effects reported in Section 4.2.2.1 (i.e., main effects for domain and time, interaction effects for Domain by Subgroup, Time by Subgroup, and Domain by Time by Subgroup), further significant two-way interaction effects were found: Time by Age cohort, Wilk's $\lambda = .93$, $F\ (2,117) = 4.76$, $p < .05$, $\eta^2 = .08$, suggesting that participants in the Fourth Age showed steeper decline trajectories as compared to Third-Age participants. Also, the interaction effect between Domain and Gender was statistically significant, Wilk's $\lambda = .94$, $F\ (2,117) = 3.82$, $p < .05$, $\eta^2 = .06$, suggesting that men and women differed across the psychological domains considered. Follow-up analyses suggested that men reported being more socially integrated than women, $F\ (1,128) = 4.16$, $p < .05$, $\eta^2 = .03$, whereas there were no gender differences on both other domain-composite measures. In Cohen's terminology (1977), the two effects were small. None of the other interaction effects was found statistically significant. That is, there was no evidence to indicate that, for example, group members in the Fourth Age showed different trajectories of change as compared to their co-members who were in the Third Age. Similarly, men and women did not differ in their change trajectories over time.

To summarize the results: There was very little evidence to indicate that subgroups whose members were older and primarily women were most at risk for functional decline over time. At the sample level, persons older than age 85 showed steeper decline trajectories, but this effect was not age-differential within the groups. The only finding that provides some evidence for the above line of argument was that the Disparate-Profile Subgroup, whose members were older, showed the strongest decline on measures of cognitive functioning. Men and women differed in their psychological functioning across the domains considered, but gender was *not* found to play a role in subgroup composition and subgroup change over time.

The Role of Biological and Environmental Factors. To examine the importance of biological and environmental factors for determining subgroup differences in change over time, multiple regression analyses were utilized with subgroup membership, physical functioning and life-history factors as predictors of change over time on the profile-defining measures.

Subgroup membership was transformed into two dummy-coded variables with one variable contrasting the Overall-Positive Profile Subgroup against the rest, and the other variable contrasting the Disparate-Profile Subgroup against the rest. These two subgroups were selected because the above results indicated that those were the groups that changed over time. Physical functioning was represented by a unit-weighted composite measure of multimorbidity and sensory functioning,[12] and life-history factors were represented by a unit-weighted composite measure of occupational prestige, education, and income. For better interpretability, both measures were *z*-standardized. Change over time on a given measure was represented by difference scores between baseline assessment and the third wave of BASE, neglecting the second wave. Results are reported regarding change over time on (a) the overall functioning/desirability composite, (b) cognition, (c) personality and self-related functioning, and (d) social integration. Information about means, standard deviations, and zero-order Pearson correlation coefficients can be obtained from Appendix C (see Section C.2.2 for Table C.12).

Multiple regression analyses indicated that the linear combination of subgroup membership (Overall-Positive Profile Subgroup, Disparate-Profile Subgroup), physical-functioning factors, and life-history factors accounted for 13.5% of the variance in change in the overall functioning/desirability measure, F (4,125) = 4.88, $p < .01$, adjusted $R^2 = .11$. Similar results were found for change in cognitive functioning, 11.7%, F (4,125) = 4.13, $p < .01$, adjusted $R^2 = .09$; change in personality and self-related functioning, 11.2%, F (4,125) = 3.54, $p < .01$, adjusted $R^2 = .07$; and change in social integration, 17.5%, F (4,125) = 6.65, $p < .001$, adjusted $R^2 = .15$. Each of the above effects can be considered small with the exception of the effect for social integration, which is of medium size (Cohen, 1977). To assess the relative importance of the four predictors, beta weights and uniqueness indices were reviewed and these are presented in Table 16. Beta weights represent standardized multiple regression coefficients obtained when a given change measure was regressed on the four predictors, and the uniqueness index for a given predictor is the percentage of variance in the outcome variable accounted for by that predictor, beyond the variance accounted for by the other predictors.[13]

Table 16 shows that the Overall-Positive Profile Subgroup ($\beta = -.38$; $UI = .070$) and physical functioning ($\beta = .09$; $UI = .027$) displayed significant (or marginally significant)

[12] It was decided not to use the ADL/IADL measure because of ceiling effects in the Overall-Positive Profile Subgroup (see Appendix C.1.3 for Table C.1).
[13] For discussion of problems associated with determining unique and shared effects, see Baron and Kenny (1986) and Lindenberger and Pötter (1998).

