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Investigating the Feasibility of a Factorial Survey in a CATI

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DFG Research Center (SFB) “From Heterogeneities to Inequalities”

Whether fat or thin, male or female, young or old – people are different. Alongside their physical features, they also differ in terms of nationality and ethnicity; in their cultural preferences, lifestyles, attitudes, orientations, and philosophies; in their competencies, qualifications, and traits; and in their professions. But how do such heterogeneities lead to social inequalities? What are the social mechanisms that underlie this process? These are the questions pursued by the DFG Research Center (Sonderforschungsbereich (SFB)) “From Heterogeneities to Inequalities” at Bielefeld University, which was approved by the German Research Foundation (DFG) as “SFB 882” on May 25, 2011.

In the social sciences, research on inequality is dispersed across different research fields such as education, the labor market, equality, migration, health, or gender. One goal of the SFB is to integrate these fields, searching for common mechanisms in the emergence of inequality that can be compiled into a typology. More than fifty senior and junior researchers and the Bielefeld University Library are involved in the SFB. Along with sociologists, it brings together scholars from the Bielefeld University faculties of Business Administration and Economics, Educational Science, Health Science, and Law, as well as from the German Institute for Economic Research (DIW) in Berlin and the University of Erlangen-Nuremberg. In addition to carrying out research, the SFB is concerned to nurture new academic talent, and therefore provides doctoral training in its own integrated Research Training Group. A data infrastructure project has also been launched to archive, prepare, and disseminate the data gathered.

Research Project B3 “Interactions Between Capabilities in Work and Private Life: A Study of Employees in Different Work Organizations”

This research project primarily addresses “capabilities” in working and private life and the interrelations between them. Adapting Sen’s approach, capabilities are the ability to achieve one’s life goals. The project adopts a comprehensive view that identifies multidimensional states of inequality. Crucial is the recognition that pursuing one’s interests in one life domain may even constrain goal attainment in other life domains. The same personal circumstances and employment conditions may be perceived and evaluated differently against the background of heterogeneous life goals. The concept of employment relationships allows us to gain an overview of a wide range of different gratifications and different demands and stresses, against the background of different psychological contracts. On the level of employees, we therefore firstly study the heterogeneity of different employment relationships in companies situated in various business sectors. Secondly, we assess these employees in terms of their embedment in various forms and phases of life. Thus, also the situation and views of a partner will be considered.

In a next step this project examines how heterogeneities (e.g. gender, age, life style preferences, education) become social inequalities with a particular focus on the role of the organizational context. As possible mechanisms different individual interests within companies and private bonds being negotiated in different ways are investigated. Health also plays a role in these interdependencies influencing the prospects for successful multiple engagement in both life domains. It is a “hard” indicator of maladjustment.

In this project detailed studies of employees and characteristics of their companies are carried out. Companies play a dual role, first as negotiation partners and second as opportunity structures. Various actors within the companies and companies’ institutional and sector-specific context are considered.

Proceeding from a sample of 100 work organizations, an extended linked employer-employee design will be used to study an average of 65 employees in each organization. If employees have life partners, they will also be surveyed with a short version of the instrument. By combining these data with information from the same employees and their companies from the German Institute for Employment Research (IAB), we can achieve a unique density of information for large case numbers. The longitudinal design initiated during the first funding period allows distinguishing causal effects more clearly and to adequately study processes of discrimination and self-selection.

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Investigating the Feasibility of a Factorial Survey in a CATI

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Abstract

Factorial surveys are a common method for studying social norms, attitudes, and hypothetical decision situations in the social sciences. Although they are usually applied in interview settings which allow for a visual representation of the factorial survey, they are also regularly used in computer assisted telephone interviews (CATI). However, we know little about the applicability of a factorial survey in an interview mode that does not allow for a visual presentation of the factorial survey. This paper investigates potential problems that may arise in implementing a factorial survey in a CATI by investigating how respondents of different age and educational backgrounds deal with factorial surveys of different degrees of complexity. To asses potential problems we rely on respondents' self-reported response difficulties, a measure of response latency, and response consistency. We do not find that older respondents are experiencing or reporting more difficulties in processing the factorial survey. Respondents with higher levels education appear to produce more consistent responses.

Keywords: vignettes; factorial survey; CATI; telephone interviews; response latency; response consistency; age; education

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Introduction

Studying social norms and belief systems thru factorial surveys (also called factorial vignettes) has become increasingly popular in the field of social science (Wallander 2009). Factorial surveys confront respondents with a description of a set of hypothetical situations or objects (vignette decks), in which the attributes (dimensions) vary in their value (level), and ask respondents to evaluate them or to form a (hypothetical) decision on their basis (Beck and Opp 2001; Jasso and Opp 1997; Rossi and Nock 1982). The aim of a factorial survey is to identify the attributes' relative importance in the evaluation or decision (Sauer et al. 2011).

