

Self-Evaluation Processes in Life Satisfaction: Uncovering Measurement Non-Equivalence and Age-Related Differences

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Accepted: 19 November 2010 / Published online: 30 November 2010
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Abstract This study demonstrates how self-evaluation processes explain subgroup differences in ratings of life satisfaction (population heterogeneity). Life domains differ with regard to the constraints they impose on beliefs in internal control. We hypothesized that these differences are linked with cognitive biases in ratings of life satisfaction. In fact, two subgroups of respondents needed to be distinguished, for which life satisfaction scores were non-equivalent measures. Self-evaluation processes also helped to explain age-related differences in life satisfaction. Age was unrelated or positively related to life satisfaction in a subgroup of respondents who perceived comparatively high levels of control over high-constraining life domains such as work, income, and standard of living. However, age yielded a substantial negative relationship with life satisfaction among participants who reported reduced levels of control in these domains. Results from a German representative sample were replicated with data from an online survey.

Keywords Self-evaluation · Cognitive bias · Life satisfaction · Population heterogeneity · Mixed Rasch model

1 Introduction

Life satisfaction measures the cognitive dimension of well-being (SWB; e.g., Diener et al. 1985; Diener and Diener 1995), while emotional well-being is indexed by positive and negative affectivity (e.g., Diener et al. 1991). We expect self-evaluation processes to predict meaningful cognitive biases in ratings of life satisfaction (e.g., Cummins and Nistico 2002; Schwarz and Strack 1999). In recent years, group differences in ratings of life satisfaction have been investigated. While previous research has examined manifest group differences related to culture, age, or value system (Oishi et al. 1999; Kasser and Ahuvia 2002; Oishi 2006), we examined latent differences between subgroups. We used hypothesized differences in the cognitive construction of life satisfaction to predict subgroups of respondents

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for whom life satisfaction scores tap different measurement dimensions. We expected that a classification of respondents into subgroups would be warranted because psychologically meaningful judgmental processes operate in ratings of life satisfaction (Taylor and Brown 1988; Taylor et al. 1995). We aimed to demonstrate how these meaningful judgmental processes underlie population heterogeneity in a life-satisfaction measure. As a consequence of heterogeneity, the validity of life-satisfaction ratings may differ between subgroups of respondents, and relationships between life satisfaction and relevant predictors need to be calculated within, rather than across, these subgroups. We focused on the participants' age, and predicted differential relationships between age and life satisfaction. We suggest that self-evaluation processes that may explain population heterogeneity also explain differential relationships with age (Robinson and Ryff 1999).

2 Top-Down and Bottom-Up Models of Life Satisfaction

Studies generally find a rather weak relationships between objective living conditions, such as socio-economic variables or health status, and life satisfaction, a phenomenon that has been labeled the subjective well-being paradox (e.g., Kunzmann et al. 2000; Staudinger 2000; Staudinger et al. 1995). To explain this phenomenon, top-down models of life satisfaction refer to biological, affective, and cognitive dispositions that explain why SWB is comparatively stable across time, irrespective of situational circumstances or even extreme life events (Brickman et al. 1978; Heller et al. 2004). Brickman and Campbell (1971) developed the notion of a "hedonic treadmill," according to which people adapt to changing circumstances to a point of affective neutrality through readjusting evaluative standards (e.g., Headey and Wearing 1992). There is also evidence for the view that well-being has a substantial heritable component (Bowling et al. 2005). Accordingly, a modification of the "hedonic treadmill" has recently suggested that people readapt to a personal set-point (Fujita and Diener 2005). In contrast, bottom-up models of life satisfaction emphasize that (objective) information and circumstances are related to subjective perceptions. A much-researched example is job satisfaction, which depends on subjective, but also objective, characteristics of the job in question (Hackman and Oldham 1976). Another example is pay level satisfaction. For instance, a meta-analysis conducted by Williams et al. (2006) reported that the actual pay level was an important, but not the dominant, predictor of pay-level satisfaction (for a review of top-down and bottom-up processes in life satisfaction see, Heller et al. 2006).

3 Self-Evaluation Processes and Life Satisfaction

To ensure a well-defined and positive view of the self, people strive for accurate self-knowledge (self-assessment), certain self-knowledge (self-verification), and favorable self-knowledge (self-enhancement). However, self-enhancement (that is, the desire to enhance a positive view of the self and to shield it from negative information) has been found to be a dominating need (Sedikides 1993). Self-evaluation theories (Sedikides 1993; Taylor et al. 1995) refer to both stable self-evaluation motives (top-down processes) and evaluations of information sources (bottom-up processes) to explain judgmental biases. Research on processes of self-evaluation has identified various judgmental mechanisms that explain how individuals maintain predominantly positive views of themselves and their lives. "Positive illusions" include a sense of control (Peterson and Stunkard 1989), optimism

regarding the future (Taylor and Brown 1988), and a positive sense of the self (Taylor and Brown 1994). Self-enhancing cognitions, such as high self-esteem, facilitate self-regulation in stressful situations (Aspinwall and Taylor 1992) and contribute directly to SWB by making self-serving social comparisons more likely (Wheeler and Miyake 1992).

The strength of self-enhancing tendencies has been found to depend on qualities of what is being evaluated (e.g., which life domain). Self-enhancement seems to be driven by an informational and a motivational principle, such that it is high if (1) ambiguity or uncertainty is high, and (2) the motivation to self-enhance is high, for instance, if the evaluated domain is central to the self (McFarlin and Blascovitch 1981; Alicke 1985; Dunning et al. 1989). Life domains are likely to differ with regard to the amount and kind of information usually available for self-evaluation (Taylor et al. 1995). We assume that self-enhancement should be high if “evidence” on which participants may base their evaluations of a life domain is scantily available or ambiguous (informational principle). Individuals should self-enhance more about those life domains over which they believe they have greater control (motivational principle).

4 Objective Living Conditions and Constraints to Self-Enhancement

Domain-specific life satisfaction seems to be one source of information that individuals consult when evaluating their overall life satisfaction (Heller et al. 2004; Schwarz and Strack 1999). We argue that the interplay of self-enhancement needs (top-down processes) and domain-specific life satisfaction as a source of information (bottom-up processes) may explain specific forms of judgmental bias in ratings of life satisfaction. The idea that constraints on self-enhancing tendencies may differ between life domains (Taylor et al. 1995) is central to this prediction. Objective living circumstances, such as standard of living and income, may play a distinct role in the judgmental processes that operate in evaluations of SWB.

4.1 Ambiguity

Life domains such as “standard of living” and “working life” are likely to differ from other domains in that objective information (income, etc.) is available to a greater extent. In many other domains, personal sources of information (personal standards, past and future selves, etc.) prevail. If objective sources are available, self-enhancing tendencies are constrained. For instance, Heidemeier and Moser (2009) found in a meta-analysis on self-evaluations that the availability of objective indicators was one of the most important moderators of self-other agreement.

4.2 Sense of Control

Moreover, a person’s working life and standard of living may have a specific potential to constrain perceptions of internal control. Research has documented that internal control beliefs depend on situational differences, wherein pre-work and post-work phases differ from phases that are dominated by work (Wolk 1976; Knoop 1989). Referring to social learning theory, Knoop (1989) argued that a person’s working life has a strong potential to increase external expectancies, that is, a stronger acknowledgment of external sources of control. We hypothesized that the evaluation of one’s *standard of living*, *working life*, or *income* may constrain self-enhancement more strongly than other domains (e.g., family, friends, personal attractiveness).

Hyp. 1 Perceived internal control over life domains is lower for “working life,” “income,” and “standard of living” than for other life domains.

4.3 System of Life Domains

If constraints to self-enhancement vary systematically between life domains, cognitive processes may lead to specific forms of judgmental bias. Comparison standards for “high- and low-constraining” life domains may influence each other. Participants who perceive their working lives or standard of living as dissatisfying, and who cannot self-enhance due to judgmental constraints, may compensate by applying comparatively lower evaluative standards regarding, for example, their social lives. If a positive evaluation is difficult in highly constraining life domains, comparison standards in less constraining life domains may be readjusted such that an overall favorable evaluation of life satisfaction results. Such cognitive bias is functional in that it enables individuals to maintain a more positive view of the self overall.