beta weights and uniqueness indices in the prediction of change in overall functioning/desirability. The minus sign for the Overall-Positive Profile Subgroup indicated that membership in the group was associated with larger decline in psychological functioning/desirability as compared to both other subgroups. Higher levels of baseline physical functioning tended to be linked with less decline in psychological functioning. The Disparate-Profile Subgroup showed a significantly negative beta weight (– .63; *UI* = .077) in predicting change in cognitive functioning suggesting that members in this subgroup declined more as compared to both other subgroups. The Overall-Positive Profile Subgroup, in contrast, declined stronger on non-cognitive measures as revealed by significant negative beta weights on both change slopes for personality and self-related functioning (β = –.37; *UI* = .035) and social integration (β = –.50; *UI* = .030). In addition, a significant positive beta weight was found for the Disparate-Profile Subgroup on the change slope for social integration (β = .48; *UI* = .026) indicating that members increased somewhat over time According to statistical convention (Cohen, 1977), each of these effects can be referred to as small effects. Neither physical functioning nor life-history variables were found to show significant beta weights on change across measures of overall psychological functioning/desirability, cognition, personality and self-related functioning, and social integration.

Table 16

Beta Weights and Uniqueness Indices Obtained in Multiple Regression Analyses of Subgroup Status, Physical Functioning, and Life-History Factors to Predict Change Over Time in the Four Composite Measures of Psychological Functioning

Outcome	Beta Weight [a]		Uniqueness index (UI) [b]	
Predictors	Beta	*t* [c]	UI	*F* [d]
Δ Overall Functioning/Desirability				
Overall-Positive Subgroup	–.38	–3.19**	.070	10.17***
Disparate-Profile Subgroup	.03	.24	.001	.06
Physical Functioning	.09	1.96[a]	.027	3.84 [b]
Life-History Factors	.02	.40	.001	.16
Δ Cognition				
Overall-Positive Subgroup	–.26	–1.46	.015	2.14
Disparate-Profile Subgroup	–.63	–3.30**	.077	10.90***
Physical Functioning	.10	1.38	.014	1.91
Life-History Factors	–.02	–.32	.001	.10
Δ Self and Personality				
Overall-Positive Subgroup	–.37	–2.22*	.035	4.47*
Disparate-Profile Subgroup	.15	.85	.005	.72
Physical Functioning	.05	.83	.005	.68
Life-History Factors	.01	–.16	.000	.01
Δ Social Integration				
Overall-Positive Subgroup	–.50	–2.14*	.030	4.58*
Disparate-Profile Subgroup	.48	2.24*	.026	4.00*
Physical Functioning	.14	1.57	.016	2.47
Life-History Factors	.11	1.16	.001	.14

Note. $N = 130$; Physical Functioning: Unit-weighted composite of multimorbidity and sensory functioning; Life-History Factors: Unit-weighted composite of occupational prestige, years of education, and income. [a] Beta weights are standardized multiple regression coefficients obtained when each of the composite measures was separately regressed on all four predictors. [b] Uniqueness indices indicate the percentage of variance in each of the composite measures accounted for by a given predictor variable beyond the variance accounted for by the other three predictors. [c] For *t* tests that tested the significance of the beta weights $df = 125$. [d] For *F* tests that tested the significance of the uniqueness indices $df = 1, 125$.
* $p < .05$, ** $p < .01$ [a] $p = .06$, [b] $p = .05$.

The above analyses offer convergent evidence to results from the repeated measures ANOVAs and suggest that subgroup differences in change over time remained after statistically controlling for differences in biological and environmental factors. In contrast, the latter factors were not found to play a major role in determining (subgroup) differences in change over time. It was only on the overall measure of psychological functioning/desirability that physical-functioning factors including multimorbidity and sensory functioning marginally accounted for unique portions of the variance in change over time. Across all four outcome measures examined, life-history factors did not show any significant contribution to explain variability in change over time. A similar picture was found when using interaction terms with subgroup status to examine whether both sets of predictors were differentially linked to subgroup change over time. In these analyses, none of the interaction terms became statistically significant (results not specifically reported). The overall pattern of results suggests that individual and group differences in objectively diagnosed health and sensory functioning as well as socio-economic inequalities did not play a major role in determining change over time in the 6-year longitudinal BASE sample. It has to be acknowledged though that such interpretation may have to be qualified by the fact that the present study was limited in statistical power to detect actual effects. For the results of power analyses, the interested reader may refer to Appendix C (see Section C.2.2 for Table C.13).

4. 3. 1. 3 Follow-Up Analyses on Subgroup Changers

To further exploit instability in subgroup membership as a potential facet of differential aging, differences in cross-disciplinary factors between individuals who were stable in group membership (i.e., at two out of three occasions, $n = 79$) and those who transited to a different group ($n = 51$) are examined. The next section briefly reports three sets of follow-up analyses: (a) differences at baseline assessment, (b) differences in change over six years on biological factors, and (c) differences between biological and environmental factors in the prediction of change over time.