The main advantage factorial surveys have over other survey instruments is their multi-factorial, quasi-experimental character (Rossi and Anderson 1982). The factorial survey allows to separately asses the relative importance of attributes that may be highly confounded in reality (Auspurg et al. 2009). The quasi-experimental design obtained by using factorial surveys provides the advantage of internal validity, achieved through a randomized, multifaceted design. This is particularly advantageous when combined with a representative (general population) survey – although external validity may be limited due to the hypothetical nature of the factorial survey (Rossi and Anderson 1982; Sniderman and Grob 1996; Atzemüller and Steiner 2010).

Because of their multifactorial design (Rossi and Anderson 1982), factorial surveys may comprise complex decision or rating tasks and may put greater cognitive burden on respondents (Sauer et al. 2011) than simpler instruments, such as direct questions. Since visual presentation , makes information processing easier (Cohen, Horowitz and Wolfe 2009), factorial surveys are mostly implemented in interview modes that allow for the visual presentation of the vignettes, such as computer assisted personal interviews (CAPI), computer assisted self-interviews (CASI), computer assisted web interviews (CAWI), or paper and pencil interviews (PAPI). To our knowledge, previous research on potential problems related to factorial surveys (e.g. Rossi and Anderson 1982; Auspurg, Hinz and Liebig 2009; Sauer et al. 2011) is concerned only with interview modes that allow for the visual representation of vignettes. However, much data in survey research is collected through computer assisted telephone interviews (CATI). CATI is not only cheaper than other interviewing modes, in particular CAPI, but it may also be better suited to collect representative general population samples – through, for instance, employing random-digit dialing (Gabler and Häder 2002; Link et al. 2008). Even though factorial surveys are regularly implemented in CATI (e.g. Hunter et al. 2009; Jorm, Wright and Morgan 2007; Wright, Jorm and Mackinnon 2012; Sikorski et al. 2012; Tindale et al. 2011; Denton et al. 2010; Lubman et al. 2007; Sorenson 2006 and Cotton et al. 2006), little is known about potential problems that may arise due to this interview mode.[1] CATI differs from the above modes crucially, because it does not allow for the visual representation of vignettes and it is therefore questionable whether previous research on the feasibility of factorial surveys in other interview modes can be transferred to CATI.

This paper addresses potential problems that may arise in implementing a factorial survey in a CATI by investigating how respondents of different age and educational backgrounds deal with factorial surveys of different degrees of complexity. The data for this study comes from a telephone survey on work-life-balance in Germany. Complexity of the factorial survey was modified by two split ballots: Respondents were randomly assigned to conditions that differed in the number of dimensions (4, 5, or 6) and the number of vignettes per deck (8 or 12). To assess potential problems in processing the factorial survey, we analyzed three types of measures: subjectively reported response difficulty, response time, and response consistency.

Cognitive Load in Factorial Surveys

Factorial surveys are a well-established method in opinion and attitude surveys (Wallander 2009). Although factorial surveys may be more realistic, due to their multifactorial design (Rossi and Anderson 1982), the combination of several different dimensions within one fictive description can also be seen as complex, putting high cognitive burden on respondents (Sauer et al. 2011).

The complexity of factorial surveys depends on the number of dimensions that a vignette consists of and the number of vignettes respondents have to process (Rossi and Anderson 1982; Auspurg, Hinz and Liebig 2009; Auspurg et al. 2009; Sauer et al. 2011). Previous research on the effects of the complexity of factorial surveys in CAPI, CASI, and PAPI indicates that no difficulties arise in processing factorial surveys, if the number of dimensions per vignette is below 12 and the number of vignettes does not exceed 20 (Sauer et al. 2011).

Yet, CATI studies differ from other interview modes in that they do not allow for a visual presentation of the vignettes. A visual representation gives respondents the possibility to re-read the vignettes and, in most cases, full control over the progress of the factorial survey. If the vignettes are presented through speech this is likely to increase in the cognitive load and the burden on the working memory, resulting in fewer items (chunk of information) (Miller 1956)

[1] Although some studies report the implementation of pilot studies to test whether the research design is suitable for telephone interviews (e.g. Hunter et al. 2009), the results of these pilot studies are not discussed.

that can be processed.[2] Moreover, auditory memory appears to be inferior to visual memory (Cohen et al. 2009). To get respondents to produce an informed reaction (e.g. a judgment or a rating), it is however a basic necessity that they understand the pieces of information provided by the vignette, recall them, and integrate them into a coherent representation of what the vignette intends to portray.[3]

