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Reported happiness, fast and slow

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Abstract

In this paper, we test how reporting behaviors (response time, cognitive effort, questionnaire order) affect reported happiness in a large Dutch internet panel survey. We find that slower responses and higher cognitive effort reduce reported happiness. Moreover, in multivariate happiness equations, these factors moderate the estimated effect of income on happiness, while no interaction effects are found for other determinants of happiness. As a consequence, relative marginal effects may not be invariant to reporting circumstances.

JEL Classification: I31

Keywords: reporting function, happiness, mood

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1 Introduction

What do people have in mind when they respond to a survey question on happiness or satisfaction with life? Ideally, we would like to assume that respondents report truthfully and that there is a close correlation between "reported happiness" and "true happiness". However, despite a considerable body of literature (see, e.g., Diener, 1994, Kahneman and Krueger, 2006), the reporting of happiness remains pretty much a black box, and no clear consensus has emerged yet regarding the validity of self-reported happiness measures. Examples for studies on the supportive side include the finding that self-reports correlate highly with assessments by friends and relatives (Sandvik et al., 1993), and that reported happiness goes hand-in-hand with a better health and immune responses (Cohen et al. 2003). Examples for studies on the skeptical side include Krueger and Schkade (2008) who conclude in a small sample test-retest study that reported well-being changes as much over the short run as affect measures, whereas "true happiness" should be relatively stable over time. Others have documented the large effects that apparently irrelevant facts such as finding a coin, or the weather, can have on reported life-satisfaction (Schwarz, 1987, Schwarz and Clore, 1983).

A hallmark of this literature is that evidence is mostly based on small, non-representative samples. This leads to a large variability in results, and makes it harder to obtain valid generalizations. Our proposal of 'opening up the black box' of the happiness reporting function follows therefore another approach, namely analyzing data from a large representative household survey (more than 4000 respondents) and exploiting internet-based survey technology to obtain and analyze "reporting correlates". Such reporting correlates capture various aspects of the response process. They are derived from technical information on the data flow between the central databank server and the personal computer of the respondent. Unnoticed by the respondent, the system traces for instance the order in which questionnaires are viewed, as well as the time between display of a question and entering of the response.

In principle, the introduction of such reporting correlates into happiness equations can have two beneficial effects. First, to the extent that reporting is affected by these correlates, including the extra information will reduce the amount of noise in the model and thereby lead to better predictions. But even if prediction is not the primary goal of the analysis, there is a second useful feature, namely that reporting correlates can give us clues about what is happening inside the black box. We can explain this idea best in relation to response time. There is the general idea in psychology that longer response times reflect a larger amount of cognitive activity, while shorter response times indicate instinctive responses. Rubinstein (2007) uses this notion to study patterns of response times among many different tasks (choice between lotteries, standard games); in this way, he can determine for each decision task whether it typically draws on cognitive effort or rather on instinct or intuition.

Our objective is different: we have only one question (life satisfaction); however, we observe substantial inter-subject variation in response time for the same question. We want to find out two things. First, to what extent, if any, does the actual response (i.e. reported happiness) vary with response time? And second, to what extent, if any, does the sensitivity of reported happiness to socio-economic characteristics vary with response time? We proceed analogously with two further reporting correlates: questionnaire order and self-assessed cognitive effort.

The paper is structured as follows: data collection, the sample, variable definitions and basic descriptive statistics are given in Section 2. In section 3, we present our findings on the above research questions. In section 4, we discuss one particular theoretical framework, that can explain part of our results. Section 5 concludes with a discussion of implications for ongoing happiness research.

2 Data

2.1 Happiness questionnaire

The Longitudinal Study for Social Sciences (LISS) is a monthly internet panel. The LISS was initiated in 2007 by CentERdata, based at Tilburg University in the Netherlands. From a random 10% sample of the Dutch population register, 10'150 addresses were arbitrarily drawn. A letter including an incentive payment of 10 Euros was sent to the oldest inhabitant of the address. The person was called or visited, if he or she did not reply. 5176 households initially agreed to participate in the survey. Households without broadband internet connection or computer were provided with it. During 2007, 73% of all members of participating households responded to the monthly questionnaires (Scherpenzeel, 2009). Knoef and de Vos (2009) concluded that elderly people and some ethnicities were underrepresented in the LISS panel. In 2009, representativeness of the LISS was established by a refreshment sample stratified by age, ethnicity and household types (de Vos, 2010).