Differences at Baseline Assessment. At baseline assessment, individuals who showed subgroup transition were found to be older, 79.8 vs. 77.2, F (1,128) = 5.75, $p < .05$; more impaired in health, 50.7 vs. 54.7, F (1,128) = 5.91, $p < .05$; and sensory functioning, 54.5 vs. 58.5, F (1,128) = 6.33, $p < .05$. When controls were introduced for age and gender, the health difference remained statistically significant, F (1,126) = 5.36, $p < .05$, but the sensory difference vanished. No differences were found for age, gender, IADL functioning, and life-history factors.

Differences in Change on Biological Factors. At the sample level, a series of repeated measures ANOVAs indicated more or less substantive decline on measures of multimorbidity, sensory functioning, and (Instrumental) Activities of Daily Living, which amounted to 0.41 *SD* units for sensory functioning. However, decline on these physical-functioning measures was neither differential for the subgroups identified at baseline assessment nor for BASE participants who changed group membership over time.

Differences Between Biological and Environmental Factors in the Prediction of Change Over Time in Psychological Profile Measures. In multiple regression analyses, change over time on the profile-defining measures was regressed on subgroup stability, physical functioning and life-history factors as well as interaction terms between subgroup stability and the physical-functioning and environmental factors, respectively. Similar to analyses using subgroup membership at baseline assessment, none of the interaction terms turned out to be statistically significant. This indicates that neither biological nor environmental factors were found to be differentially linked with subgroup stability in the prediction of change in measures of psychological functioning.

In sum, follow-up analyses indicated that lower functioning at baseline assessment on measures of physical functioning, particularly multimorbidity, distinguished among BASE participants who were stable in subgroup membership and those who were not. No evidence, however, was found to suggest that participants who changed membership status, relative to stable participants, were more likely to decline on physical functioning measures. In the same vein, biological and environmental factors did not add to the prediction of change in psychological functioning between ‘subgroup-movers’ and ‘subgroup-constants.’ The latter two findings provide convergent evidence to results reported in Section 4.2.3, which suggest that physical functioning and life-history factors were not of major importance in the present study to determine change over time.

To conclude the section on the role of external correlates in determining subgroup change over time: It was found that the psychological profile subgroups showed meaningful and substantive differences at baseline assessment on a number of cross-disciplinary measures that may represent past and current developmental contexts. However, these measures were not found to play a major role in determining differential change over time neither between the subgroups identified at baseline assessment nor between those who were stable in group membership and those who were not (Q_{2b}). This lack of association may be attributed to the general positive selection of the 6-year longitudinal BASE sample on these factors. That is, the sample may have been functioning too well to have faced physical restrictions that may in turn be associated with decline in other areas of functioning.

4. 3 Outcomes of Heterogeneity and Differential Development Over Time: Consequences of Subgroup Differences in Psychological Profiles and Change Over Six Years

The last set of research questions to be examined in the present dissertation study addresses pivotal consequences of heterogeneity and differential development in old age. It was proposed that individuals in subgroups with more functional psychological profiles were more ‘successful’ on a subjective outcome (well-being) as well as on an objective outcome (survival). More specifically, the prediction was that these subgroups reported higher well-being over time (Q_{3a}) and lived longer after study completion (Q_{3b}). In the following sections, results from multiple regression analyses to examine subgroup differences in well-being are reported first. This is followed by presenting results from hazard regression analyses that examined survival differences between the subgroups. In each section, two sets of follow-up analyses are carried out. First, the predictive effect of subgroup status for successful aging outcomes is contrasted against that of a function-oriented approach. Second, special attention is paid to BASE participants who changed subgroup status over time.

4. 3. 1 Well-Being

To examine subgroup differences in well-being at baseline assessment, a one-way ANOVA was carried out with group status as independent variable and baseline measures of well-being as dependent variable. Findings indicated significant differences between the subgroups, F (2,127) = 10.86, $p < .001$. The effect remained after covarying out age, gender, multimorbidity, sensory functioning, and life-history status, F (2,122) = 7.20, $p < .01$. Post-hoc analyses denoted that the Disparate-Profile Subgroup (M = 47.4) reported significantly less well-being than both the Overall-Positive Profile Subgroup (M = 55.2) and the Average-Profile Subgroup (M = 51.6), which suggests that group differences were substantial and amounted to three quarters of a standard deviation. Basically the same pattern of subgroup differences was found at the last measurement occasion, F (2,127) = 8.72, $p < .001$. Repeated measures ANOVAs revealed that the within-subject factor was significant, Wilk’s $\lambda = .90$, F (1,127) = 14.4, $p < .001$, $\eta^2 = .10$, indicating that well-being declined over time, but this decline was not differential among the three subgroups, Wilk’s $\lambda = .99$, F (2,127) = 0.5, $p > .10$. Accordingly, evidence was found for the proposal that the subgroups not only differed from one another in their psychological profile, but also on a powerful subjective outcome measure of successful aging. Figure 17 shows graphically that the subgroups differed from one another in subjective well-being at baseline assessment and that these differences were more or less maintained over a period of six years.