The demands on respondents' working memory (Daneman and Merikle 1996), which dynamically determines their ability to comprehend, store, and recall information and thus constitutes the basis for making evaluations and decisions based on these information (Cowan 2005), increases with (vignette) information complexity and may affect the outcomes (Swait and Adamowicz 2001). Current research on working memory capacity indicates that people may be able to process only about three to five pieces of information (Mathy and Feldman 2012; Li et al. 2013; Cowan 2012 et al.; Cowan 2001). Generally, the higher the number of pieces of information that have to be processed, the more difficult will it become for respondents to form an informed evaluation of the depicted situation. We therefore assume that *the higher the number of dimensions, the more difficult will it be to process the factorial survey* (H1).

The ability to process information also depends on cognitive ability. People with lower cognitive ability may have difficulties integrating successively encountered information into a coherent representation (Daneman and Merikle 1996). Since cognitive capacity relates to schooling (Brody 1997; Rindermann and Neubauer 2004; Falch and Sandgren Massih 2011), lower levels of education may be associated with increased difficulties to process information. We therefore assume *that less educated respondents will exhibit more difficulties in processing the factorial survey* (H2).

The individual ability to process the factorial survey may, moreover, depend on the respondent's age. First, cognitive capacity declines with age (Park 1999; Salthouse 1996). Second, aging may also impair hearing and speech understanding (Murphy, Daneman and Schneider 2006, Pichora-Fuller and Souza 2003), making it difficult to encode verbally presented the information. This problem is particularly pertinent in CATI interviews. We therefore assume *that older respondents will exhibit more difficulties in processing the factorial survey* (H3).

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[2] It should be noted, however, that the interviewers were instructed to re-read the vignettes if necessary.

[3] It may also be argued that there is a central capacity limit, i.e. that the limit for visual and auditory information does not differ (Cowan 2000). While this may be the case, it is unnecessary to recall information when one is able to look at the vignette while performing the rating task.

Data and Methods

To test these hypotheses data was collected on 331 randomly chosen respondents in a CATI through list-directed dialing. The universe comprises all households in Germany who had their telephone number listed in a telephone book. Within households, eligible respondents were identified through the birthday method (Salmon and Nichols 1983; Rizzo, Brick and Park 2004). Because this study was part of pretest for a larger research project, eligibility also depended on employment status so that all respondents in the sample are working. Moreover, since in this pretest the response rate was not of primary concern, it turned out low (AAPOR Response Rate 1 = 5.8%, AAPOR 2010). After listwise deletion of missing values and exclusion of respondents with extreme values on response time (see variables section) and those who did not complete all vignettes the finale sample comprises 291 respondents. Descriptive statistics on the sample are shown in table 3.

Table 1: Vignette Dimensions and Levels

Dimensions	Levels
Earnings (gross, monthly, in Euros)	1000, 2000, 3000, 4000, 5000
Job (prestige according to MPS)	Unskilled worker (MPS = 31) Train conductor (MPS = 50.1) Retailer / shopkeeper (MPS = 78) Architect (MPS = 111.7) Doctor (MPS = 191.3)
Marital status	Partner / no partner
Children	0, 1, 2, 3
Health	Very good, good, satisfactory, bad, very bad
Close friends	0, 2, 4, 6, 8

Note: The dimensions health and close friends were only included 68.28% and 32.63% of the cases respectively. Job prestige is operationalized through the magnitude prestige scale (Christoph 2005; Wegner 1985)

Vignettes

The vignettes described hypothetical constellations of work and family variables and asked the respondents to rate those constellations according to their hypothetical life satisfaction on an eleven point scale. The vignette dimensions and their values are presented in table 1. A sample vignette would read "Imagine you are a trained retail salesman, you have a partner, and 2 children; your health is excellent, you earn 2000 euro pre-tax and you have 2 close friends. How satisfied would you be?"

Vignette investigation plan

The study implemented six split ballots, following the experimental design shown in table 2. The product of the number of levels per dimension leads to a vignette universe of 5,000 possible vignettes. In the first step, 60 decks, with 12 vignettes per deck, were drawn thru stratified random sampling (stratification dimension: earnings) out of the vignette universe.[4] In the second step, either one (number of close friends) or two the dimensions (number of close friends and health) were deleted in 20 randomly chosen decks, leaving 20 decks with 4, 5, and 6 dimensions respectively. In a third step, 30 decks were randomly chosen out of the full 60 decks and 4 vignettes were randomly deleted within each of the chosen decks. This procedure lead to 20 decks with 4, 5, or 6 dimensions each and to 30 decks with either 8 or 12 vignettes. The split ballot design is shown in table 2.