Hyp. 2 Comparison standards for “high- and low-constraining” life domains interact to enable high levels of overall life satisfaction. That is, reduced scores in high-constraining life domains are compensated for by augmented scores in low-constraining domains. (For a subgroup of respondents, item difficulties for high-constraining life domains are augmented while those for low-constraining life domains are overly low).

If cognitive biases operate in systematic ways, the corresponding subgroups of respondents can be identified. Technically speaking, these subgroups differ with regard to the latent dimension (life satisfaction) that is being assessed with the same set of items. Consider the more well-known case of differential item functioning (DIF). The research question addressed by DIF is whether item characteristics differ depending on manifest group differences, such as gender (Horn and McArdle 1992; Zumbo 2007). If differences in the way items are related to the latent construct are detected, researchers assume that the latent dimension assessed is not equivalent between subgroups (e.g., male and female respondents). The present study examines differential item functioning for latent rather than manifest groups (von Davier and Yamamoto 2004). We use the mixed Rasch model to identify subgroups of respondents for whom item difficulties differ, and different latent dimensions are being assessed. Within these subgroups, a Rasch model holds (i.e., items of varying difficulty contribute equally to the latent measurement dimension). We expect item difficulties to differ between life domains, as well as between unobserved subgroups of respondents. The reason is that work-related life domains should impose higher constraints on self-enhancement for a subgroup of respondents. This amounts to arguing that heterogeneity in life satisfaction is not closely tied to manifest group differences (e.g., age, sex, education). After all, the notion that satisfaction with objective living conditions is only loosely tied to actual living conditions is supported by much research evidence. Instead, systematic differences in subjective evaluations of life domains can be used to identify subgroups in the overall sample.

5 Group-Specific Validities of Life Satisfaction Scores

Population heterogeneity implies that life satisfaction represents different latent dimensions for subgroups of the sample. As a consequence, the validities of life satisfaction scores may differ between these subgroups. If relationships with important predictors (such

as age, socio-economic variables, and personality) differ between subgroups, this underlines that different latent traits are indeed being assessed by measures of life satisfaction. Accordingly, we examined an important predictor of life satisfaction that has also been related to perceptions of internal control (e.g., Lachman 2006): participants' age.

5.1 Relationships with Age

Recall that the amount of *internal control* that respondents perceive that they have over different life domains is expected to explain heterogeneity in ratings of life satisfaction, and thus the need to distinguish between subgroups of respondents. Participants' *age* has been found to be relevant to individual differences in internal control (Wolk and Kurtz 1975; Nehrke et al. 1980; Ryckman and Malikiowski 1975). Lachman (1986), for instance, found that while internal control was mostly preserved, sources of external control (e.g., chance, powerful others) were acknowledged more with increasing age. Lachman (2006) reported that older adults were less likely to report high levels of control over aging-related decline. Similarly, it is reasonable to assume that hopes to control or change living circumstances in various life domains may decline with age, that is, elapsed life time. Both the informational and the motivational principle of self-deception are likely to constrict self-enhancing information processing at higher ages (Robinson and Ryff 1999). The informational principle of self-deception suggests that with elapsed life time (i.e. age) more "evidence" regarding one's living conditions accrues, while hopes to control or change outcomes in various life domains may shrink. Thus, the same self-evaluation principles that may explain differences between life domains may explain individual differences that are related to age.

Results regarding the relationship between life satisfaction and *age* are mixed and confirm that it is of a small magnitude at most. "Stability despite loss" (e.g., Kunzmann et al. 2000) is a well-established principle, which describes the paradoxical finding that life satisfaction is *on average* stable despite age-related losses. While, for instance, Diener and Suh (1998) found no significant relationship between life satisfaction and age, other authors reported a slightly positive (e.g., Stock et al. 1983; Horley and Lavery 1995) or a slightly negative (Staudinger et al. 2003) relationship. A substantial relationship between age and life satisfaction may receive support, however, if the possibility is taken into account that subpopulations of adults age differently depending on their perceptions of internal control over (high- and low-constraining) life domains. To the extent that differences in internal control explain why subgroups of respondents need to be distinguished, these subgroups of adults may differ with regard to the relationship between age and life satisfaction. The informational and motivational principles of self-deception suggest that with elapsed life time (i.e. age) more "evidence" regarding one's living conditions accrues, while hopes to control or change outcomes in various life domains may shrink. As a result, the same principles may explain a negative relationship between age and SWB, as well as stability, or even a positive relationship, depending on whether the perceived "evidence" is negative or positive.

Hyp. 3 Subgroups of adults can be identified for whom age yields different relationships with life satisfaction. For adults who face constraints to self-enhancement (reduced internal control/negative evidence), age yields a negative relationship with life satisfaction since ambiguity and beliefs in internal control decrease with age. For respondents who do not face strong constraints to self-enhancement, age yields a stable or even positive relationship with life satisfaction.

The hypotheses of the present study were first tested in one sample and subsequently replicated in a second study. Study 1 employed a national representative sample, and study 2 data from a (non-representative) large online survey. Replication seemed even more warranted than usual due to the rather uncommon research method employed, namely mixture distribution latent variable modeling. The same hypotheses were tested within both samples; results, therefore, are presented and discussed in parallel.

6 Method

6.1 Sampling and Measures

6.1.1 Study 1

A German national survey collected data on a sample of 1,607 middle-aged adults who ranged between 24 and 65 years in age (average = 45). The sample was stratified by age (five year intervals), gender, and geographical location (Eastern versus Western Germany). Data were collected as part of a larger survey within a research cooperation of the John D. and Catherine T. MacArthur Research Network on Successful Midlife Development (MidMac) and the Max Planck Institute for Human Development. Random-root sampling was carried out by a survey company (INFAS GmbH). Electoral districts served as the basis of a random assignment procedure of quotas to residential areas. Participants were interviewed face-to-face (with a response rate of 69%), in their homes, for about 1 h. All participants provided socio-demographic information (age, gender, education, income, occupational and professional status) and were randomly assigned to complete other measures that were used for different research purposes. Four levels of *educational attainment* were distinguished that are roughly equivalent to “no high school degree”, “high school degree”, “trade or technical high school degree”, and “master’s degree or higher”. To assess total *household income*, participants were asked to indicate which of the listed income categories applied. Six categories of *occupational status* were distinguished, including full-time employment, part-time employment, non-regular employment, being a homemaker, being in school or training, being in early retirement, and being unemployed. Finally, *regional origin* in either Eastern or Western Germany was recorded. Objective living conditions (e.g., socio-economic status), as well as important attitudinal measures (beliefs in internal control, worrying, importance ascribed to life domains, and confidence) are included in all subsequent analyses referring to study 1, since they serve as controls whenever relationships between life satisfaction and age are examined.

One thousand participants were randomly chosen from the entire sample and asked to respond to questions regarding their *quality of life (life satisfaction)*. Quality of life instruments typically ask respondents to rate their satisfaction with a number of life domains that are aggregated into an overall measure of life satisfaction. Participants reported their satisfaction with seven life domains: family, working life, standard of living and income, friends, physical health, physical attractiveness, and mental fitness. For each of these domains respondents indicated their satisfaction (“How satisfied are you currently with your...”) on a five-point Likert scale ranging from 1, not satisfied, to 5, very satisfied. The same 1,000 participants reported important beliefs that they held regarding the seven life domains. For each of these life domains, respondents indicated the *importance* they placed on them (ranging from 1 “not important” to 5 “very important”), how much they can influence circumstances in these life domains, i.e. *internal control* (1 “no influence”,

5 “a lot of influence”), how much they *worry* about these life domains (1 “no worries”, 5 “many worries”), and how *confident* they are that good things will happen within each life domain (ranging from 1 “not confident” to 5 “very confident”).

6.1.2 Study 2

For the purpose of replication, data from 1,470 adults were collected as part of a larger online survey. Incentives for participation in the survey were monetary (participants received credit that they can exchange for money or small gifts) as well as non-monetary (participants received feedback on survey results). More women (65%) than men participated (35%). The respondents' average age was 39.11 years, and ranged between 16 and 82 years. About .1% of the participants had no high school degree, while 9% possessed a high school degree, 28% a trade or technical high school degree, 26% a bachelor degree, and 37% a master's degree. Six levels of *occupational status* (being a homemaker, being a student or in training, marginal employment, part-time, and full-time employment, being unemployed) were distinguished. Participants reported how satisfied they were with seven life domains that constituted a *quality of life* measure: friends, family, health, personal attractiveness, working life, income, and standard of living. A single-item measure was also included that captured *global life satisfaction* (“Overall, how satisfied are you with your life at present?”). All satisfaction ratings were made on five-point Likert scales (1 “very dissatisfied”, 5 “very satisfied”). Beliefs in *internal control* were assessed for all seven life domains, as well as life in general (using a five-point Likert scale: 1 “very little control”, 5 “very high levels of control”).