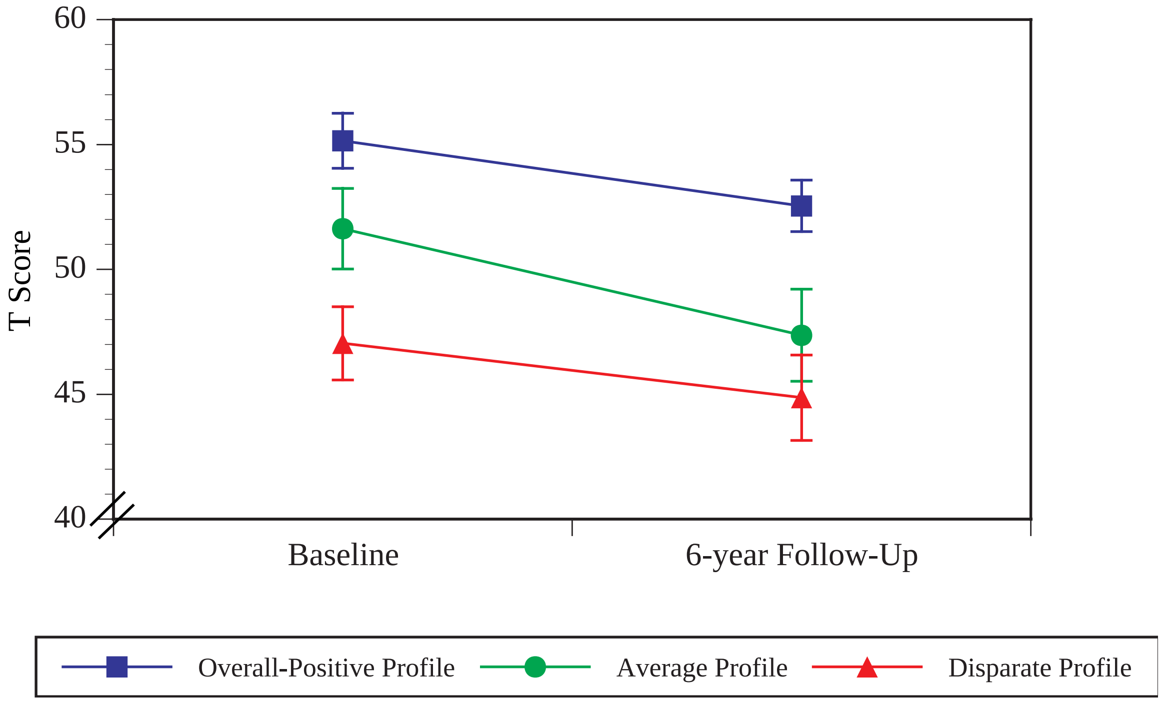

Figure 17 Differences in subjective well-being over six years between the three subgroups identified at baseline assessment of the 6-year longitudinal BASE sample.
Note. Well-being declined over time, but decline was not differential among the three subgroups. Error bars = *SE*.

To examine whether subgroup status at baseline assessment is predictive of well-being over time, well-being scores at the third occasion were regressed on subgroup membership. The effect of other potentially important correlates (i.e., age, gender, multimorbidity, sensory functioning, and life-history status) was covaried out by entering the covariates block-wise in a first step, followed by entering subgroup status in a second step. To be in analogy to results reported from the subgroups identified in the total cross-sectional BASE sample (Smith, 2003b; Smith & Baltes, 1997), the Average-Profile and the Disparate-Profile Subgroup were pooled to represent the, relative to the sample, less functional/desirable profiles (see also Section 4.1.4). This pooled subgroup was contrasted against the Overall-Positive Profile Subgroup, which represents the more functional/desirable psychological profiles. Acknowledging the positive selection of the 6-year longitudinal BASE sample implies that the less functional/desirable profiles extracted from this sample were functioning at a higher level than those in the total sample. Demonstrating predictive effects despite the constraints of positive sample selection highlights the utility of a subgroup approach to study aspects of differential development in old age. Analyses carried out to examine outcomes of subgroup membership over time (see also survival analyses in Section 4.3.2) are primarily reported on the basis of this pooling procedure, but analyses contrasting the three subgroups separately are also denoted.

Means, standard deviations, and intercorrelations for the predictor and outcome variables used in multiple regression analyses to predict well-being over time can be obtained from Appendix C (see Section C.3 for Table C.14). As shown in Table 17, multiple regression analyses indicated that membership in the subgroups identified at baseline assessment was highly predictive of well-being six years later, F (1, 128) = 16.24, p < .001; R^2= .113; adjusted R^2 = .106.[14] Beta weights for the subgroups were positive and substantial (β = 0.34, p < .001), which suggests that membership in the Overall-Positive Profile Subgroup was linked to higher well-being over time. The effect size R^2 pointed out that subgroup membership at the zero-order level accounted for 11% of the variance in well-being at the third measurement occasion.

