



Trust and Understanding, Two Psychological Aspects of Randomized Response

A Study of a Method for Improving the Estimate of Social Security Fraud

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Abstract. This study examines two different Randomized Response methods to see whether they evoke sufficient understanding and trust, and ensure fewer evasive answers to socially sensitive questions. Two Randomized Response methods were employed by trained interviewers to study fraud: the Forced Response method, using dice, and Kuk's method, using playing cards. Respondents were selected from the files of the social security offices of three Dutch cities. A total of 334 respondents participated voluntarily in this study of two Randomized Response methods. Most respondents were known to have committed some form of fraud, and their answer on the Randomized Response question is validated with this information. The results indicate that subjects who have a better understanding of the Forced Response technique give more socially undesirable answers. The interviewer has a most important role establishing trust and understanding. Respondents who are less able to understand the instructions, e.g., have limited language abilities, develop less trust in the method.

Key words: measures–instruments, social service clients, fraud estimates, Netherlands.

1. Introduction

The Randomized Response technique, originally developed by Warner (1965), is intended to minimize evasive responses to sensitive social questions. All Randomized Response techniques use a randomizing device, such as dice or playing cards. Depending on the result produced by the randomizing device, the answer is based on the true status of the respondent or is without meaning. Because both interviewer and researcher are unaware of the result of the randomizing device, the use of this device ensures that an individual respondent cannot be identified on the basis of his/her answer. Aggregate estimates of the responses to the sensitive questions remain possible while the privacy of the individual respondent is protected. Since the first introduction of the Randomized Response method, researchers have proposed improvements (Fox & Tracy, 1986; Umesh & Peterson, 1991) for making the technique statistically more efficient.

The Randomized Response technique is quite complex and one of the central assumptions is that the respondent understands how the method guarantees his or her privacy and that this understanding increases the subject's willingness to answer questions about socially unacceptable behavior. This study focuses on the question of whether two different Randomized Response methods evoke sufficient trust and understanding for the respondent to answer questions on socially undesirable topics, in this case the question of whether the respondent has committed social security fraud. Several factors which may bear on the development of sufficient understanding or trust, such as level of education or mastery of the Dutch language, and on the ability of the interviewer to evoke understanding and trust are also reviewed.

Several researchers have investigated the advantages of the Randomized Response method. It increases respondents' willingness to participate in such research (Fox & Tracy, 1980; Goodstadt & Gruson, 1975), it generally reduces evasive responses (Fox & Tracy, 1986), and it discloses more instances of socially undesirable characteristics (Goodstadt & Gruson, 1975), although exceptions to this rule have also been found (see Umesh & Peterson (1991) for an overview). There is also some evidence that the RR-method works better when the answers are clearly of a desirable or undesirable nature (Himmelfarb & Lickteig, 1982).

Several authors have mentioned the importance of psychological aspects of the RR-method for its successful application. When a respondent does not fully understand the method, this may lead to a reduction of trust (Fox & Tracy, 1980). The trust of an innocent respondent may be reduced because he or she may find it more difficult to report his/her innocence (Fox & Tracy, 1980). For respondents to cooperate it would seem that they need to understand how the Randomized Response method works (Soeken & Macready, 1982) and, furthermore, to develop a psychological sense of security (Umesh & Peterson, 1991). However, previous research has mainly been focused on various technical aspects of the method (Nathan, 1988; Umesh & Peterson, 1991) and empirical data about such psychological aspects are scarce.

Several studies have shown that the RR-method is not successful under all circumstances. Umesh and Peterson (1991: 112) have stated that "Contrary to popular belief, the RR-method does not consistently yield higher estimates of sensitive behavior". In their comparison of estimates obtained by the Randomized Response method and by Direct Questioning, they showed that out of thirteen recent studies, one study reported consistently lower estimates for RR-method compared with Direct Questioning, four studies reported that none or almost none of the estimate differences were significant, and eight studies showed that the Randomized Response estimate was significantly higher. Soeken and Macready (1982) demonstrated that the perceived protection is significantly associated with the probability of selecting the sensitive item. Edgell et al. (1982) presented the results of a post-experimental telephone interview, showing that 91% of the subjects who had cooperated in a RR-experiment felt that the use of the RR-method would enhance

the confidentiality of their responses and 90% felt that using the RR-method would make people more willing to admit to socially unacceptable behavior.