6.2 Analytical Procedures

To determine whether it is justified to treat the seven domain-specific satisfaction items as indicators of a common construct (“life satisfaction”), the ordinal Rasch model (Masters 1982) was fitted in both studies to the overall dataset. If the Rasch model holds, items constitute a scale which represents a unidimensional latent trait (overall life satisfaction). In Study 1, the item that asked respondents to evaluate their satisfaction with their mental fitness did not match with the other items, and was dropped. Analyses confirmed that the remaining six life domain items made up a joint measurement dimension that reached an anova reliability of .80 (equivalent to Cronbach's alpha). The seven domains that constituted quality of life measure, in Study 2, yielded a reliability of .78. Thus, three life domains hypothesized to impose comparatively high constraints on self-deceptive evaluation (working life, standard of living, and income) and four potentially low-constraining domains (family, friends, health, physical attractiveness) were included in subsequent analyses. Note that only a small number of single items were used to assess domain satisfactions for strategic reasons. Having each item represent a different life domain is not only a widespread approach, but allowed for observing immediately how ratings of domain-specific satisfaction acted together to compose a scale score of life satisfaction.

To test for heterogeneity, we employed a polychotomous mixed Rasch model (Rost 1991, 1997), the mixture partial credit model (Masters 1982). The partial credit model is applicable to Likert scales for which ordered item categories are intended to indicate increasing scores on the latent trait. A location parameter (item difficulty) and threshold parameters are estimated for each item. The model defines the mean of the latent measurement dimension to be zero; and estimates item difficulties for items that are equally discriminating. As a result, strict measurement principles apply and scale sum scores are a

meaningful indicator of a person's position on the latent trait. The mixed partial credit model assumes that the overall sample can be subdivided into latent classes with different item parameters. Calculations were performed using the "mixRasch" package provided in the R environment for statistical computing (R Development Core Team 2009). The number of classes was increased stepwise until the best-fitting model was identified. We also tested whether the more parsimonious "Andrich's rating scale model" (Andrich 1978), which assumes that all items share the same rating scale, was applicable. The best fitting model was selected based on its BIC value (Schwartz's Best Information Criterion). We found that the partial credit model applied, which conceptualizes each item to exhibit a unique rating scale of ordered categories (Masters 1982).

7 Results

Results are organized in four analytical steps. First, the assumed distinction of high- and low-constraining life domains, and the relationship between internal control and age are examined. Second, we test for response heterogeneity to identify subgroups for which life satisfaction is an equivalent latent dimension. Finally, within-subgroup validities of SWB and predictors of subgroup membership are examined.

7.1 Differences in Internal Control: Life Domains and Age

7.1.1 Study 1

To test the assumption that "working life" and "standard of living" are rightly viewed as potentially high-constraining life domains, domain-specific beliefs in *internal control* were assessed (across the entire sample). In fact, respondents reported lower mean levels of internal control when rating their working lives and standard of living (working life: $M = 2.96$, $SD = 1.35$; standard of living $M = 2.84$, $SD = 1.17$) rather than the other four life domains (friends: $M = 3.74$, $SD = .93$; family: $M = 3.91$, $SD = 1.03$; personal attractiveness: $M = 3.45$, $SD = 1.00$; health: $M = 3.52$, $SD = 1.01$). The difference between both "working life" and "standard of living" and the other four life domains was significant in a Wilcoxon signed rank test, with $p < .01$.

Also as expected, the participants' *age* was negatively associated with global and domain-specific beliefs that respondents were able to exert influence (internal control) over their living circumstances. Bivariate negative correlations between age and internal control over life in general ($r = -.17^{**}$), over family life ($r = -.15^{**}$), working life ($r = -.34^{**}$), standard of living ($r = -.20^{**}$), friends ($r = -.16^{**}$), health ($r = -.22^{**}$), and personal attractiveness ($r = -.28^{**}$) were significant, with $p < .01$. To unconfound age and situational differences, internal control was regressed on participants' age, gender, their occupational status, and educational level (cf., Knoop 1989). Still, the participants' age remained a significant negative predictor of beliefs in internal control ($p < .001$). Besides age, low occupational status ($p < .001$) and being unemployed ($p < .01$) were negative predictors of internal control.

7.1.2 Study 2

The assumption that work, standard of living, and income constrain perceptions of *internal control* more than other life domains received further support (working life: $M = 3.21$,

SD = 1.23; standard of living: $M = 3.16$, SD = 1.11; and income: $M = 2.67$, SD = 1.21; friends: $M = 3.77$, SD = .98; family: $M = 3.70$, SD = 1.15; personal attractiveness: $M = 3.62$, SD = 1.01; and health: $M = 3.59$, SD = 1.08). In line with the results of Study 1, *age* yielded a negative correlation with domain-specific beliefs in internal control ($r = -.09$ on average). In a linear regression, age, low occupational status, and unemployment were negatively related to internal control, while gender and educational level were controlled for. That is, basic assumptions underlying the subsequent analyses were confirmed, in both samples.

7.2 Population Heterogeneity: Identifying Subgroups of Respondents

7.2.1 Study 1

We had assumed that a six-item measure of life satisfaction, which integrated six life domains, were heterogeneous measures in a representative German sample of adults. And indeed this was the case. A two-class model explained the data better than an overall model, and also better than a three-class model (see Table 1 for information on model fit, the size of the resulting classes, measurement reliability, as well as mean scale and trait scores). The resulting two classes were of similar size (class one: $n = 543$, 54%; class two: $n = 400$, 46%). The assignment of individuals to classes was highly reliable, as indicated by a high average assignment probability of .89 (class 1: .88, class 2: .90). This indicates that the same classes are very likely to emerge in other samples or if different items are employed. Life satisfaction raw scale scores were only slightly higher in class one than class two, but the difference was significant. Trait scores (Warm maximum likelihood estimates; Warm 1989) also indicated that life satisfaction was at a significantly higher level among class-one respondents as compared to class-two respondents (Table 1).

7.2.2 Study 2

As in Study 1, the latent traits assessed by seven satisfaction items were not the same for respondents who belonged to one of two different subgroups. Unlike in the representative sample 1, class sizes differed (class one: $n = 964$, 67%; class two: $n = 482$, 33%). As is to

Table 1 Model selection and information about the resulting latent classes: sample 1 and 2

Model	BIC	Class size	Scale reliability	Mean scale scores (SD)	Mean trait scores (SD)
Sample 1					
1 class	14,293				
2 classes	14,130	53/47%	.83/.78	3.84 (.65)/3.76 (.84)	1.35 (1.61)/.56 (.99)
3 classes	14,139				
4 classes	14,203				
Sample 2					
1 class	24,469				
2 classes	24,316	67/33%	.79/.78	3.22 (.73)/3.50 (.65)	.52 (1.15)/.11 (1.11)
3 classes	24,495				

BIC Schwartz's Best Information Criterion; *scale reliability*: reliability of measurement within each class; Mean scale score = life satisfaction scale score based on six (sample 1), and seven life domain items (sample 2), respectively; Mean trait score = IRT-based score on the latent trait (WLE); *SD* standard error

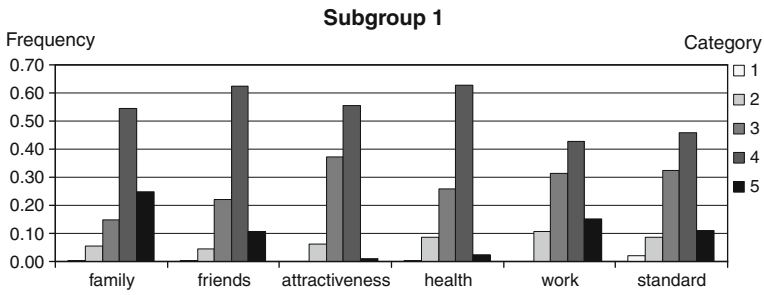


Fig. 1 Ratings for domain-specific life satisfaction: How frequently subgroup-one respondents used item categories 1 to 5 (sample 1)