To determine the robustness of this effect, it was tested whether subgroup membership was predictive of well-being over and above important cross-disciplinary factors in old age, which represent past and current contexts of differential development in old age. The equation that simultaneously contained subgroup membership as well as age, gender, life-history factors (occupational prestige, education, income), dementia, multimorbidity, and sensory functioning was found to significantly predict well-being at the last occasion, F (6, 120) = 4.82, p < .001, R^2 = .194; adjusted R^2 = .154, and subgroup membership contributed uniquely to this prediction after all other variables were entered in a previous step, Δ F (6, 120) = 6.54, p < .05; Δ R^2 = .044. The beta weight (β = .23) for the subgroups was still substantive. According to statistical convention (Cohen, 1977), both effect sizes were small.

The above results provide evidence for the expectation that subgroups with more functional/desirable psychological profiles reported higher well-being over time (Q_{3a}). The effect remained after taking into account other potentially relevant correlates that represent past and current developmental contexts (P. B. Baltes et al., 1998). Specifically, Table 17 shows that subgroup status was the only predictor that was uniquely associated with well-being over time in the final model that included all factors. In other words, psychological profile information was solely related to feeling well in old age, but age, gender, socio-economic status,

[14] Using the three subgroups separately (two dummy-coded variables) also revealed a significant predictive effect for well-being at the last occasion, F (2, 127) = 8.72, p < .001; R^2= .121; adjusted R^2= .107.

health status, and sensory functioning were not. In a similar vein, follow-up analyses compared the predictive effect of the profile approach to that of the single profile-defining measures. It was found that some of these measures were predictive of well-being (e.g., perceptual speed), but that the effect vanished when controls were introduced for the above covariates and for subgroup status. As is to be expected, neuroticism was the only profile-defining measure for which a robust predictive effect was found, but subgroup membership also remained a unique predictor of well-being in these analyses. The next section reports results from a last set of analyses on well-being that specifically targeted those BASE participants who changed subgroup membership over time.

Table 17
Hierarchical Regression Analyses of Subgroup Status, Age, Gender, Life-History Factors, Multimorbidity, and Sensory Functioning to Predict Well-Being at the Third Measurement Occasion

	Hierarchical Regression					
	Step 1			Step 2[b]		
Predictors	*B*	*SE*	*β*	*B*	*SE*	*β*
Age				-0.12	0.16	-.07
Gender				-0.99	1.65	-.05
Life-History Factors				0.16	0.10	.14
Multimorbidity[a]				0.12	0.09	.12
Sensory Functioning				0.15	0.11	.14
Subgroups	6.66***	1.65	.34***	4.37*	1.71	.23*
R^2	.11			.19		
ΔR^2	.11			.04		
F for ΔR^2	16.24			6.54		
df	1,128			6,120		
$p <$	.001			.05		

Note. Life-history factors: Unit-weighted composite of occupational prestige, years of education, and income. [a] reverse-coded. [b] Dementia cases were excluded ($n = 3$). * $p < .05$; *** $p < .001$.

4. 3. 1. 1 Follow-Up Analyses on Subgroup Changers

To further explore characteristics of individuals whose subgroup membership was not stable, additional analyses compared mean levels and change over time in subjective well-being between BASE participants who changed subgroup membership over time ($n = 51$) and those who remained in the same subgroup over two out of three occasions ($n = 79$).

At baseline assessment, individuals who showed subgroup transition and those who remained stable in subgroup membership were not found to differ significantly from one another in subjective well-being, 51.3 vs. 52.2, F (1,128) = 0.32, $p > .10$. Despite the finding that well-being declined significantly over time at the sample level, Wilk's $\lambda = .85$, F (2,127) = 11.44, $p < .001$, $\eta^2 = .15$, this decline was not differential between the 'subgroup-movers' and 'subgroup-constants', Wilk's $\lambda = .99$, F (2,127) = 0.65, $p > .10$, $\eta^2 = .01$. Overall, well-being was not found to be a factor that distinctively characterized those who changed subgroup membership status over time. The following section reports analyses aimed at examining an objective outcome of heterogeneity and differential development in old age, survival.

4. 3. 2 Survival

To examine whether subgroups with more functional psychological profiles lived longer after study completion (Q_{3b}), Cox proportional hazards regression models (Cox, 1972) were evaluated for the effects of risk factors. The PHREG procedure from the SAS software package (SAS, 1997) was used to estimate regression models that predicted survival after the third measurement occasion over a period of approximately 4 years (Allison, 1995). To control for the confounding effects of demographic characteristics (e.g., higher mortality rates for men than for women and for older than for younger persons; Palmore, 1982), proportional hazard regression models are preferable to model mortality status after a certain period of time (see also Smith, 2001). Results are reported with and without introducing controls for other potentially important covariates of survival. The effects of covariates were partialed out by using hierarchical regression-type block-wise entry of variables: Covariates were entered in the first step, and subgroup membership was entered in the second step.