We analyze information from a happiness questionnaire that was in the field during March and April of 2011. We have 4399 valid responses. The happiness questionnaire consisted of four consecutive screens.

Figure 1 shows screenshots of all of them. The first page told participants that only one question will be asked. On the second page respondents were presented a usual single item happiness question. Participants answered the question "All things considered, how happy would you say you are?" on a Likert scale ranging from 0 to 9.[1] Next, on the third page of the questionnaire, respondents were invited to evaluate the happiness question by assessing difficulty in answering, clarity of the question, and degree of thought provocation, on a Likert scale ranging from 1 to 5. On the last page participants were offered the possibility to write a comment. Only 35 individuals did so.

2.2 Reporting correlates

At the beginning of each month the LISS participants receive an electronic message including web links directing to different question modules. Participants can freely choose at which day and time or in which order they want to respond to the question modules. The LISS mechanically collects time stamp data on the interaction between the user and the underlying database. Thus, it is known for example, at what time a particular question module or question was opened and when an answer was sent back. Moreover, as stated above, participants self-assessed their reporting behavior on page 3 of the happiness questionnaire. We use these data to construct three reporting correlates.

The first reporting correlate measures the time used to answer the happiness question. Figure 2 shows a kernel estimate of response times in seconds.[2] Response times vary quite a bit. The minimum answer

[1] Since the survey includes only this one question, we are unable to determine how the wording of the question, e.g. happy vs. satisfied, affects our analyses. This is a topic for future research.

[2] The graph uses an Epanechnikov kernel and the bandwidth that minimizes the mean integrated squared error (bandwidth = 0.6).

time was 2 seconds. The slowest individual left page 2 after 97 seconds. 50% of all individuals answered within 8 seconds. One possible explanation for different response times is that some people are simply faster than others at reading the question. Moreover, reading speed may correlate with (observed and unobserved) determinants of happiness. Therefore, we first obtained adjusted response times by estimating an exponential regression model of item response times.[3] The estimated marginal effects of a large set of socioeconomic and sociodemographic variables are shown in Table 1. Older people and foreigners are found to answer slower, whereas employed, married and better educated participants respond faster on average. The response time is also higher for those who mentioned difficulties in answering.[4] The regression residual gives us the adjusted response time for each individual. This is our first and main reporting correlate. The adjusted response time is positive if a person was slower in answering the happiness question than a typical person with similar characteristics, but negative otherwise.

It is conceivable that participants differ in the amount of cognitive effort they put into the answering process. Of course, response time could capture some of this variation, but we cannot know for sure. Another approach is to use the self-assessed responses of people when asked about their effort. In particular, page three of the happiness questionnaire included the question: "Did the questionnaire get you thinking about things?". Figure 3 shows the distribution of answers. More than 20% completely disagreed with this statement, while slightly more than 10% fully agreed. The second reporting correlate is the dichotomized variable that takes the value 1 if the score is larger than the mean response (2.9) and 0 otherwise.[5] We call

[3] We use an exponential regression because response time is non-negative. We estimated the parameters by Poisson maximum likelihood. Faust et al. (1998) discuss different methods for adjusting response times.

[4] The speed of the internet connection should not affect response times. The LISS panel offered broadband internet to all households (Scherpenzeel, 2009).

[5] Results are not sensitive to the threshold choice. Dichotomization with respect to the median, for instance, led to similar

this variable subjective "cognitive effort". It is self-assessed and by its very nature limited to the conscious dimension of effort.

Cognitive effort and response duration measure happiness reporting aspects at the time of the answering process. The third reporting correlate records how participants deal with the response burden of different question modules. The LISS panel sends each month a Background Variable Questionnaire to the contact person of the household. The Background Variable questionnaire contains questions on core socioeconomic or sociodemographic variables, such as income, education or age. The contact person updates the information for all household members. We compared the activation time of the Background Variable questionnaire to that of the happiness questionnaire. The third reporting correlate takes the value 1 if the Background Variable questionnaire was opened by the contact person during the two hours preceding the happiness questionnaire. It is zero otherwise. Ones are observed in about 23% of all cases.