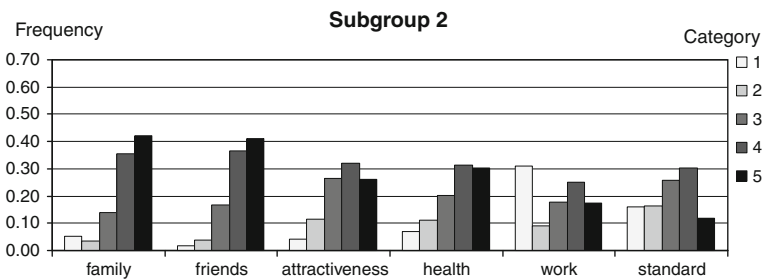


Fig. 2 Ratings for domain-specific life satisfaction: How frequently subgroup-two respondents used item categories 1 to 5 (Sample 1)

be expected from a convenience sample the more “privileged” subgroup was overrepresented. The assignment of participants to the two classes proved to be highly reliable (average assignment probability = .88; .87 for class 1; .91 for class 2). The average level of overall life satisfaction (scale scores) was even slightly higher in subgroup 2 as compared to subgroup 1 (see Table 1). However, trait scores, which take into account item difficulties indicated that life satisfaction was actually reduced in subgroup 2 as compared to subgroup 1 (as before, in Study 1).

7.3 Bias in Domain-Specific Life Satisfaction

7.3.1 Study 1

Figures 1 and 2 present category frequencies for the six domain-specific satisfaction items, that is, the frequencies with which respondents ticked off the five response categories. Indeed, we found that the differences between the two response patterns were not captured by a simple difference in the average of ratings. Within *class 1*, all six items had similar difficulties (i.e. likelihood to elicit agreement). Respondents preferred the positive end of the 5-point Likert scale consistently, while avoiding extreme categories. Within *class 2*, category frequencies did not show the same consistent pattern. Among class-two respondents, average satisfaction with working life and standard of living was reduced, while the other four life domains were evaluated very favorably (even the extreme category on the positive end of the scales was used frequently; see Fig. 2). This finding is in accordance with the hypothesis that comparison standards among life domains (items) influenced each

Table 2 Average satisfaction, control beliefs, and item difficulties (samples 1 and 2)

Sample 1	Satisfaction		Internal control		Item difficulty	
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2
Family	3.98 (.83)	4.07 (.94)	3.85 (.95)	3.99 (1.12) ^a	-.68	-.38
Friends	3.78 (.69)	4.17 (.83) ^a	3.63 (.89)	3.89 (.98) ^a	-.25	-.70
Attractiveness	3.51 (.60)	3.67 (.89) ^a	3.41 (.91)	3.50 (1.11)	.62	-.16
Health	3.59 (.65)	3.67 (.98)	3.47 (.91)	3.59 (1.13)	.44	-.07
Work	3.63 (.85)	2.80 (1.27) ^a	3.16 (1.23)	2.69 (1.45) ^a	-.56	.70
Stand. of living	3.58 (.82)	3.32 (1.10) ^a	2.97 (1.08)	2.66 (1.26) ^a	.42	.61
Sample 2	Satisfaction ^b		Internal control ^b		Item difficulty	
Family	3.74 (1.05)	3.87 (1.08)	3.64 (1.10)	3.76 (1.22)	-.32	-.94
Friends	3.64 (1.02)	4.21 (.86)	3.65 (.98)	3.76 (1.22)	-.31	-1.43
Attractiveness	3.07 (.92)	3.44 (1.08)	3.52 (.98)	3.76 (1.02)	.81	-.35
Health	3.44 (1.00)	3.76 (1.18)	3.54 (1.05)	3.66 (.94)	.03	-.68
Work	3.48 (1.06)	2.79 (1.38)	3.34 (1.13)	2.91 (1.36)	.15	.31
Stand. of living	3.77 (.87)	2.61 (1.12)	3.30 (1.03)	2.84 (1.17)	-.59	.77
Income	3.34 (.98)	1.88 (.95)	2.79 (1.14)	2.37 (1.24)	.23	2.30

^a The difference between classes 1 and 2 is significant, with $p < .05$

^b All of the differences between classes 1 and 2 were significant. Item difficulty: the more difficult an item is, the less likely respondents are to provide positive ratings; the mean of the item difficulties is zero

other. For a subgroup of the sample, the two domains that were assumed to impose comparatively high constraints on self-deceptive responding (working life, standard of living and income) represented “more difficult” items, while the remaining items appeared to be “overly easy” for these respondents (see item difficulties in Table 2; note that item “difficulty” implies that subjects are less likely to provide high scores on an item). As expected, a systematic cognitive bias seems to be the basis for high levels of *overall* life satisfaction. In subgroup 2, reduced average satisfaction with working life and standard of living was compensated by extreme positive ratings for other life domains (see Table 2). Systematic relationships were also found between domain-specific beliefs in internal control and the favorability of domain-specific evaluations. For instance, high satisfaction with friends and family, which is characteristic of class-two respondents, was accompanied by strong beliefs in internal control regarding these life domains; while low levels of internal control were associated with reduced satisfaction (see working lives and standard of living).

7.3.2 Study 2

Figures 3 and 4 again illustrate systematic differences in response behavior between the two subgroups. The bars represent the frequencies with which respondents picked each item category. Respondents in subgroup 1 were likely to report consistently high levels of satisfaction across all life domains. Class-two respondents reported reduced satisfaction with their income, standard of living, and working life, while they were quite likely to provide extreme positive responses for all other life domains (see Table 2 for the mean level of satisfaction with each life domain and item difficulties). For these respondents,

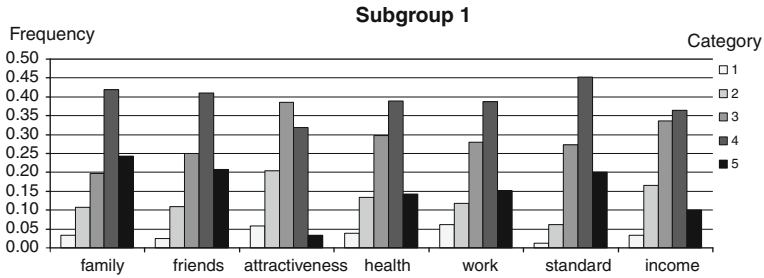


Fig. 3 Ratings for domain-specific life satisfaction: How frequently subgroup-one respondents used item categories 1 to 5 (sample 2)

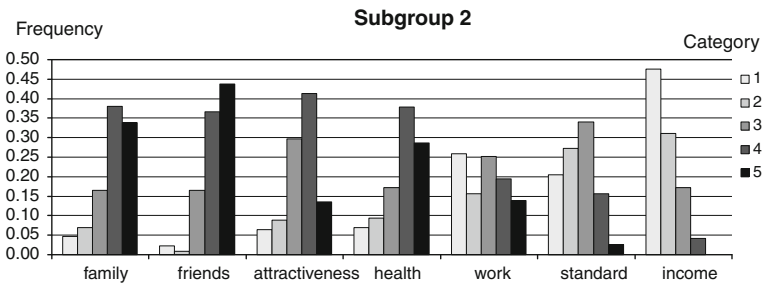


Fig. 4 Ratings for domain-specific life satisfaction: How frequently subgroup-two respondents used item categories 1 to 5 (sample 2)

reduced average satisfaction with working life, income, and standard of living was compensated by highly positive ratings for the other four life domains. These findings replicate those of Study 1 and support the assumption that comparison standards influence each other.