The respondents of our current study are 334 clients of the Dutch social security office. Our research is focused on social security fraud, that is, the concealment of information from the social security office that would have lowered the amount of money these clients are entitled to. The sample can be considered as a validation sample, as most of the respondents were known by the social security office to have committed some form of fraud. This information was coupled to the rest of the data, using a method that ensured that the researchers were protected against knowledge of the status of the individual respondent.

The rationale of this study of the RR-method is that trust and understanding is not automatically evoked, but may be dependent on subject attributes, such as educational level and mastery of the Dutch language, and of the abilities of the interviewer to instruct the respondent. Moreover, understanding is one thing, but this does not necessarily ensure that the reluctance of the respondent to give a socially undesirable answer has been overcome. We could find no earlier study that measures these psychological attributes of the RR-method. Clearly, a better understanding of the psychological attributes of the RR-method might contribute to the understanding of the way the method works and might lead to further improvements of the method. We have therefore developed scales to measure the constructs 'trust' and 'understanding', specifically in regard to the Randomized Response technique.

Firstly, we expect that respondents with limited means to understand the instructions, such as inability to understand the Dutch language or low educational attainment, will develop a lower level of trust and understanding in relation to the Randomized Response method. Secondly, we expect those respondents who refuse to cooperate further after the initial instruction phase of one of the Randomized Response methods will be those who have developed less trust and understanding. Thirdly, we expect to find differences between interviewers in establishing trust and understanding. Fourthly, the group of respondents who are not known to have concealed important information from the social security service allows us to check Fox and Tracy's (1980) hypothesis that innocent respondents will develop less trust when a Randomized Response method is used, because it is more difficult to demonstrate innocence. If this is true, we would expect a lower trust score in the 'No Known Fraud' group compared with the groups that are known to have committed some form of fraud. Lastly, we expect that subjects who understand and develop a trusting attitude towards the RR-method will be inclined to answer less evasively, whereas for subjects that do not develop such an attitude the Randomized Response method will work less efficiently. We expect that subjects who lack trust or do not understand the method sufficiently will cooperate less, resulting in more evasive answers.

Definitions. 'Trust' is defined as the confidence of being protected by the use of the Randomized Response methods. 'Understanding' is defined as insight into the

protection that the methods have to offer and knowing what to do at every phase of the interviewing process. Nonnative origin, a limited ability to understand and speak the Dutch language, and a lower educational level are used as indicators of limited means to understand the instructions. The sensitive question “Did you ever conceal some part of your income to the social security office, when you were required by law to declare this?” is the focus of this study. Evasive answering is operationally defined as the number of negative answers given to the socially sensitive question. The truthfulness or untruthfulness of answers is determined by comparing the answers to the social sensitive question with the social security office register of false income declaration.

2. Methods

Conditions. The Forced Response method (Fox & Tracy, 1986) uses dice as the randomizing device. Part of the answers is determined by the result of the dice cast (2, 3 or 4 is “Yes”, 11 or 12 is “No”), while the rest of the answers are expected to be honest. The interviewer is not aware of the result of the dice cast and cannot see if the answer is determined by the result of the dice cast or not. The other method is Kuk’s playing card method (Kuk, 1990). In this method, two piles of playing cards are used. Both piles contain different proportions of red playing cards, in this case 20% and 80%. The respondent takes a card from each pile and answers by calling the card color. If the answer to the question is “Yes”, then the respondent calls the color of the card taken from the left pile, if it is negative, the respondent calls the color of the card taken from the right pile. The interviewer is unaware from which pile the mentioned color has been obtained. Kuk’s method has no forced response.

Participants. The respondents were randomly assigned to the two RR-methods. Background variables were collected during the interview. Subjects were selected from the files of the municipal social security offices of three Dutch cities. All subjects were approached by letter from the social security office, with the request to cooperate in a study about the attitude of clients towards the social security system, making it clear that new methods of questioning would be used. Persons who did not wish to participate were requested to return a reply card. All other addresses (67%) were transferred to the researchers.