Table 2: Number of decks obtained through the split ballot design

		Number of vignettes		
		8	12	Decks
Number of dimensions	4	10 (44)	10 (51)	20
	5	10 (43)	10 (64)	20
	6	10 (43)	10 (46)	20
Decks		30	30	60

N=291; number of respondents in parentheses

Variables

To test the hypotheses, we focus on several dependent variables that are measure of response latency, response consistency, difficulty of envisioning the situation described by the vignettes and the difficulty of rating the vignettes.

The ease with which respondents envisioned and rated the vignettes was measured through the respondents' subjective assessment. To that end, two questions were included in the

[4] Problems that may occur in random sampling are impossible or implausible combinations, such as doctors without a tertiary education. Implausible combinations may impact respondents' judgment (Faia 1980; Alves and Rossi 1978). In the present case, there are no impossible, but potentially uncommon combinations, such as unskilled workers with 5,000 € monthly earnings. Additional analyses (available on request) show that excluding these uncommon combinations (93 vignettes across 49 decks) does not change the results in a meaningful way.

CATI following the factorial survey: “How difficult was it for you to imagine the described situation?” and “How difficult was it for you to rate your satisfaction in the described situation?”. Both items used a 5 point scale ranging from very easy to very difficult (see table 4).

Because social desirability (Stocke and Hunkler 2007) may hamper the validity of such subjective assessments, we additionally use measures of response latency and response consistency to assess potential difficulties in processing the factorial survey. Response time is an indicator for processing ability (Bassili and Scott 1996; Mulligan et al. 2003; Urban and Mayerl 2007; Mayerl, Sellke and Urban 2005; Mayerl and Urban 2008; Mayerl et al. 2005; Sauer et al. 2011), with higher responses time indicating processing difficulties. The mean response time was computed by dividing the response time for the whole vignette block by the number of vignettes (8 or 12). The result is the so-called “raw response time”. Following the suggestions in the literature, the analyses excludes respondents whose response time deviates ± 2 standard deviations from the mean (Mayerl and Urban 2008, Mayerl et al. 2005). As a measure of response latency, we employ the residual score index (RS) (Mayerl et al. 2005, 2008). This index is created by using the residual from a regression of the raw response time (RTraw) on the baseline speed (BS) that is the mean response time of a comparison item-block. We chose a comparison block consisting of 6 ratings of area specific life satisfaction (work, income, family life, health, friends, and general life satisfaction) on a 11-point scale and an assessment of the current health status on a 5-point scale. The response time of the whole block was divided by the number of items (7). The residual score index is then computed as the difference between the expected response time (RTexp) and the raw response time (RTraw) (Mayerl and Urban 2008 or Mayerl et al. 2005): $RS = RTraw – Rtexp = RTraw – (\hat{a}+\hat{b}BS)$. The residual score index can be interpreted as the part of the raw speed which cannot be explained by the baseline speed and may thus be suited to capture specific problems of an item-block. Positive values of the residual score indicate that it took the respondents longer than *expected*, with higher values indicating longer response times. Negative values indicate that respondents completed the factorial survey *faster* than expected.

Ideally, response time is available for every single vignette within a deck, net of the time it takes the interviewer to read out the vignette. In the current data, response time is unfortunately only available for the complete deck. This has to be kept in mind, limiting the interpretability of response time with regard to vignette complexity (number of dimension), since the vignette description to be read by the interviewer will be longer in more complex vignettes.

Our indicator of response consistency is the squared individual level residual ($\hat{e}_{ji}^2$) of a multilevel regression (Hox, Kreft and Hermkens 1991, Raudenbush and Bryk 2002) of the 4, 5, or 6 vignette dimensions (and deck dummies) on the perceived satisfaction as described by the specific vignette (compare Sauer et al. 2011). The higher the error, the higher is the amount of variance unexplained by the vignette. We use the squared version of the individual error term as an indicator for inconsistent answers, which puts a heavier weight on large errors (Sauer et al. 2011).

The independent variables are age, level of education (see table 3), number of vignettes per deck, and number of dimensions in the vignette. Age has been categorized into three groups, respondents below the age of 40, respondents aged 40 to 59, and respondents who are 60 years and older. Because respondents had to be employed to be eligible for inclusion in this study, the sample comprises a relatively large share of middle aged respondents (70.7%). Education is measured as low (inadequately completed general education, general elementary education), middle (intermediate general qualification), and highly educated (lower and higher tertiary education, see table 3).