3 The effects of reporting correlates

We first analyze the bivariate relationship between reported happiness and reporting correlates. Figure 4 shows average reported happiness for each of the two values of the reporting correlates, together with 95% confidence intervals.[6] Longer adjusted response time and high subjective cognitive effort decrease average reported happiness by 0.2 and 0.15 points, respectively. These effects are statistically significant. No such effect is found for questionnaire order.

findings.

[6] For this exercise the adjusted response time was dichotomized. A zero was attributed to negative and a one to positive response times.

A comparison of mean happiness scores can be misleading though. Average reported happiness may be similar among subsamples, even though the distributions differ (e.g. in their spread). Figure 5 plots the cumulative distribution functions conditional on all three reporting correlates. At a first glance, the distributions look very similar. However, a Pearson's Chi squared test for equality of distributions reveals statistically significant differences in the upper two graphs. For instance, answering slower than average decreases the estimated probability of an happiness score below 8 by around 6 percentage points. Thus, there is some evidence that reporting correlates indeed affect levels of reported happiness. In order to gain further insights into the black-box reporting mechanism, we make use of regression analysis. Our specifications are motivated by the concept of a *reporting function*, which will be explained in the next section.

3.1 Reporting function

Suppose that reported happiness

$$R = R(x, z) \tag{1}$$

is some unknown function of x and z, where x is a vector containing external factors that determine true happiness, for instance income, health and labor force status, while z denotes the reporting correlates.[7] A restrictive version of (1), that assumes separability between x and z and explicitly introduces the notion of "true happiness"m, $H(x)$, can be written as

$$R(x, z) = g(H(x), z) \tag{2}$$

[7]For an earlier discussion of happiness reporting functions that focusses on the first derivatives, see Owald (2008).

Now, x affects reported happiness only through $H(x)$, while z has no effect on $H(x)$. The key difference between (1) and (2) relates to the marginal rate of substitution, $(\partial H(x)/\partial x_i)/(\partial H(x)/\partial x_j)$ (i.e. the relative marginal effects). Under model (2), it holds that

$$\frac{\partial H(x)/\partial x_i}{\partial H(x)/\partial x_j} = \frac{\partial R(x,z)/\partial x_i}{\partial R(x,z)/\partial x_j}$$

which means that reported happiness data can identify the relative marginal effect of true happiness. Under model (1), this is not the case, as the reporting process drives a wedge between true and reported happiness that distorts relative effects. Thus, a key objective is to test model (2) against the more general model (1). If model (2) cannot be rejected, then we know at least that the difference between reported and true happiness is unimportant, as long as conclusions focus on relative marginal effects of true happiness. These remain valid and are unaffected by reporting, justifying the treatment of the reporting mechanism as a black box.

3.2 Empirical model

The deterministic part of a linearized version of the reporting model can be written as

$$R = x'\beta + z'\gamma + (zx)'\delta$$

where δ captures interaction effects. The intensity of the response of reported happiness to differences in socio-economic background variables is a function of reporting behavior as long as $\delta \neq 0$. For instance, with z being the adjusted response time and x income, $\beta > 0$ and $\delta < 0$ would imply that the marginal effect of income decreases with answer speed. In other words, respondents attribute less weight to income the longer they take to answer. The difference between Model (1) and Model (2) depends on δ. If δ is a multiple of β, relative marginal effects with respect to components of x are unchanged by Z, giving rise to Model (2). Otherwise, Model (1) is obtained.