Each respondent to be approached was assigned to an interviewer, depending on the city where they lived. Twelve percent of the addresses had not been used on the moment that the survey was concluded. Respondents were approached until at least 300 respondents had participated fully in the two Randomized Response conditions. After being approached, 22% of the respondents refused cooperation. Some of the respondents cooperated badly during the interview and their incomplete and incoherent answers could not be used for further analysis. A total of 334 respondents was interviewed in the two RR-conditions: 162 in the Forced Response method and 172 in Kuk’s playing card method.

There are minor differences between the respondents of the Forced Response condition and those of the Kuk's Playing Card condition concerning gender (49% versus 55% males), age (M 40.0 and 38.6), place of birth (42% versus 44% non-natives) and educational level (67% versus 70% low level education). None of these differences are significant. Dropouts were respondents who have decided not to cooperate any further with the Randomized Response questions, after having received the Randomized Response instructions and some trial questions. These respondents did answer the questions concerning trust and understanding. The number of dropouts per method is larger for the dice method, a nearly significant difference ($F(1,333) = 3.1, p < 0.10$).

Most of the fraud (67%) concerned undeclared income, and 12% concerned concealed information about respondents' living situation which determined the amount of social security they were entitled to, while 21% of the respondents were not known to have committed fraud.

Operationalization. For the measurement of 'understanding' we formulated questions which would lead to an affirmative answer when the respondent fully grasped the implications of the RR-method. For instance, 'It is clear that the procedure with (playing cards)/(dice) guarantees secrecy about someone's activities in real life'. For the measurement of the 'trust' construct, questions were formulated with a clear emotional content, such as 'It is more like a casino game than like serious research'. Trust is operationalized as the extent of agreement with positive statements, questions with a clear negative emotional content being inversely coded. The questions are presented in Table I.

The reliability of the two scales was found to be reasonable: when both RR-groups are combined the Trust-scale has a Cronbach's Alpha of 0.70, the Understanding-scale of 0.73. As could be expected, the two scales are somewhat interdependent ($r = 0.48$).

Interviewers. A total of twelve interviewers was selected and received a training in the application of the two Randomized Response methods. All interviewers had previous experience in common interview procedures. The interviewers were also given a brief lecture in which the background of the Randomized Response procedures was explained. The assignment of respondents to interviewers was, for obvious reasons, determined by the respondent's place of residence. Interviewers were randomly assigned to conditions.

Procedure. The sensitive questions were introduced in a general manner. It was emphasized that the questions would be of a private nature and that a method of questioning would be used that would protect respondents' privacy. The randomizing device (dice or playing cards) was introduced and the respondent received a card which explained how to answer, depending on the outcome of the random device. The interviewer also explained the method. For instance, the dice were introduced by saying: 'If you throw the two dices, and the result is 5, 6, 7, 8, 9 or 10 you always give a true answer, yes or no. If you throw 2, 3 or 4, you answer always yes. If you throw 11 or 12, you always answer no. In this way, when you

Table I. The items of the understanding and trust scales for the randomized response method

Items of the understanding scale	
Answers: strongly agree/agree/uncertain/disagree/strongly disagree, re-coded agree/otherwise.	
	Answer reflecting understanding
1. It is clear that the procedure with (playing cards)/(dice) guarantees secrecy about someone's activities in real life.	Agree
2. It was clear to me when I had to answer ("yes")/"red") or ("no")/"black").	Agree
3. The use of (playing cards)/(dice) makes it easier for a lot of people to give an honest answer.	Agree
Items of the Trust-scale	
Answers: strongly agree/agree/uncertain/disagree/strongly disagree. Items with a negative affect are coded inversely.	
1. It is more like a casino game than like serious research.	
2. This method of questioning promotes a tendency to answer less seriously.	
3. The use of (playing cards)/(dice) gives someone the feeling of being approached as if they have something to conceal.	
4. I am confident that all my answers are kept secret.	

throw 2, 3, 4, 11 or 12, your answer is based on the dice. Because I can't see what you have thrown, your personal privacy is guaranteed: your true answer remains a secret.' The use of the playing cards was explained in a similar way.