Table 3: Frequencies of demographic variables

Variable	Frequency (Percent)
Sex	
Female	178 (61.8%)
Male	113 (38.2%)
Age	
<40	56 (19.2%)
40-59	208 (71.5%)
60+	27 (9.28%)
Education	
Low	49 (16.8%)
Middle	118 (40.6%)
High	124 (42.6%)
Total	291

Statistical Analyses

The analysis is conducted in three main steps. First, univariate distributions of the variables used in the study are presented. Second, bivariate associations between our measures of processing difficulty and the number of dimensions, age, and education are examined. Third, multivariate models are estimated to further test the hypotheses. The first models regresses the subjective indicators on age and education and the number of dimensions in a vignette. To test the hypothesis with response consistency as the dependent variable, we estimated a linear multilevel model (random intercept model) (Hox, Kreft and Hermkens 1991, Raudenbush and Bryk 2002).

Results

Table 4 shows the univariate distribution on the respondents' reported difficulties to envision the situation described by the vignettes. Only a small percentage of respondents finds it very difficult to image the vignettes (2.4%) or to rate them (5.2%). The vast majority does neither report difficulties in envisioning nor in rating the vignettes. It is, however, noteworthy that respondents appear to find it slightly easier imagining the described situation compared to rating them.

Table 4: Difficulty of envisioning and rating the vignettes

	Difficulty of	
	Envisioning	Rating
1 very easy	75 (25.8%)	31 (10.6%)
2	91 (31.3%)	100 (34.4%)
3	89 (30.6%)	97 (33.3%)
4	29 (10.0%)	48 (16.5%)
5 very difficult	7 (2.4%)	15 (5.2%)
Total	291 (100%)	291 (100%)

Table 5 presents the univariate distributions of the different measures on response time. The baseline speed is on average 9.8 seconds. It took the respondents on average additional 8.1 seconds to complete a vignette from the factorial survey. The residual score has, by construction, a mean value of zero, since it is based on a linear regression model.

Table 5: Speed measures

Measure	Mean	S.D.	Min	Max
Baseline speed	9.8	2.2	5.6	17.7
Raw speed	17.9	3.8	10.7	28.8
Residual-score	0.0	3.5	-8.8	11.2
N	291			

N=291

Table 6 shows the bivariate associations on the basis of mean differences. Rating the vignette was perceived slightly more difficult than envisioning it.

Table 6: Mean differences

	Subjective measures Difficulty to envision	rate	Latency RS	Consistency Squared residual ($\hat{e}_{ji}^2$)*
Number of Dimensions				
4	2.29	2.71	-1.66	3.53
5	2.24	2.82	0.28	3.00
6	2.44	2.58	1.44	2.58
Age				
<40	2.43	2.89	-0.23	3.05
40-59	2.28	2.68	0.042	3.05
60+	2.41	2.59	0.15	2.99
Education				
Low	2.06	2.24	-0.45	3.61
Middle	2.25	2.71	-0.21	3.29
High	2.49	2.90	0.38	2.59

N=291, *: person-means

First, as a general observation, rating the vignette was generally perceived slightly more difficult than envisioning it. Respondents within the 6 dimension conditions reported the highest difficulty envisioning the vignettes with a mean of 2.44, compared to 5 (mean = 2.24) and 4 dimensions (mean = 2.29). However, these mean differences are not statistically significant (see table 8a and 8b in the appendix). Observable differences between different age groups (Table 6, as well as table 9a and 9b in the appendix) are similarly statistically insignificant.

Education, however, has a statistically significant influence on the reported difficulty to envision the vignettes. Respondents with a high level of education report a higher difficulty of envisioning the described vignettes (mean 2.49) than respondents with low education (mean 2.06, see table 10a in the appendix). A Sidak test (Hochberg et al. 1987) for multiple mean differences (see table 10c in the appendix) shows that only the difference between high and low education ($t = 2.48$, $p = 0.041$) is statistically significant.

Regarding the second indicator, the difficulty to rate the vignette, the pattern is similar: any observable differences between older and younger respondents or between respondents with 4, 5, or 6 dimensions per vignette are statistically insignificant (tables 11a, 11b, 12a and 12b in the appendix). Again, differences between respondents with different levels of education turned out being statistically significant. Respondents with a high level of education report the highest difficulty of rating the vignettes (mean = 2.90), followed by middle education (mean = 2.71) and low education with the lowest difficulty (mean = 2.23). A Sidak test of multiple mean comparisons (see table 13c in the appendix) reveals that the difference between respondents of middle and high levels of education (mean difference = 0.47) is statistically significant (t = 2.72; p = 0.02) as is the difference between respondents of low and high levels of education (mean difference = 0.65, t = 3.82, p = 0.00). The difference between middle and high education is not statistically significant (see table 13c in the appendix).