7.4 Overall and Within-Class Validities of Life Satisfaction

7.4.1 Study 1

Relationships between life satisfaction and age were examined in the overall sample, as well as in each of the two subgroups (see Table 3). In the overall sample, age had a slightly negative relationship with life satisfaction. We assessed whether age and life satisfaction are related differently in the two subgroups by examining the interaction term of age and subgroup membership in the overall sample. This interaction term was significant. While *age* did not show any significant relationship with life satisfaction among class-one respondents, a significant negative relationship resulted in class two, controlling for socio-economic status and attitudinal measures (internal control, confidence, importance, worrying). The five indicators of *socio-economic background* (education, occupational status, unemployment, monthly household income, and regional origin) explained a substantial amount of variance among class-two respondents (a much larger amount than in latent class one). Confidence and low levels of worrying were positively associated with life satisfaction, within both classes. Unexpectedly, control beliefs lost some of their explanatory power

Table 3 Predictors of overall life satisfaction (sample 1)

	Overall sample			Subgroup 1			Subgroup 2		
	<i>B</i>	SE	<i>R</i> ²	<i>B</i>	SE	<i>R</i> ²	<i>B</i>	SE	<i>R</i> ²
Intercept	2.07	.35		2.85	.28		3.65	.49	
Age	.02**	.01	.07**	.00	.00	.01	-.01**	.00	.18**
Gender (female)	-.02	.04	.07	.03	.05	.01	-.00	.07	.18
SES: Education	.01	.01	.18**	-.01	.01	.06**	.02	.02	.38**
Occupational status	.04	.02		.02*	.01		.07**	.02	
Income	.00**	.00		.01**	.02		-.06*	.03	
Regional origin (east)	-.02	.05		-.01	.05		-.02	.09	
Global beliefs Control	.11**	.02	.41**	.11**	.03	.30**	.10*	.04	.54**
Confidence	.14**	.03		.11**	.03		.15**	.04	
Importance	.06	.04		.07	.04		.07	.08	
Worrying	-.15**	.02		-.12**	.02		-.17**	.04	
Class membership	.79**	.17	.43**						
Class × age	-.02**	.00							

Stepwise regression. Dependent variable is overall life satisfaction. Coefficients are estimated while unemployed participants ($n = 70$) are excluded to avoid small cell sizes. *B* unstandardized coefficient, *R*² total variance explained at each step, * $p < .05$, ** $p < .01$. If class membership and the interaction with age are omitted, the overall relationship between age and life satisfaction is negative ($B = -.01$)

among class-two respondents. Attitudes (control, confidence, worrying, etc.) explained the largest amount of variance in life satisfaction within both subgroups.

To rule out the possibility that certain life domains, such as health or personal attractiveness, had an undue influence on the relationship between age and life satisfaction, results for chronological age were reexamined using a single-item measure of *global* life satisfaction as dependent variable (“Overall, how satisfied are you with your life?”). Results demonstrated again that class membership moderated the relationship between age and global life satisfaction. While no significant relationship was shown among class-one respondents (bivariate correlation = $-.07$), age was negatively associated with global life satisfaction among class-two respondents (bivariate correlation = $-.18^{**}$). An overall regression (bivariate correlation = $-.11^{**}$) overestimated the relationship for class one and underestimated the relationship found in class two. Finally, note that the negative relationship between age and internal control was identical within both subgroups.

7.4.2 Study 2

Within the overall sample, age was unrelated to global life satisfaction, controlling for gender, level of education, occupational status, and beliefs in internal control (Table 4). Whether the relationship between age and life satisfaction differed between the two subgroups was tested again by assessing the interaction term of age and subgroup membership. In subgroup 1, age yielded a positive relationship with life satisfaction. Within subgroup 2, however, a substantial negative relationship resulted. Even when beliefs in internal control were kept constant, age remained a significant positive (subgroup 1) or negative (subgroup 2) predictor of life satisfaction. When control beliefs were not included in the model, the

Table 4 Predictors of overall life satisfaction (sample 2)

	Overall			Subgroup 1			Subgroup 2		
	<i>B</i> (sig)	SE	<i>R</i> ²	<i>B</i> (sig)	SE	<i>R</i> ²	<i>B</i> (sig)	SE	<i>R</i> ²
(Intercept)	1.78	.30		1.43	.30		1.45	.53	
Age	-.01*	.00	.00	.01**	.00	.00	-.01*	.01	.03**
Sex (male)	.02	.07	.00	-.03	.08	.00	.16	.16	.03
SES Education	.16**	.03	.05**	.15**	.04	.04**	.18**	.07	.07**
Occupational status	.00	.02		-.01	.03		.04	.05	
Being unemployed	-.45**	.13		-.50*	.20		-.39*	.19	
Control beliefs Control attractive	.10*	.04	.26**	.06	.04	.25**	.18*	.08	.27**
Control work	.10**	.04		.10**	.04		.08	.07	
Control standard	.22**	.04		.19**	.05		.28**	.08	
Control family	.27**	.03		.30**	.04		.23**	.06	
Control friends	.11**	.04		.13**	.04		.09	.08	
Control income	-.04	.04		-.01	.04		-.11	.08	
Control health	.09**	.04		.07	.04		.12	.07	
Class membership	-.55*	.23	.27**						
Class × age	.02**	.01							

Step-wise regression (in the overall sample, and within subgroups 1 and 2). Dependent variable is overall life satisfaction. *B* unstandardized coefficient, *R*² total variance explained at each step, **p* < .05, ***p* < .01. If class membership and the interaction with age are omitted, age and life satisfaction are not significantly related (*B* = .00)

effects that age had on life satisfaction were stronger, indicating that age and control beliefs partly explain the same variance. Unemployment, which is negatively related to control beliefs, was also included in the regression and controlled for.

7.5 Group Differences in the Cognitive Construction of SWB: Predictors of Group Membership

7.5.1 Study 1

Finally, we tested if the participants' socio-economic background, as well as attitudinal measures, predicted membership in either of the two subgroups. Table 5 displays the results of a logistic regression with membership in class two (rather than class one) as the dependent variable. Neither demographic information (age, gender, regional origin), nor indicators of socio-economic status (educational attainment, monthly household income, occupational status) predicted class membership. Individuals with different occupational status (full-time, part-time and temporary employment, homemaker, school or training, early retirement) were equally represented in both subgroups, with only one exemption: *unemployed* respondents were significantly more likely to be grouped into class two (10 unemployed respondents were categorized into class 1, 70 into class 2). Note that unemployment is associated with a comparatively strong loss of control over working life and standard of living. How much internal control participants believe to exert over living circumstances proved to be an important predictor of subgroup membership. Specifically, reduced control over one's standard of living predicted membership in subgroup 2 rather

Table 5 Predicting subgroup membership in class 2 rather than 1 (samples 1 and 2)

Sample 1	<i>B</i>	<i>SE</i>	<i>p</i>	Sample 2	<i>B</i>	<i>SE</i>	<i>p</i>
Constant	-3.92	1.19	.00	Constant	.80	1.67	.63
Age	-.02	.01	.03*	Age	-.01	.01	.02*
Gender (female)	.04	.19	.82	Gender (male)	-.26	.16	.11
Education	-.08	.06	.22	Education	-.29	.07	.00**
Occupational status	-.11	.04	.01*	In school/training	.05	.37	.90
Unemployment	1.98	.47	.00**	Marginal employment	.33	.26	.20
Income	.00	.00	.68	Part-time employment	.15	.22	.48
Regional origin	.23	.21	.26	Full-time employment	-.52	.20	.01*
Control working life	.20	.11	.06	Unemployment	1.49	.26	.00**
Control standard	-.36	.10	.00**	Control attractive	.32	.08	.00**
Control family	.09	.11	.42	Control work	-.11	.07	.13
Control friends	.26	.11	.02*	Control standard	-.29	.08	.00**
Control health	.17	.14	.21	Control family	.08	.07	.22
Control attractiveness	-.01	.13	.96	Control friends	.36	.08	.00**
Confidence (overall)	-.07	.11	.54	Control income	-.19	.08	.01*
Importance (overall)	.48	.17	.01**	Control health	.02	.07	.76
Worries (overall)	.16	.09	.08				

Logistic regression: *B* unstandardized coefficient (positive coefficients indicate that membership in class 2 is more likely), *SE* standard error of the coefficient, *p* significance of the *t* value, *(*) = $p < .05$ (.01)

than 1. That is, reduced control over this domain was predictive of the kind of cognitive bias that characterized subgroup 2.

7.5.2 Study 2

The assignment of respondents to one or the other subgroup was again predicted by beliefs in internal control as well as objective conditions that are positively related to beliefs in internal control. Class-one respondents had slightly higher levels of education, were more likely to be full-time employed and less likely to be unemployed (see Table 5). Class-two respondents seemed to perceive their living circumstances to be more constraining. Whether respondents perceived their living circumstances as constraining, however, was again only loosely tied to objective living conditions.