Since R is logically restricted to lie between 0 and 9, it is impossible to observe negative mean values $E(R|x,z)$, or values above 9. This consideration would be ignored by a linear regression model. Hence we specify a stochastic model whereby

$$R = f[x'\beta + z'\gamma + (zx)'\delta] + v\,, \tag{3}$$

f is a transformation function that maps the real line onto the $[0,9]$ interval, and $E(v|x,z) = 0$.[8] We use a modified logit function, and the model parameters are estimated by Bernoulli Quasi Maximum Likelihood. This is in the spirit of Papke and Wooldridge, who applied a similar approach to fractional data. It was also used for happiness data by Studer and Winkelmann (2011). In this nonlinear model, marginal effects differ from individual to individual. As a rule of thumb, average marginal effects can be obtained by multiplying the coefficient with the factor $\bar{R}(R^{max} - \bar{R})/R^{max}$, where $\bar{R}$ is mean reported happiness in the sample. In our data, this factor is approximately equal to 1.5.

3.3 Results

We first estimate the model without interaction terms. x includes objective individual characteristics that are generally used in the economic well-being literature (e.g., Frey and Stutzer, 2002). We add one reporting correlate at a time. Estimates of the parameter vector β and γ are shown in Table 2. Findings

[8] Our model abstracts from further complications such as omitted variables or measurement error that have been studied by, for instance, by Bertrand and Mullainathan (2001).

on $\hat{\beta}$ resonate the results from the earlier literature. Reported happiness is found to increase with income, marriage and employment. Men and foreigners report lower happiness and happiness scores are U-shaped in age. Moreover, sizes of correlations are similar to earlier findings. For instance, a 1% raise in income increases reported happiness by 0.4 points on average.

In addition, there is evidence that reporting correlates affect levels of reported happiness as well. The first two columns suggest that an adjusted response time of 12 seconds, or a cognitive effortful answer, reduce reported happiness by more than 0.1 points ceteris paribus. These effects are substantial. For instance, they are larger in absolute value than the impact of being employed vs non-employed (this includes unemployment and non-participation). The last column of Table 2 reports a positive, but only marginally significant effect of questionnaire order on reported happiness. We conclude that average reported happiness scores reflect in part aspects of the reporting mechanism, as captured by our reporting correlates.

In most cases, researchers estimating happiness equations are less interested in absolute levels and more so in the effects of socio-economics characteristics and their changes.[9] Therefore, for all practical purposes, it is the more interesting question, whether reporting circumstances change the estimated relationship between happiness and these socio-economic characteristics, and in particular, whether relative marginal effects change (i.e., the distinction between Model (1) and Model (2)).

Table 3 presents the estimates of the unconstrained model (3). The upper half of the table reports estimates of the main effects of happiness determinants (β) and reporting correlates (γ). In the lower half

[9] For example, in fixed effects panel logit estimates, the levels are not identified at all.

of the table, the estimated interaction coefficients δ are displayed.

Column 1 of Table 3 shows the results for the happiness equation that is interacted with response time. All but one of the interaction terms is close to zero and statistically significant. The one exception is the estimated effect of income on reported happiness that is found to decrease with response time. For instance, the average marginal effect of a 1% income increase increases by 0.07 points or 15%, if the response time is reduced by 10 seconds. A similar pattern is found in column 2 of Table 3, where again all but the income interaction effects are statistically insignificant. The marginal effect of a 1% income increase is found to double (0.7 points) for individuals who stated that answering the question required no cognitive effort.

The last column of Table 3 shows results for the questionnaire order variable. We conjectured that answering the socio-economic questions might increase the salience of these variables, leading to a stronger observed relationship. Also, questionnaire order might lead to priming (e.g. Schwarz and Strack, 1988; Deaton, 2012) whereby participants substitute answers given to previous questions, for instance about their income or employment status, for the assessment of happiness. However, we cannot find any evidence for such effects in our data. We only find that an increased workload is associated with lower reported happiness.

Summarizing the evidence, we find that interaction effects matter for response time and cognitive effort, but not so for questionnaire order. This is also confirmed by formal Wald tests for the null hypothesis, that all elements of δ are jointly zero. The negative interaction effects for income suggest that higher response effort is associated with lower relevance of materialistic determinants during the assessment of happiness. In contrast, it is conceivable that slower and more thoughtful answers contain more information about social relationships and other non-material factors. As to our additional hypothesis, namely whether the effect of reporting correlates is proportional for all x's, or whether there are disproportionate shifts, the evidence speaks clearly in favor of the latter, as it is the income effect that is modified, while interaction effects are absent for other variables.