The method was then demonstrated using a question with an obvious answer and it was again emphasized that personal privacy would be guaranteed if the respondent followed the rules. Then six questions of increasing sensitivity were used to practice the method. A more detailed description of the design can be found in Van Gils et al. (1996).

3. Results

In the first place, we tested our expectations concerning the effects of limited means of understanding the Randomized Response instructions. The differences between the two RR-methods on trust and understanding are not significant for educational level on trust or understanding, possibly due to the fact that most of our respondents had a low level of education. There is a significant interaction effect between RR-method and educational level on trust: respondents with a higher educational attainment develop more trust when Kuk's playing card method is used ($F(3,326) = 4.45, p < 0.05$). None of the other interactions between RR-methods and respon-

dent attributes were significant. Respondents with high reading and writing skills develop significantly more trust ($F(2,328) = 3.7, p < 0.05$) than respondents with low or medium skills. The 143 nonnative respondents developed significantly less trust of the Randomized Response methods than the 191 natives, $F(1,330) = 6.1, p < 0.05$.

The nonnative respondents were also asked if they had problems understanding and speaking the Dutch language. Those nonnatives who reported an inability to understand and speak the Dutch language were considered as having limited means of understanding the instructions. The results show that they develop significantly less understanding ($F(2,137) = 3.2, p < 0.05$) compared with nonnative respondents who are able to understand and speak Dutch. There was no significant interaction effect between RR-method and language ability.

Secondly, we tested our prediction that respondents who, after the instructions, were unwilling to cooperate further on one of the Randomized Response methods, would score significantly lower on the trust and understanding scales. There were significant differences between the dropout respondents and those who fully cooperated, both on understanding ($F(1,330) = 36.3, p < 0.0005$) and trust ($F(1,330) = 4.7, p < 0.05$).

In the third place we looked at differences between the interviewers. The differences are very large. The Understanding scale has a grand mean of 1.8, with a deviation of -1.63 for the worst interviewer and a deviation of 0.87 for the interviewer who evokes the most understanding. The Trust scale has a grand mean of 3.6, with a deviation of -0.60 for the interviewer who brings on the least trust and a 1.05 deviation for the interviewer who evokes the most trust. The differences in trust established by different interviewers is highly significant ($F(11,310) = 9.09, p < 0.0005$) and explains as much as 24% of the variance. The effect is even stronger on the Understanding-scale ($F(11,310) = 16.3, p < 0.0005$), explaining 36% of the variance. These differences were much greater than we had anticipated, since all interviewers are experienced and have been thoroughly trained, specifically in the Randomized Response methods. There is no significant interaction-effect between interviewers and applied Randomized Response method.

Not all respondents are known to have concealed important information from the social security office. This allows us to test Fox and Tracy's prediction that the trust of an innocent respondent may be reduced, because he or she will find it more difficult to demonstrate his/her innocence when a Randomized Response method is used. If this is true, we would expect a lower trust score in the 'No Known Fraud' group compared with the other two groups. No significant differences on the dependent variables trust and understanding have been found between the two RR-methods, nor were there any significant interaction effects between these predictive variables and the RR-methods.

The last issue we have studied concerns the answering tendency of those respondents who manifest an attitude of trust towards and an understanding of the method, once it has been introduced. These respondents are expected to answer the

Table II. Univariate results of the Logistic Regression Analysis for the two Randomized Response methods, using Dice and Playing Cards as randomizing device. The dependent variable is the answer to the Randomized Response question “Did you ever conceal some part of your income to the social security office, when you were required by law to declare this”

	Kuk’s method, using playing cards ($n = 163$)		Forced response method, using Dice ($n = 144$)	
	<i>b</i> -estimate	<i>t</i> -value	<i>b</i> -estimate	<i>t</i> -value
Undeclared income, known by the social security office	-1.253	-1.833*	-1.067	-2.074**

* $p < 0.05$ one side.

** $p < 0.025$ one sided.

RR-question less evasively. The method of analysis is explained in Van der Heijden & Van Gils (1996) and Van der Heijden et al. (1997). The results are presented in Tables II, III and IV. Of course, drop-outs are not included. Only the univariate results are presented, as the various multivariate analysis performed, showed similar parameter estimates. Because it is impossible to study all relevant variables in a single analysis, the choice of which specific multivariate analysis results to present would have been arbitrary.