The investigation of response latency showed that respondents in the 4 dimension condition have the lowest response latency value (1.66), followed by the 5 (2.8) and 6 dimension condition (1.44). These differences are all statistically significant (F = 20.55, p = 0.000, see tables 14a, 14b and 14c in the appendix). Older respondents display higher response latencies as do respondents with lower levels of education, but these differences are statistically insignificant (see tables 15a, 15b, 16a and 16b in the appendix).

Regarding response consistency, the results indicate that a higher number of dimensions produces more consistent results, since the values for $\hat{e}_{ji}^2$ are lower the higher the number of dimensions (see table 6). However, only the difference between 4 and 6 dimensions is statistically significant as indicated by a Sidak test (mean difference = 0.952, t = 2.46, p = 0.04), while the other means are not statistically different from one another (see table 17c in the appendix). The observed mean differences in response consistency for the different age groups are statistically insignificant (see tables 16a and 16b in the appendix).

There seem to be differences in response consistency between respondents' of different levels of education, the higher the education, the more consistent the response. Yet, although an ANOVA (see tables 18a and 18b, appendix) identifies these differences as significant, the more conservative Sidak test (see table 18c in the appendix) does not.

Multivariate Analysis

To jointly investigate the hypothesis, we additionally computed regression models.[5] The results are presented in table 7.

Table 7: OLS and GSL regression

	OLS regression			Random-effects GLS regression
	Model 1	Model 2	Model 3	Model 4
	Difficulty to envision	Difficulty to rating	Response latency	Response consistency
Number of Dimensions (ref.: 4)				
5	-0.012	0.156	2.024***	-0.637
	(0.147)	(0.143)	(0.470)	(0.368)
6	0.170	-0.073	3.191***	-1.054**
	(0.153)	(0.149)	(0.491)	(0.386)
Age (ref. <40)				
40-59	-0.113	-0.204	0.421	-0.105
	(0.156)	(0.152)	(0.501)	(0.393)
60+	-0.039	-0.271	0.367	-0.042
	(0.243)	(0.237)	(0.779)	(0.612)
Education (ref.: low)				
middle	0.207	0.456**	0.500	-0.440
	(0.176)	(0.172)	(0.565)	(0.440)
high	0.438*	0.644***	1.193*	-1.149**
	(0.175)	(0.171)	(0.562)	(0.438)
Constant	2.086***	2.388***	-2.766***	4.347***
	(0.218)	(0.213)	(0.699)	(0.546)
N (respondents)	291	291	291	291
N (vignettes)				2972
R^2	0.033	0.064	0.142	Between:0.04 Overall: 0.014

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The regression models confirm the results of the bivariate analyses. The number of dimensions and the age groups are still not statistically significantly associated with the difficulty to envision and rating the vignette (table 6, models 1 and 2). However, respondents with middle and high levels of education report statistically significantly more difficulties than respondents with a low

[5] Results from additional analyses, in which the self-reported difficulties are not treated as a metric but an ordinal variable confirmed the results.

level of education (models 1 and 2). Response latency is again associated with the number of dimensions; the more dimensions, the higher the response latency (model 3). Contrary to the results of the bivariate analysis, the regression analysis also finds that high educated respondents have a higher response latency than respondents with a low level of education (model 3). Lastly, regarding response consistency, we the regression analysis finds significant differences in the respondents' response consistency regarding the number of dimensions and the respondents' level of education (model 4). Respondents in the 6 dimension condition arrived at more consistent responses than respondents with 4 dimensions. Respondents with high education answered more consistent the respondents with low education.

Discussion

Factorial surveys are widely used instruments to study believes, attitudes, norms, and (hypothetical) descions in survey research (Wallander 2009; Auspurg, Hinz and Liebig 2009; Sauer et al. 2011). This article investigated the application of a factorial survey in the setting of a computer assisted telephone interview (CATI). We analyzed the influence of vignette complexity (4, 5, 6 dimensions), age, and level education on the speed of response (response latency), the consistency of the ratings, as well as the respondents' subjective assessment regarding the difficulty to process the vignettes.

We hypothesized that vignette complexity, age, and lower levels of education would be associated with increased problems in processing a factorial survey. Overall, the results do not conform to these hypotheses. An increasing number of dimensions in the vignettes do not increase self-reported difficulties in processing the factorial survey. What is more, a higher number of dimensions seem to increase response consistency, indicating that four dimensions may not provide the respondents with sufficient information to arrive at a rating. Thus, it seems as if respondents do not appear to have problems processing 6 dimensions. On the contrary, at least with the factorial survey used in this study, 6 dimensions produce more consistent results compared with fewer dimensions.