From the 6-year longitudinal BASE sample, 52 (42%) participants were deceased four years after the last measurement occasion and 72 were still alive. Mortality status was missing for 6 participants because they had moved out of the Berlin area. These individuals were not considered in the mortality analyses. As is to be expected for a sample of this advanced age, a larger proportion of participants in the Fourth Age had died than in the Third Age category, 54% vs. 34%, χ^2 (1, N = 124) = 4.8, $p < .05$. Men and women did not differ in their mortality status, 46% vs. 38%, χ^2 (1, N = 124) = 0.8, $p > .10$. Figure 18 and Table 18 report descriptive information of subgroup differences in mortality status and distance to death (survival). Figure 17, for example, shows that the Disparate Profile Subgroup had numerically the shortest distance to death (survival) after the end of the study (44 months, on average).

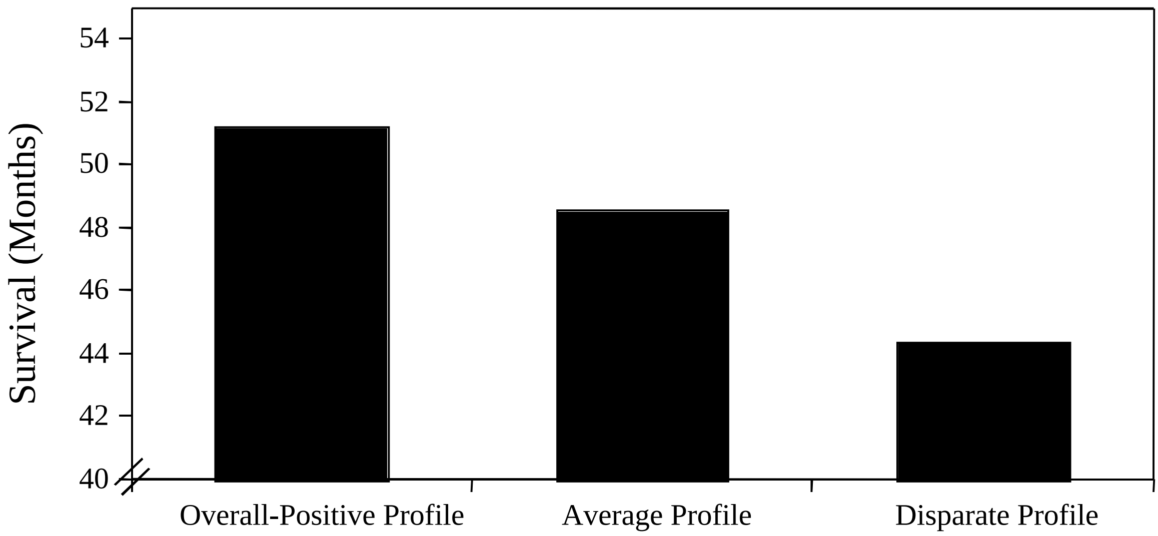

Figure 18 Differences in survival time over four years for the three subgroups identified at baseline assessment of the 6-year longitudinal BASE sample.

Note. Survival time was calculated for those who were deceased 4 years after the last measurement occasion in BASE. For overview, see Table 18.

From Table 18 can be obtained that, for example, 39 of the 58 participants from the Overall-Positive Profile Subgroup for whom mortality information was available were still alive in July 2002. This means that less than 50% in this group have died and thus constitute censored cases. As a consequence, the risk ratio represents a safer and more robust effect size measure than a monthly survival disadvantage (J. Singer & Willett, 2003). In analogy to previous mortality analyses in BASE (Smith, 2003b; Smith & Baltes, 1997) as well as to the preceding section on subgroup differences in well-being, the Average Profile Subgroup and the Disparate Profile Subgroup were pooled to represent the, relative to the sample, less functional/desirable profiles (see also Section 4.1.4). Survival analyses primarily focused on contrasting this pooled subgroup against the Overall-Positive Profile Subgroup, and survival differences among the three subgroups separately are only be briefly mentioned. Accordingly, Table 18 also reports mortality status and distance to death for the Average-Profile and the Disparate-Profile Subgroup pooled.

Table 18
Differences in Mortality Status and Distance to Death for the Three Subgroups Identified at Baseline Assessment of the 6-Year Longitudinal BASE Sample

Subgroup	Dead	Alive	Distance to Death (months)*
Overall-Positive (*n* = 61)	19	39	51.16
Average Profile (*n* = 28)	13	13	48.51
Disparate Profile (*n* = 41)	20	20	44.33
Average & Disparate Profile Pooled	38	38	45.98
Total	52	72	48.40

Note. Mortality information was missing for *n* = 6. * Survival time was calculated as the distance between last measurement occasion and participant's date of death.