8 Discussion

8.1 Study 1

Study 1 contributed to research on the social-cognitive regulation of SWB by exploring heterogeneity in a six-item measure of life satisfaction (within a representative sample of German adults). We provided evidence that two subgroups with characteristic patterns of domain-specific life satisfaction needed to be distinguished to adequately describe and interpret life satisfaction data. Within the two subgroups, life satisfaction scores yielded

different relationships with chronological age. In the following, the discussion focuses on what can be learned from these results regarding the cognitive regulation of SWB and its links to age.

8.2 Motivated Cognition and the Regulation of SWB

This study demonstrated that principles of self-evaluation may help to understand how a psychologically meaningful cognitive bias contributes to heterogeneity in measures of life satisfaction. Two highly reliable subgroups of respondents were empirically identified for whom six life-domain satisfaction items represented non-equivalent measures of life satisfaction or quality of life. Across class-one respondents, all six life domains had similar probabilities of eliciting positive responses. Participants grouped into latent class two perceived their standard of living and working life to be on average less satisfying, while describing other life domains (friends, family, attractiveness) overly positive (compensatory or contrast effect). We predicted that standard of living and working life plays an important role in the (differential) construction of life satisfaction. The rationale for this assumption was that these two life domains have a greater potential to impose constraints on self-deceptive information processing. In fact, this assumption was verified within a representative German sample. Both life domains, standard of living and working life, were characterized by lower average levels of internal control in the overall sample as well as in the two subgroups.

Life domains differ with regard to the level of ambiguity involved in evaluations or expectations as to the degree of control that seems possible over living circumstances. As a result, ratings of domain-specific life satisfaction may yield specific forms of judgmental bias. Among class-two respondents, satisfaction with highly constraining domains, such as working life and standard of living, was reduced, while satisfaction with many of the lowly constraining life domains (friends, family, personal attractiveness) was augmented. And while class-one respondents generally reported a more positive sense of control over their lives, class-two respondents held particularly weak beliefs in their ability to control outcomes in the two highly constraining life domains, standard of living and working life. Class-two respondents also reported that they had comparatively more reason to worry about life.

A judgmental mechanism that explains such patterns is that participants may adjust comparison standards across life domains. Unfavorable comparisons in highly constraining life domains, in particular, may shift comparison standards within the low-constraining life domains so as to allow for more favorable evaluations. These judgmental tendencies enabled an overall positive outlook on life, and are thus conducive to SWB. The notion that an interaction of evaluative standards among life domains helps respondents to maintain a positive view on their lives is reflected in the fact that the raw scale scores of overall life satisfaction (averages of the six life domains) were very similar in both subgroups of the sample—despite reduced satisfaction with two domains among class-two respondents. We consider self-evaluation processes to contribute to our understanding of how life satisfaction is controlled by cognitive biases. Similarly, Cummins and Nistico (2002) proposed that “perceived well-being” is an adaptive human attribute.

8.3 Differential Relationships with Age

The prominent claim that *age* is mostly unrelated to life satisfaction (“stability despite loss”) received only partial support by present findings. Age-independent, high levels of

SWB were only observed within parts of the sample (57%), while this indicator of “successful aging” did not apply to the remaining 43% of the sample (class 2). The more negative evaluations that class-two respondents reported for the “high-constraining” life domains, working life and standard of living, were even more pronounced at higher ages. To ensure that this negative relationship was not due to the specific measure employed to assess life satisfaction, the relationship of age and SWB was also assessed using a single-item measure of global life satisfaction, which again yielded differential, and for parts of the sample, negative relationships. Age-related increases in constraints on self-deceptive judgmental tendencies (elapsed lifetime; reduced beliefs in internal control) may explain this finding. In fact, beliefs in the ability to exert control over living circumstances were negatively related to age, even after situational differences (e.g., occupational status) were controlled for.

SWB typically yields almost no substantial association with objective living conditions. This was also true for almost half of the present sample (class 1). For these individuals, demographic and socio-economic variables explained comparatively small percentages of variability in life-satisfaction scores and this was due to only two of the socio-economic indicators: unemployment and monthly income. Long established explanations for the weak influence of objective living conditions are laid out in adaptation-level or set-point theories (Aspinwall and Taylor 1992; Brickman and Campbell 1971). The present article contributes to the discussion of the “well-being paradox” by demonstrating that relationships between subjective and objective living circumstances were in fact of substantial magnitude, but only within a subgroup of the overall sample. Among the respondents that were grouped into latent class 2, demographic and socio-economic variables explained substantial amounts of variability in life satisfaction (if “unemployment” was dropped from this model, other socio-economic variables still explained substantial parts of variability in life satisfaction). The fact that SWB is based on adaptive social-cognitive mechanisms does not necessarily imply that objective conditions have low predictive value, but rather that their influence is complex and not uniform across individuals. Still, it was global attitudes and beliefs (internal control, confidence, importance, worrying) that explained the greatest amounts of variability in life satisfaction scores. This was equally true for both subgroups of the sample. This finding underlines the important role that social-cognitive variables play in the regulation of life satisfaction, that is, the social-cognitive component of SWB.

Finally, it is worth mentioning that the findings of this study are relevant to the analysis and interpretation of global measures of life satisfaction and not to scales that aggregate domain-specific satisfaction ratings (quality of life measures) only. It is plausible to assume that judgmental processes operate in similar ways in global or single-item measures of life satisfaction, but remain unobserved and may lead researchers to overlook important differential results regarding the validity of life satisfaction scores. To demonstrate this, the current study assessed a single-item measure of *global* life satisfaction. The respondent’s age was again differentially related to life satisfaction within the two subgroups.

8.4 Predicting Patterns of Domain-Specific Life Satisfaction: Subgroup Membership

To further illuminate possible reasons why individuals show either of the two patterns of domain-specific life satisfaction, we assessed whether objective living conditions or psychological variables predicted membership in the two subgroups. Results indicated that age and high occupational status predicted membership in the first subgroup. Moreover, unemployed participants were particularly likely to be assigned to class 2, that is, the

subgroup of respondents for whom high-constraining (working life and standard of living) and low-constraining life domains (friends and family) interacted. The specific relevance of unemployment is in line with other research that has examined life satisfaction in representative German samples, which also concluded that unemployment played a specific role in life satisfaction (e.g., Knabe and Raetzl 2007). Unemployment has a particularly high potential to constrain living conditions as well as beliefs in the ability to exert control over these living conditions. The fact that being unemployed is a predictor of membership in subgroup two underlines that (psychologically) constraining situations may play an important role in understanding cognitive bias in life satisfaction. Moreover, class-two respondents reported that they assigned higher importance to life domains, which may indicate that these respondents perceive a discrepancy between wished for and actual living circumstances (Wu 2008). Class membership, that is, different patterns of domain-specific life satisfaction, generally seemed to be a judgmental, cognitive-evaluative phenomenon that can only partly be explained by objective information on living circumstances. Age and socio-economic information explained about 16% of the variance in subgroup membership. This finding is in accord with the widely accepted view that SWB results from adaptive cognitive mechanisms. And it underlines that employing the mixed Rasch model to life satisfaction data is a promising and theoretically adequate approach, since systematic differences in response behavior exist that are not closely tied to manifest variables (age, income, education, etc.). Ratings for life satisfaction yielded unobserved heterogeneity, that is, unobserved differences between individuals, which the mixed Rasch model was able to identify.

8.5 Study 2

The purpose of Study 2 was to replicate the findings of Study 1 in a second sample. We again tested whether overall life satisfaction was a homogeneous latent variable that demonstrates measurement equivalence across all individuals. As expected, and this was an expectation we derived from theory as well as the evidence provided in Study 1, this was not the case and we continued to identify subgroups for whom ratings of life satisfaction were non-equivalent. Again, two subgroups needed to be distinguished to adequately describe life satisfaction data. Accordingly, the hypothesis that cognitive biases seem to explain the observed heterogeneity in ratings of life satisfaction received further support. Differences between life domains regarding their potential to constrain beliefs in internal control helped to predict systematic cognitive bias that emerges in ratings of domain-specific life satisfaction. This cognitive bias enabled higher overall levels of life satisfaction among adults who were comparatively dissatisfied with their working life, income, and standard of living. Within the sample that we examined in Study 2, mean scale scores of life satisfaction were even higher among class-two respondents, who “over-compensated” low scores in the high-constraining life domains by overly high scores in the low-constraining life domains. We also provided further evidence for the claim that the same mechanisms that help predict population heterogeneity explain differential relationships between age and life satisfaction. Again, the two subgroups who constructed life satisfaction differently based on domain-specific ratings identified groups of adults who seemed to have aged differently: respondents’ age showed differential relationships with SWB. Among respondents who perceived rather high levels of control over all life domains, self-reported life satisfaction was not only stable but increased with age. For adults who seemed to face constraints to self-enhancement in “high-constraining” life domains, age and life satisfaction yielded a negative relationship.