3.4 A possible explanation

Suppose, as in Rubinstein (2007), that there are two polar states of mind for answering happiness questions, an instinctive one and a cognitive one. [10] As a general happiness question is of an evaluative nature, one might expect that those who think longer about it and also state that they spent more cognitive effort, are the same individuals, for which the happiness answers are less random and for whom one finds stronger relationships to the socio-economic determinants. However, this is not what we find, on the contrary.

A possible resolution to this "puzzle" is a different approach, whereby our reporting correlates do not primarily relate to the amount of cognitive deliberations when answering the question, but rather proxy for mood (e.g., Frederick, 2005; Kahneman, 2011). Experiments have shown that mood has a large causal effect on the cognitive processes that are at work when a question is answered. For instance, people randomly put in good mood reflect less their current environment (Schwarz and Clore, 1983), rely heavier on general knowledge structures (Bless et al., 1996), trust more their intuition (Bolte et al., 2003) and are more gullible (Forgas and East, 2008). People in a good mood are more likely to answer spontaneously and intuitively, while people in a bad mood are more likely to rely on effortful mental activities when answering

[10] This distinction between system 1 and system 2 processes (Stanovich and West, 2000) has been generally adopted in the literature on decision taking (e.g. Frederick, 2005).

a question.

This theory is clearly compatible with our observation that slower respondents, as well as those exerting more cognitive effort, report lower levels of happiness. It is not because of the effort per se, but rather because effort proxies for mood which is otherwise not captured by the model. It also appears that a negative mood reduces the weight that individuals give to income changes when thinking about their happiness. The reason for this phenomenon is less clear and remains an interesting question for future research.

4 Conclusions

New internet-based survey technologies automatically record certain aspects of response behaviors, including how long a person takes to answer a question and in what order questionnaires are opened. The objective of this paper was to explore whether and how these "reporting correlates" affect reported happiness. There were two main findings on response time. First, responding slowly is associated with a lower reported happiness. Second, the marginal effect of income on happiness decreases with response time. A possible explanation is that respondents in a positive mood are more likely to give intuitive and therefore faster, answers.

The implications for happiness research are twofold. First, and this is a positive result, reporting correlates such as response times are relatively easy to measure and they can significantly enrich the specification of happiness equations, among other things by capturing the confounding effect of temporary mood on happiness responses. Second, the fact that response time changes the marginal effect of income but leaves the marginal effects of other variables unaffected, implies that income trade-off ratios (or relative marginal effects) may not be invariant to reporting correlates (including mood). This is a somewhat problematic finding, as exactly these trade-off ratios are of great interest to a large part of applied happiness research, for instance for studies that use happiness equations to value intangibles .

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Table 1: Exponential regression of response time on characteristics

	Marginal Effect	Standard Error
Male	0.183	(0.208)
Log Net HH Income (EUR)	-0.485	(0.455)
Age	0.098***	(0.008)
Log HH-members	0.094	(0.379)
Cohabiting	0.016	(0.483)
Houseownership	-0.493	(0.300)
Employed	-1.212***	(0.275)
Secondary Education	-0.825**	(0.365)
Tertiary Education	-0.979**	(0.381)
Married	-0.626**	(0.305)
Separated	-0.327	(0.461)
Foreigner	1.535***	(0.423)
Returned to the question	3.126*	(1.795)
Difficulty in answering	0.455***	(0.103)
April dummy	0.141	(0.207)

$N = 4399$

Heteroscedasticity consistent standard errors are presented.