We expected to find differences between respondents with different level of education. Partly, the results conform to this hypothesis, at least with regards to the consistency of the responses. At the same time however, respondents with higher levels of education report more difficulties in processing the factorial survey and needed more time to answer it (contrary to our expectations). Thus, regarding level of education the results are inconclusive. A possible explanation might be that respondents with higher levels of education put more effort into rating the vignettes and there found it more difficult albeit producing more consistent results.

Contrary to our expectations, age is not associated with difficulties in processing the factorial survey. Neither self-reported difficulties nor response latency and response consistency showed significant age group effects.

This study has a number of shortcomings that need to be addressed. The current study does not allow any inferences on potential mode effects (Sauer et al. 2011). It is entirely possible that the process of rating a vignette differs according to the mode of the interview, that is, for instance, between CATI and CAWI. Future research should investigate if there are systematic differences attributable to the interview mode. Even though we are confident that the internal validity of our study is given due to our experimental design, external validity might be questioned because of the quality of our sample. The sample for this study is comparably small, with a very low response rate, comprising only working respondents. The sample may therefore be rather selective, not only as regards to age and employment status. Respondents whose cognitive capacity and hearing is substantially impaired because of their aging may be more likely to drop out of the labor force, thus not being eligible for inclusion in our sample. The results should thus be scrutinized with larger samples comprising also non-working respondents. Moreover, as we found that 6 dimensions were not statistically more difficult to process than 4, future research could additionally investigate an increase in the number of dimensions used in factorial surveys in CATI.

It should also be mentioned that the specific factorial survey implemented in this study has to be seen as rather difficult, because it consists of (potentially) contra-factual life situations, e.g. respondents without children were asked to picture themselves with children. If the factorial survey comprises a less difficult task (e.g. a hypothetical voting decision), respondents can be expected to have even fewer difficulties in processing the instrument.

On the whole, however, these results can be seen as encouraging as to the implementation of factorial surveys in CATI.

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Appendix

Table 8a: Difficulty to envision by number of dimensions

Dimensions	Mean	Std. dev.	Freq.
4	2.29	1.07	95
5	2.24	1.04	107
6	2.44	1.01	89
Total	2.32	1.04	291

Table 8b: Difficulty to envision by number of dimensions

Source	Sum of Squares	df	Mean Square	F	p
Between groups	1.939	2	.969	0.90	0.409
Within groups	311.340	288	.081		
Total	313.278	290	1.080		

Table 9a: Difficulty to envision by age

Age	mean	Std. dev.	Freq.
<40	2.43	1.13	56
40-59	2.28	1.01	208
60+	2.41	1.08	27
Total	2.32	1.02	291

Table 9b: Difficulty to envision by age

Source	Sum of Squares	df	Mean Square	F	p
Between groups	1.217	2	.609	0.56	0.570
Within groups	312.060	288	1.083		
Total	313.278	290	1.080		

Table 10a: Difficulty to envision by education

Education	mean	Std. dev.	Freq.
Low	2.06	.902	49
Middle	2.25	.942	118
high	2.49	1.14	124
Total	2.32	1.04	291

Table 10b: Difficulty to envision by education

Source	Sum of Squares	df	Mean Square	F	p
Between groups	7.597	2	3.799	3.58	0.029
Within groups	305.681	288	1.0614		
Total	313.278	290	1.080		

Table 10c: Sidak test Difficulty to envision by education

			95% CI	
Comparisons	Mean Difference	Std. Error	Lower Bound	Upper Bound
middle vs low	.185	.175	-.236	.605
high vs low	.431*	.174	.013	.848
High vs middle	.246	.132	-.072	.564

* $p < 0.05$

Table 11a: Difficulty to rate by number of dimensions

Dimensions	mean	Std. dev.	Freq.
4	2.71	1.01	95
5	2.82	.99	107
6	2.58	1.10	89
Total	2.71	1.03	291

Table 11b: Difficulty to rate by number of dimensions

Source	Sum of Squares	df	Mean Square	F	p
Between groups	2.761	2	1.381	1.30	0.273
Within groups	304.992	288	1.059		
Total	307.753	290	1.061		

Table 12a: Difficulty to rate by age

Age	mean	Std. dev.	Freq
<40	2.89	1.12	56
40-59	2.68	1.00	208
60+	2.59	1.08	27
Total	2.71	1.03	291

Table 12b: Difficulty to rate by age

Source	Sum of Squares	df	Mean Square	F	P
Between groups	2.457	2	1.229	1.16	0.315
Within groups	305.294	288	1.060		
Total	307.753	290	1.061		