9 Overall Discussion

We presented evidence from two samples that meaningful cognitive bias operates in domain-specific ratings of life satisfaction. Differences between life domains regarding extant constraints on internal control helped to explain self-report behavior. An important aim was to predict population heterogeneity in measures of life satisfaction. Some previous research has pointed out that measures of life satisfaction are potentially heterogeneous (see e.g., Eid 2008). However, previous research has not tried to predict such heterogeneity on a theoretical basis. Based on self-evaluation processes, it was possible to predict how item characteristics (domain differences regarding internal control) interacted with individual response behavior.

To understand the results presented in this article it is important to note that it is not relevant whether differences between life domains regarding evaluation standards correspond to differences regarding actual investment in life domains. It is possible that individuals who perceive constraints in certain (high-constraining) life domains focus their investment (psychological and behavioral) on other, less constraining life domains. Best et al. (2000), for instance, described how compensatory mechanisms across life domains contributed to the homeostatic maintenance of subjective quality of life in rural and urban populations in Australia. The observed interaction of comparison standards among life domains may reflect such compensatory mechanisms, but may also represent a purely judgmental phenomenon. We believe that cognitive bias plays an important role. After all, it appears unlikely that respondents truly invest more into each of the “low-constraining” life domains and truly have reason to report augmented levels of satisfaction with their health or personal attractiveness. Whether evaluative patterns correspond to patterns of real-life investment cannot be decided based on the data at hand. It is important to realize that both pathways help to explain heterogeneity in measures of life satisfaction. Technically speaking, the relationships between the items used to assess life satisfaction and the underlying latent construct differed between subgroups. As a consequence, overall scores of life satisfaction proved to be non-equivalent measures for subgroups of respondents. Note again that it is not different validities (i.e. correlations with external criteria such as age or socio-economic status) that were used to identify subgroups, but item-person interactions (i.e. measurement inequivalence as such). However, differential validities underline that it is psychologically meaningful and therefore important to acknowledge measurement heterogeneity. If researchers fail to account for measurement heterogeneity, they may overlook substantial relationships between SWB and its predictors (see the “well-being paradox”), as well as differential results that apply to subgroups of respondents only.

In two samples, age was differentially related to SWB within subgroups of respondents. We suggest that perceived control over potentially high-constraining life domains may help explain individual differences in SWB and its relationship to age. Objective living conditions may be related to subgroup differences in as much as they are also related to differences in internal control. Individuals who perceive comparatively high levels of internal control over various life domains may be able to maintain positive or even increasing levels of life satisfaction with age. If living conditions (e.g., work and standard of living) are *perceived* to be constraining, however, such perceptions may become more pronounced with age. With age, both ambiguity and internal control over life domains are likely to decline (Robinson and Ryff 1999). In sum, from a judgmental point of view, life satisfaction can be conceived of as an outcome of self-evaluative processes that are part of our self-regulatory capabilities.

10 Limitations and Future Research

The present study found differential and, for parts of the sample, substantial relationships between life satisfaction and objective living conditions, including age. This finding challenges the widespread notion in psychological literatures that subjective and objective living conditions are mostly unrelated. Replicating such results in other samples is of empirical and theoretical interest. Response heterogeneity in self-reports of life satisfaction may occur in samples with various national origins, but the meaning and implications of heterogeneity may be specific to certain cultural or socio-historical backgrounds.

As a potential methodological contribution to research on SWB, the current study demonstrated that it is possible to identify relevant subpopulations of individuals through the use of mixture distribution Rasch modeling. Mixture IRT models are used to identify differences between latent classes in the use of the response scale, that is response biases or differences in solution strategies (Eid and Rauber 2000; Mislevy and Velherst 1990). For example, Maij-de Meij et al. (2008) found that a mixture IRT model was able to improve the predictive value that personality scales had for external criteria. More general models than the Rasch model can also be combined with mixture distribution modeling. Factor mixture modeling (Muthén and Shedden 1999) is a potentially interesting avenue for future research on population heterogeneity in life satisfaction data (Heidemeier and Göritz 2010). It allows researchers to test all assumptions that can be made about a factor model (Lubke and Muthén 2005). The two approaches serve different research purposes. Employing an IRT model, researchers test whether the data fit a model that has properties that are desirable for measurement and person scoring. Using factor mixture modeling, researchers can freely model the data to examine the exact form of population heterogeneity, including intercepts and slopes (Lubke and Muthén 2005). Sawatzky et al. (2009), for instance, used a mixture factor analysis to evaluate the validity of a life satisfaction scale. A limitation of mixture distribution modeling is that it requires rather large data sets, and their use in smaller convenience samples is limited. Moreover, it is certainly of interest to avoid the shortcomings of cross-sectional data and to verify aspects of the present findings using longitudinal data. The evaluation of longitudinal data is both theoretically and statistically very different from the present approach, which deals with instantaneous, evaluative links between life domains. The present paper argued that processes of self-evaluation help explain both the cognitive regulation of SWB, and population heterogeneity in self-reports of life satisfaction.

References

- Alicke, M. D. (1985). Global self-evaluation as determined by the desirability and controllability of trait adjectives. *Journal of Personality and Social Psychology*, *49*, 1621–1630.
- Andrich, D. (1978). A rating scale formulation for ordered response categories. *Psychometrika*, *43*, 561–573.
- Aspinwall, L. G., & Taylor, S. E. (1992). Modeling cognitive adaptation: A longitudinal investigation of the impact of individual differences and coping on college adjustment and performance. *Journal of Personality and Social Psychology*, *63*, 989–1003.
- Best, C. J., Cummins, R. A., & Lo, S. K. (2000). The quality of rural and metropolitan life. *Australian Journal of Psychology*, *52*, 69–74.
- Bowling, N., Beehr, T., Wagner, S., & Libkuman, T. (2005). Adaptation-level theory, opponent process theory, and dispositions: An integrated approach to the stability of job satisfaction. *Journal of Applied Psychology*, *90*, 1044–1053.