*** significant at the 1 percent level, ** at the 5 percent level,

* at the 10 percent level

Table 2: Regressions of reported happiness on characteristics and reporting correlates

Response time	-0.007***	(0.002)				
Subjective cognitive effort			-0.083***	(0.026)		
Questionnare order					0.056*	(0.031)
Log Net HH Income	0.265***	(0.030)	0.264***	(0.030)	0.267***	(0.030)
Employed	0.078**	(0.032)	0.078**	(0.032)	0.077**	(0.032)
Higher Education	0.004	(0.026)	0.007	(0.026)	0.002	(0.026)
Age	-0.028***	(0.005)	-0.028***	(0.005)	-0.029***	(0.005)
$\text{Age}^2 \cdot 10^{-2}$	0.031***	(0.005)	0.030***	(0.005)	0.031***	(0.005)
Male	-0.068***	(0.024)	-0.071***	(0.024)	-0.068***	(0.024)
Married	0.318***	(0.032)	0.314***	(0.032)	0.320***	(0.032)
Foreigner	-0.167***	(0.038)	-0.165***	(0.038)	-0.170***	(0.038)
Log HH-members	-0.100***	(0.032)	-0.096***	(0.032)	-0.096***	(0.032)
April dummy	-0.029	(0.024)	-0.023	(0.024)	-0.011	(0.026)
Constant	-0.227	(0.248)	-0.176	(0.254)	-0.254	(0.251)

$N = 4399$

Estimates for the parameter vectors β and γ are presented and

heteroscedasticity consistent standard errors are reported in parentheses.

*** significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 3: Regressions of reported happiness on characteristics by reporting correlates

	Adjusted response time		Subjective cognitive effort		Questionnaire order	
Log Net HH Income	0.274***	(0.030)	0.423***	(0.057)	0.249***	(0.034)
Employed	0.077**	(0.032)	0.020	(0.061)	0.074**	(0.036)
Higher Education	0.005	(0.026)	-0.040	(0.049)	0.015	(0.030)
Age	-0.029***	(0.005)	-0.018**	(0.009)	-0.028***	(0.005)
Age^2 $\cdot 10^{-2}$	0.031***	(0.005)	0.023**	(0.009)	0.031***	(0.006)
Male	-0.071***	(0.024)	-0.065	(0.044)	-0.062**	(0.027)
Married	0.319***	(0.032)	0.265***	(0.060)	0.297***	(0.037)
Foreigner	-0.170***	(0.038)	-0.167**	(0.074)	-0.194***	(0.045)
Log HH-members	-0.110***	(0.032)	-0.112*	(0.062)	-0.062*	(0.037)
April dummy	-0.030	(0.024)	-0.055	(0.044)	-0.011	(0.028)
Reporting Correlate	0.046*	(0.024)	1.912***	(0.544)	-0.538	(0.598)
Constant	-0.282	(0.248)	-1.581***	(0.465)	-0.163	(0.288)
Interactions with reporting correlate						
Log Net HH Income	-0.004*	(0.002)	-0.222***	(0.066)	0.086	(0.073)
Employed	0.000	(0.004)	0.079	(0.072)	0.031	(0.083)
Higher Education	0.001	(0.004)	0.070	(0.058)	-0.059	(0.063)
Age	-0.001	(0.001)	-0.015	(0.011)	0.001	(0.014)
Age^2 $\cdot 10^{-2}$	0.000	(0.00)	0.012	(0.011)	-0.002	(0.014)
Male	-0.005	(0.004)	-0.008	(0.053)	-0.037	(0.057)
Married	0.002	(0.005)	0.075	(0.071)	0.113	(0.075)
Foreigner	-0.005	(0.004)	-0.001	(0.086)	0.104	(0.083)
Log HH-members	0.000	(0.005)	0.016	(0.072)	-0.156**	(0.074)
April dummy	0.008*	(0.004)	0.043	(0.053)	0.001	(0.079)

$N = 4399$

Estimates for the parameter vectors β, γ and δ are presented and heteroscedasticity consistent standard errors are reported in parentheses.

*** significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Figure 1: Screenshots of happiness questionnaire

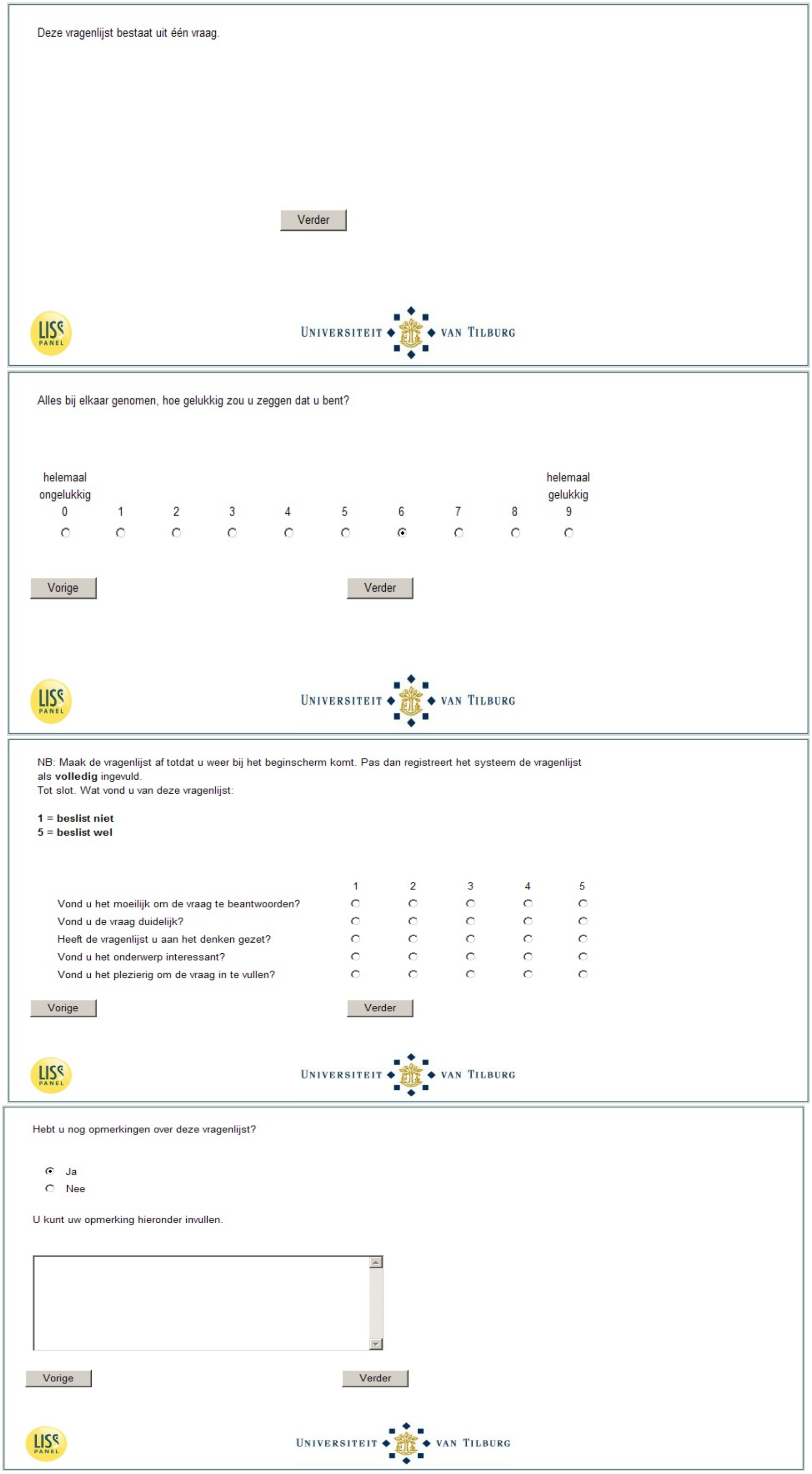

Figure 2: Kernel density estimate of response time

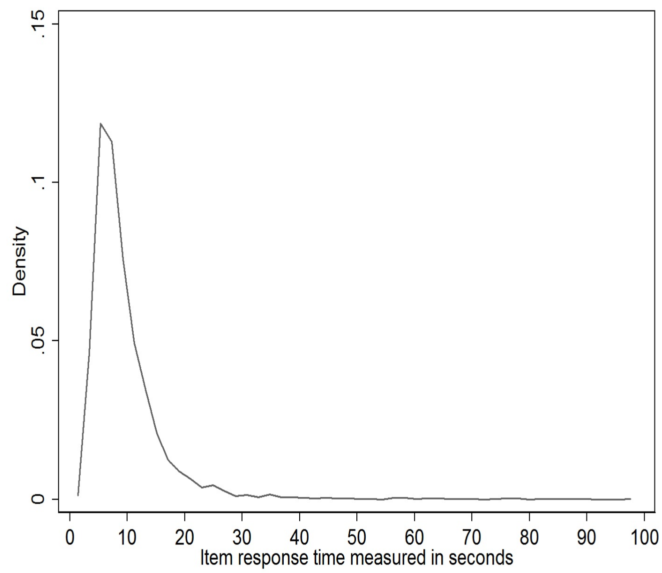