Hazard regression models provided empirical evidence that was consistent with the expectation (Q_{3b}): Subgroups with more functional/desirable psychological profiles lived longer after the end of the study period in BASE, χ^2 (1, N = 124) = 4.7, $p < .05$, *Relative Risk* [*RR*] = 0.54; Confidence Interval [*CI*] = 0.30–0.95. A relative risk or hazard ratio of 0.54 suggests that the hazard of dying for the Overall-Positive Profile Subgroup was approximately half of that for the pooled Average-Profile and Disparate-Profile Subgroup.[15] Subgroup differences in mortality hazards were found to be robust because the effect remained after controls were introduced for dementia, life-history factors, sensory functioning, multimorbidity, and gender, χ^2 (1, N = 124) = 4.0, $p < .05$, *RR* = 0.51; CI = 0.26–0.99. After additional controls were introduced for whether the participant was in the Third Age or Fourth Age category, the survival difference between the subgroups slightly surpassed the .05 significance level boundary, χ^2 (1, N = 124) = 3.3, $p = .07$, *RR* = 0.54; CI = 0.28–1.06, but the tendency was still there. Figure 19 shows graphically how the subgroups differ from one another in their mortality hazards over a period of four years. It can be seen that survival probabilities diverge relatively early (by approximately two years) over the four-year period and remain more or less constant afterwards. It was decided to consider the complete four-year period after the last measurement occasion in BASE because effect sizes can be expected to become more stable, the more censored cases (i.e., dead) are available (J. Singer & Willett, 2003).

[15] Follow-up analyses indicated that the Overall-Positive Profile Subgroup lived longer than both other subgroups separately. As compared with the Disparate-Profile Subgroup, the relative risk for the Overall-Positive Profile Subgroup was 0.71, χ^2 (1, N = 124) = 4.5, $p < .05$, CI = 0.52–0.97. As compared with the Average-Profile Subgroup, the relative risk was 0.75, χ^2 (1, N = 124) = 2.9, $p = .08$, CI = 0.54–1.04, which slightly exceeded the .05 significance level. However, after taking inequalities in life context factors into account (occupational prestige, education, income), the relative risk was 0.65, χ^2 (1, N = 124) = 5.2, $p < .05$, CI = 0.44–0.95.

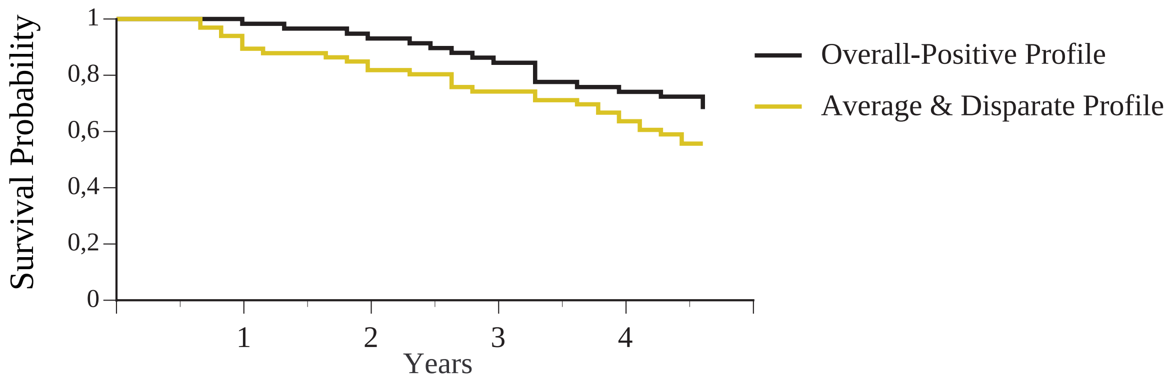

Figure 19 Differences in survival probabilities between the three subgroups identified at baseline assessment of the 6-year longitudinal BASE sample: Subgroups with more functional/desirable psychological profiles lived longer over a 4-year period after the end of the study.

Note. Survival differences between the groups were already present after two years and remained more or less constant afterwards. The complete four-year period after the last wave of BASE was nevertheless considered because effect-size estimates become increasingly more stable, the more censored cases (i.e., dead) are available (J. Singer & Willett, 2003).