- Brickman, P., & Campbell, D. (1971). Hedonic relativism and planning the good society. In M. Apley (Ed.), *Adaptation-level theory: A symposium* (pp. 287–302). New York: Academic Press.
- Brickman, P., Coates, D., & Janoff-Bolman, R. (1978). Lottery winners and accident victims: Is happiness relative? *Journal of Personality and Social Psychology*, *37*, 917–927.
- Cummins, R. A., & Nistico, H. (2002). Maintaining life satisfaction: The role of positive cognitive bias. *Journal of Happiness Studies*, *3*, 37–69.
- Diener, E., & Diener, M. (1995). Cross-cultural correlates of life satisfaction and self-esteem. *Journal of Personality and Social Psychology*, *68*, 653–663.
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, *49*, 71–75.
- Diener, E., Sandvik, E., & Pavot, W. (1991). Happiness is the frequency, not the intensity, of positive versus negative affect. In F. Strack & N. Schwarz (Eds.), *Subjective well-being: An interdisciplinary perspective* (pp. 119–139). Elmsford NY: Pergamon Press.
- Diener, E., & Suh, M. E. (1998). Subjective well-being and age: An international analysis. In K. W. Schaie & M. P. Lawton (Eds.), *Annual review of gerontology and geriatrics, vol. 17: Focus on emotion and adult development* (pp. 304–324). New York, NY, USA: Springer Publishing Co.
- Dunning, D., Meyerowitz, J. A., & Holzberg, A. D. (1989). Ambiguity and self-evaluation. *Journal of Personality and Social Psychology*, *57*, 1082–1090.
- Eid, M. (2008). Measuring the immeasurable. In M. Eid & N. R. J. Larsen (Eds.), *The science of subjective well-being*. New York: The Guilford Press.
- Eid, M., & Rauber, M. (2000). Detecting measurement invariance in organizational surveys. *European Journal of Psychological Assessment*, *16*, 20–30.
- Fujita, F., & Diener, E. (2005). Life satisfaction set point: Stability and change. *Journal of Personality and Social Psychology*, *1*, 158–164.
- Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational Behavior and Human Performance*, *16*, 250–279.
- Headey, B., & Wearing, A. (1992). *Understanding happiness: A theory of subjective well-being*. Melbourne: Longman Cheshire.
- Heidemeier, H., & Göritz, A. S. (2010). Using factor mixture models for classification: Individual differences in how work and nonwork life domains contribute to subjective well-being (unpublished document).
- Heidemeier, H., & Moser, K. (2009). Self-other agreement in job performance ratings: A meta-analytic test of a process model. *Journal of Applied Psychology*, *94*, 353–370.
- Heller, D., Watson, D., & Ilies, R. (2004). The role of person versus situation in life satisfaction: A critical examination. *Psychological Bulletin*, *130*, 574–600.
- Heller, D., Watson, D., & Ilies, R. (2006). The dynamic process of life satisfaction. *Journal of Personality*, *74*, 1421–1451.
- Horley, J., & Lavery, J. J. (1995). Subjective well-being and age. *Social Indicators Research*, *34*, 275–282.
- Horn, J., & McArdle, J. (1992). A practical guide and theoretical guide to measurement invariance in aging research. *Experimental Aging Research*, *3*, 117–144.
- Kasser, T., & Ahuvia, A. (2002). Materialistic values and well-being in business students. *European Journal of Social Psychology*, *32*, 137–146.
- Knabe, A., & Raetzl, S. (2007). Quantifying the psychological costs of unemployment: The role of permanent income. *SOEPpapers (German Socio-Economic Panel Study, DIW Berlin)*, *32*. Retrieved August 5, 2008 at <http://www.diw.de/soeppapers>.
- Knoop, R. (1989). Locus of control: A work-related variable? *Journal of Social Psychology*, *129*, 101–106.
- Kunzmann, U., Little, T. D., & Smith, J. (2000). Is age-related stability of subjective well-being a paradox? Cross-sectional and longitudinal evidence from the Berlin Aging Study. *Psychology and Aging*, *15*, 511–526.
- Lachman, M. E. (1986). Locus of control in aging research: A case for multidimensional and domain-specific assessment. *Psychology and Aging*, *1*, 34–40.
- Lachman, M. E. (2006). Perceived control over aging-related declines: Adaptive beliefs and behaviors. *Current Directions in Psychological Science*, *15*, 282–286.
- Lubke, G., & Muthén, B. (2005). Investigating population heterogeneity with factor mixture models. *Psychological Methods*, *10*, 21–39.
- Maij-de Meij, A. M., Kelderman, H., & van der Flier, H. (2008). Fitting a mixture item response theory model to personality questionnaire data: Characterizing latent classes and investigating possibilities for improving prediction. *Applied Psychological Measurement*, *32*, 611–631.
- Masters, G. (1982). A Rasch model for partial credit scoring. *Psychometrika*, *47*, 149–174.

- McFarlin, D. B., & Blascovitch, J. (1981). Effects of self-esteem and performance on future affective preferences and cognitive expectations. *Journal of Personality and Social Psychology*, *40*, 521–531.
- Mislevy, R. J., & Velherst, N. (1990). Modeling item responses when different subjects employ different solution strategies. *Psychometrika*, *55*, 195–215.
- Muthén, B., & Shedden, K. (1999). Finite mixture modeling with mixture outcomes using the EM algorithm. *Biometrics*, *55*, 463–469.
- Nehrke, M., Hulicka, I., & Morganti, J. (1980). Age differences in life satisfaction, locus of control, and self-concept. *International Journal of Aging and Human Development*, *11*, 25–33.
- Oishi, S. (2006). The concept of life satisfaction across cultures: An IRT analysis. *Journal of Research in Personality*, *41*, 411–423.
- Oishi, S., Diener, E. F., Lucas, R. E., & Suh, E. M. (1999). Cross-cultural variations in predictors of life satisfaction: Perspectives from needs and values. *Personality and Social Psychology Bulletin*, *25*, 980–990.
- Peterson, C., & Stunkard, A. (1989). Personal control and health promotion. *Social Science and Medicine*, *28*, 819–828.
- R Development Core Team (2009). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria (<http://www.R-project.org>).
- Robinson, M. D., & Ryff, C. D. (1999). The role of self-deception in perceptions of past, present, and future happiness. *Personality and Social Psychology Bulletin*, *25*, 595–606.
- Rost, J. (1991). A logistic mixture distribution model for polychotomous item responses. *British Journal of Mathematical and Statistical Psychology*, *44*, 75/92.
- Rost, J. (1997). Logistic mixture models. In W. van der Linden & R. Hambleton (Eds.), *Handbook of modern item response theory* (pp. 449–463). New York: Springer.
- Ryckman, R., & Malikiowski, M. (1975). Relationships between locus of control and chronological age. *Psychological Reports*, *36*, 655–658.
- Sawatzky, R., Ratner, P. A., Johnson, J. L., Kopec, J., & Zumbo, B. D. (2009). Sample heterogeneity and the measurement structure of the multidimensional students' life satisfaction scale. *Social Indicators Research*, *94*, 273–296.
- Schwarz, N., & Strack, F. (1999). Reports of subjective well-being: Judgmental processes and their methodological implications. In D. Kahnemann, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology*. New York: Russel Sage Foundation.
- Sedikides, C. (1993). Assessment, enhancement, and verification determinants of the self-evaluation process. *Journal of Personality and Social Psychology*, *65*, 317–338.
- Staudinger, U. M. (2000). Viele Gründe sprechen dagegen und trotzdem fühlen viele Menschen sich wohl: Das Paradox des subjektiven Wohlbefindens. [Many reasons speak against it, nevertheless most people are happy: The paradox of subjective well being]. *Psychologische Rundschau*, *51*, 185–197.
- Staudinger, U. M., Bluck, S., & Herzberg, P. (2003). Looking back and looking ahead: Adult age differences in consistency of diachronous ratings of subjective well-being. *Psychology and Aging*, *18*, 13–24.
- Staudinger, U. M., Marsiske, M., & Baltes, P. B. (1995). Resilience and reserve capacity in later adulthood: Potentials and limits of development across the life span. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology (Vol. 2: Risk, disorder, and adaptation)* (pp. 801–847). New York: Wiley.
- Stock, W., Okun, M., Haring, M., & Witter, R. (1983). Age differences in subjective well-being: A meta-analysis. In R. Light (Ed.), *Evaluation studies. review annual* (pp. 279–302). Beverly Hills, CA: Sage.
- Taylor, S., & Brown, J. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, *103*, 193–210.
- Taylor, S., & Brown, J. (1994). Positive illusions and well-being revisited: Separating fact from fiction. *Psychological Bulletin*, *116*, 21–27.
- Taylor, S. E., Neter, E., & Wayment, H. A. (1995). Self-evaluation processes. *Personality and Social Psychology Bulletin*, *21*, 1278–1287.
- von Davier, M., & Yamamoto, K. (2004). Partially observed mixtures of IRT models: An extension of the generalized partial-credit model. *Applied Psychological Measurement*, *28*, 389–406.
- Warm, T. A. (1989). Weighted likelihood estimation of ability in item response models. *Psychometrika*, *54*, 427–450.
- Wheeler, L., & Miyake, K. (1992). Social comparison in everyday life. *Journal of Personality and Social Psychology*, *62*, 760–773.
- Williams, M. L., McDaniel, M. A., & Nguyen, N. T. (2006). A meta-analysis of the antecedents and consequences of pay level satisfaction. *Journal of Applied Psychology*, *91*, 392–413.
- Wolk, S. (1976). Situational constraint as a moderator of the locus of control-adjustment relationship. *Journal of Consulting and Clinical Psychology*, *44*, 420–427.

- Wolk, S., & Kurtz, J. (1975). Positive adjustment and involvement during aging and expectancy for internal control. *Journal of Consulting and Clinical Psychology, 43*, 173–178.
- Wu, C. H. (2008). Examining the appropriateness of importance weighting of satisfaction score from range-of-affect hypothesis: Hierarchical linear modeling for within-subject data. *Social Indicators Research, 86*, 101–111.
- Zumbo, B. D. (2007). Three generations of differential item functioning (DIF) analyses: Considering where it has been, where it is now, and where it is going. *Language Assessment Quarterly, 4*, 223–233.