Figure 3: Self-reported cognitive effort

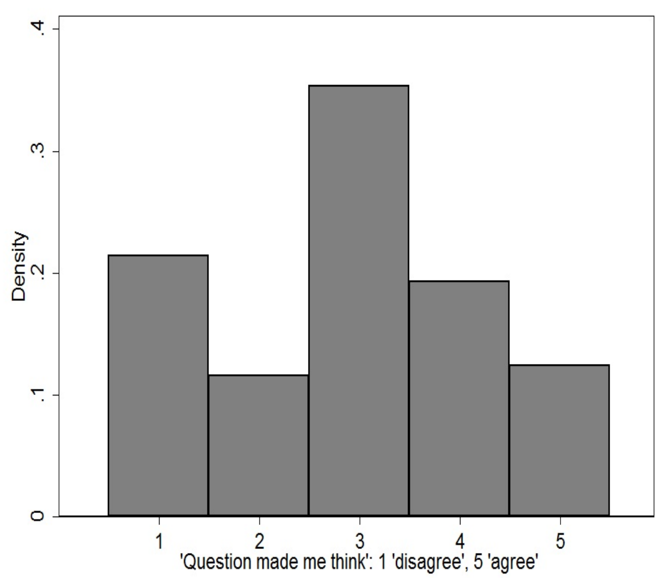

Figure 4: Mean reported happiness by realizations of reporting correlates

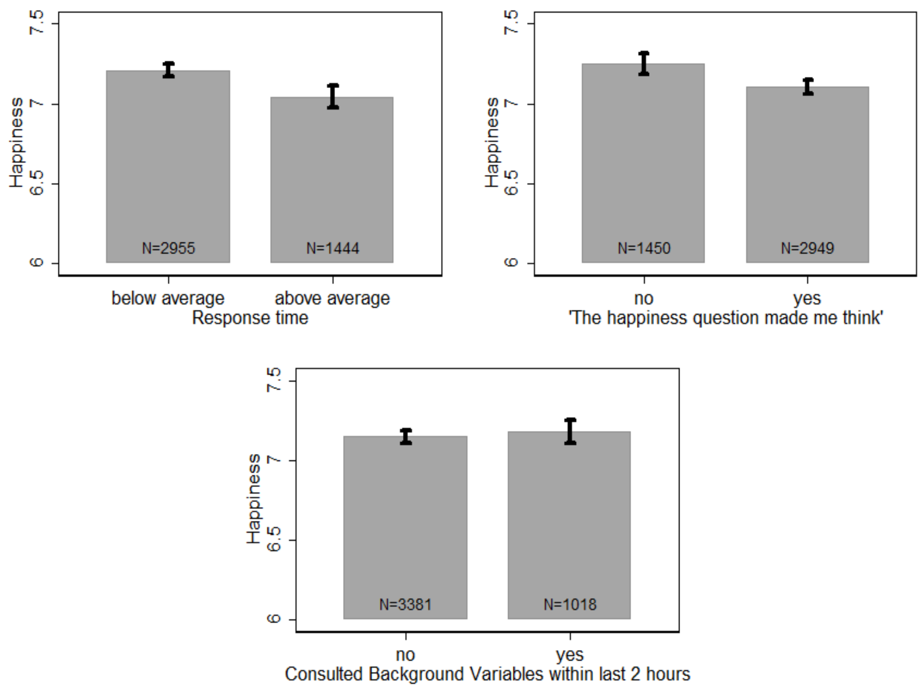

Figure 5: Distributions of reported happiness by realizations of reporting correlates