Table 13a: Difficulty to rate by education

Education	mean	Std. dev.	Freq
Low	2.24	.879	49
Middle	2.71	1.06	118
high	2.90	1.00	124
Total	2.71	1.03	291

Table 13b: Difficulty to rate by education

Source	Sum of Squares	df	Mean Square	F	p
Between groups	14.851	2	7.425	7.30	0.001
Within groups	292.902	288	1.017		
Total	307.753	290	1.0612		

Table 13c: Sidak test Difficulty to rate by education

			95% CI	
Comparisons	Mean Difference	Std. Error	Lower Bound	Upper Bound
middle vs low	.467*	.171	.055	.879
high vs low	.650***	.170	.242	1.06
High vs middle	.183	.130	-.128	.495

* p < 0.05 , **p<0.01, ***p<0.001

Table 14a: response latency by number of dimensions

Dimensions	mean	Std. dev.	Freq.
4	-1.66	3.05	95
5	.275	3.54	107
6	1.44	3.34	89
Total	0	3.54	291

Table 14b: response latency by number of dimensions

Source	Sum of Squares	df	Mean Square	F	p
Between groups	453.540	2	226.770	20.55	0.000
Within groups	3177.442	288	11.0327		
Total	3630.983	290	12.520		

Table 14c: Sidak test response latency by education

			95% CI	
Comparisons	Mean Difference	Std. Error	Lower Bound	Upper Bound
5 vs 6	-1.16*	.477	-2.31	-.017
4 vs 6	-3.10***	.490	-4.27	-1.92
4 vs 5	-1.94***	.468	-3.06	-.811

* $p < 0.05$, **$p<0.01$, ***$p<0.001$

Table 15a: response latency by education

Dimensions	mean	Std. dev.	Freq.
Low	-.446	3.64	49
Middle	-.212	3.40	118
high	.378	3.62	124
Total	0	3.54	291

Table 15b: response latency by education

Source	Sum of Squares	Df	Mean Square	F	p
Between groups	32.775	2	16.387	1.31	0.271
Within groups	3598.208	288	12.494		
Total	3630.983	290	12.521		

Table 16a: response latency by age

Age	Mean	Std. dev.	Freq
<40	-.231	3.02	56
40-59	.042	3.71	208
60+	.153	3.23	27
Total	0	3.54	291

Table 16b: response latency by age

Source	Sum of Squares	df	Mean Square	F	p
Between groups	3.981	2	1.991	0.16	0.854
Within groups	3627.001	288	12.594		
Total	3630.983	290	12.521		

Table 17a: Response consistency by number of dimensions

Dimensions	mean	Std. dev.	Freq
4	3.53	3.17	95
5	3.00	2.48	107
6	2.58	2.09	89
Total	3.04	2.64	291

Table 17b: Response consistency by number of dimensions

Source	Sum of Squares	df	Mean Square	F	p
Between groups	41.995	2	20.998	3.06	0.048
Within groups	975.146	288	6.858		
Total	2017.142	290	6.956		

Table 17c: Sidak test Response consistency by number of dimensions

			95% CI	
Comparisons	Mean Difference	Std. Error	Lower Bound	Upper Bound
5 vs 6	.421	.376	-.482	1.324
4 vs 6	.952*	.3866	.024	1.880
4 vs 5	.531	.36916	-.356	1.417

* p < 0.05 , **p<0.01, ***p<0.001

Table 18a: Response consistency by education

Education	Mean	Std. dev.	Freq
Low	3.61	2.76	49
Middle	3.29	2.89	118
High	2.59	2.26	124
Total	3.04	2.64	291

Table 18b: Response consistency by education

Source	Sum of Squares	df	Mean Square	F	p
Between groups	48.531	2	24.265	3.55	0.030
Within groups	1968.611	288	6.835		
Total	2017.142	290	6.956		

Table 18c: Sidak test Response consistency by education

			95% CI	
Comparisons	Mean Difference	Std. Error	Lower Bound	Upper Bound
middle vs low	-.321	.444	-1.39	.747
high vs low	-1.02	.441	-2.08	.038
High vs middle	-.701	.336	-1.51	.107

* $p < 0.05$

Table 19a: Response consistency by age

Age	mean	Std. dev.	Freq
<40	3.05	2.76	56
40-59	3.05	2.696	208
60+	2.99	1.94	27
Total	3.04	2.64	291

Table 19b: Response consistency by age

Source	Sum of Squares	df	Mean Square	F	p
Between groups	.080	2	.040	0.01	0.994
Within groups	2017.061	288	7.004		
Total	2017.142	290	6.956		

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