In analogy to analyses from Maier and Smith (1999) using the total-cross-sectional BASE sample, it was examined which profile-defining domains were associated with elevated mortality hazards in the 6-year longitudinal BASE sample. Cox regression models suggested that cognitive functioning was the only domain that was related with elevated risks of dying, χ^2 (3, N = 124) = 12.2, $p < .01$, whereas the domains of personality and self-related functioning, χ^2 (5, N = 124) = 2.9, $p > .10$, and social integration were not, χ^2 (3, N = 124) = 5.0, $p > .10$. When controls were introduced for dementia, life-history factors, sensory functioning, multimorbidity, and gender, the cognitive domain was no longer significant, χ^2 (3, N = 124) = 4.9, $p > .10$. Follow-up analyses revealed that the predictive effect of cognitive functioning for survival was due to memory (RR = 0.95; CI = 0.91–0.98, $p < .01$): For each one-unit increase in memory (i.e., one T-score unit) the hazard of dying goes down by an estimated 5.0%. Taken together, at the single-variable/domain level, there were very few indications that measures of psychological functioning in the 6-year longitudinal BASE sample were associated with increased hazards of dying. This result is somewhat in contrast to findings from the total cross-sectional BASE sample (see Maier & Smith, 1999) and it once again illustrates the positive selection of the small 6-year longitudinal BASE sample. Despite the finding that only one out of 11 profile-defining measures evinced (less robust) predictive effects for mortality, a systemic-wholistic perspective, in contrast, indicated substantive evidence that profile information about psychological functioning was associated with living longer.

Table 19 shows mortality risks associated with subgroup status in the context of other potentially important correlates of survival. At the zero-order level, multimorbidity χ^2 (1,N = 124) = 4.6, $p < .05$, RR = 0.97; CI = 0.94–0.99, and sensory functioning, χ^2 (1,N = 124) = 4.9, $p < .05$, RR = 0.97; CI = 0.94–0.99 were also found to predict survival. However, after adjusting for all other factors, it was only the subgroup variable that showed statistically significant associations with 4-year survival.

Table 19
Mortality Risks Associated with Membership in the Subgroups Identified at Baseline Assessment of the 6-Year Longitudinal BASE Sample and with Other Potential Risk Factors

	Mortality Risk	
Risk Factor	Unadjusted [a]	Adjusted [b]
Subgroup (0 = Overall-Positive)	0.54 (0.30 – 0.95)*	0.51 (0.26 – 0.99)*
Gender (0 = men)	0.82 (0.47 – 1.43)	0.88 (0.47 – 1.68)
Life-History Factors	1.00 (0.97 – 1.04)	1.02 (0.99 – 1.06)
Sensory Functioning	0.97 (0.94 – 0.99)*	0.97 (0.93 – 1.00)
Multimorbidity	0.97 (0.94 – 0.99)*	0.98 (0.95 – 1.01)

Note. Relative risks are reported. 95% Confidence intervals for relative risks are shown in parentheses. Life-history factors: Unit-weighted composite of occupational prestige, years of education, and income. [a] Zero-order association of each risk factor with mortality. [b] Associations of risk factors with mortality after statistically controlling for all other factors. Dementia cases were excluded (n = 3).
* $p < .05$.

To sum up the above analyses, substantive evidence was found to indicate that subgroups with more functional psychological profiles lived longer than less desirable profile subgroups over a period of four years after study completion (Q_{3b}). Effect sizes were fairly impressive because the hazard of dying for the Overall-Positive Profile Subgroup was about one half as that for the other two lower-functioning subgroups combined. The survival difference was particularly interesting because the effect was not accounted for by a number of cross-disciplinary factors that represent past and current contexts of development (P. B. Baltes et al., 1998) that have also been found to link to mortality. This finding documents the predictive strength of a systemic-wholistic view for outcomes of successful aging (P. B. Baltes & Baltes, 1990; Rowe & Kahn, 1997; Ryff & Singer, 1998).

4. 3. 2. 1 Follow-Up Analyses on Subgroup Changers

To further explore the role of subgroup changers as representing one facet of differential aging, BASE participants who remained in the same subgroup over two out of three occasions (n = 79) were contrasted in their survival hazards against those who were not (n = 51).

Cox regression analyses indicated that participants who showed subgroup transition were more likely to die over the 4-year period than were participants who were continuously assigned to the same subgroup, χ^2 (1, N = 124) = 7.0, $p < .01$, RR = 0.47; CI = 0.27–0.82. The hazard of dying for stable participants was about 53% lower as compared to their co-members who showed decline in subgroup membership. Distances to death after the last measurement occasion were 43.8 versus 51.3 months, respectively. Differences in survival remained statistically significant after controls were introduced for age cohort, gender, life-history factors, dementia, multimorbidity, and sensory functioning, χ^2 (1, N = 124) = 4.1, $p < .05$, RR = 0.54; CI = 0.30–0.98. In sum, a small group of 6-year longitudinal BASE participants were found show systemic decline across various domains of psychological functioning and, associated with this, were vulnerable for subgroup transition (see Section 4.2.2.2.2). Subgroup transition, in turn, was found to be accompanied by an elevated risk of death over a four-year period after the end of the study. The finding nicely illustrates the potential utility of applying a systemic-wholistic approach to study issues about differential aging: It was not only level information across a number of different psychological domains, but also systemic change over time that was predictive of survival in a sample of older individuals.