Not surprisingly, respondents who are known by the social security office to have committed income fraud, more often answer affirmatively to the Randomized Response question, regardless of which method has been used (Table II).

Respondents who are known to have committed fraud, and who report a better understanding of the method, answer significantly less evasively (Table III). The more trusting respondents, who are not known to have committed fraud, answer less evasively in the Forced Response condition; this result is almost significant ($p < 0.10$). The country of birth, reading and writing skills and educational level are all nonsignificant as predictors for a tendency to answer evasively.

In Table IV the probabilities of the nonevasive answer, $p(\text{yes})$, are presented. More understanding results in a considerably higher probability of a nonevasive answer in the group of those respondents known to have committed fraud.

4. Discussion

Our results indicate that understanding of and trust in the protection against exposure is not automatically established by the Randomized Response. Both the Forced Response method and Kuk’s Playing Card method are complex and hard to instruct. Nevertheless, this study shows that both the Randomized Response methods result in an improved estimate of fraud when sufficient understanding of the method has been implemented.

Table III. Univariate results of the Logistic Regression Analysis for the two Randomized Response methods, using Dice and Playing Cards as randomizing device. The dependent variable is the answer to the Randomized Response question “Did you ever conceal some part of your income to the social security office, when you were required by law to declare this”. The b-values represent the regression parameter and the t-values indicate the significance of the regression parameter

	Kuk’s method, using playing cards				Forced response method, using dice			
	Known fraud (<i>n</i> = 106)		No known fraud (<i>n</i> = 57)		Known fraud		No known fraud <i>n</i> = 48	
	b	t	b	t	b	t	b	t
Trust	0.018	0.052	0.047	0.085	−0.237	−0.703	−0.977	−1.627 [#]
Understanding	−0.979	−2.262 [*]	0.239	0.557	−0.577	−2.107 ^{**}	−0.730	−1.123
Native/nonnative	0.379	0.581	1.199	0.631	0.028	0.051	0.432	0.440
Reading/writing skill	−0.474	−1.198	−0.229	−0.247	0.277	0.761	−0.429	−0.753
Educational level	0.312	0.528	−1.325	−1.490	0.120	0.256	0.466	0.685

* $p < 0.05$ one sided.

** $p < 0.025$ one sided.

Nearly significant.

Table IV. The probabilities of a nonevasive answer p (yes) to the Randomized Response question “Did you ever conceal some part of your income to the social security office, when you were required by law to declare this”, for mean level minus one standard deviation, mean level, and mean level plus one standard deviation on the variables trust and understanding

	Kuk's method, using playing cards						Forced response method, using dice					
	Known fraud ($n = 106$)			No known fraud ($n = 57$)			Known fraud $n = 96$			No known fraud $n = 48$		
	\bar{x} -1sd	\bar{x}	\bar{x} +1sd	\bar{x} -1sd	\bar{x}	\bar{x} +1sd	\bar{x} -1sd	\bar{x}	\bar{x} +1sd	\bar{x} -1sd	\bar{x}	\bar{x} +1sd
Trust	0.49	0.53	0.57	0.23	0.22	0.21	0.50	0.50	0.50	0.12	0.25	0.44
Understanding	0.35	0.53	0.70	0.28	0.22	0.17	0.26	0.50	0.74	0.11	0.24	0.46

Respondents, who have limited means of understanding the instructions, develop less trust and understanding in the Randomized Response methods. This implies that the trust/understanding questions at least function as valid indicators of such problems. Moreover, respondents among whom understanding is established at a higher level, are also more willing to answer less evasively. The results also demonstrate that variables indicating limited means of understanding the instructions, such as limited language skills, have no significant direct effect on evasive answering.

The ability of the interviewer to establish trust in and understanding of the Randomized Response method varies more strongly than we had anticipated, given the fact that experienced and trained interviewers were used. It depends on the interviewer's ability to instruct clearly as well on the respondent's ability to understand the instructions. If sufficient understanding is established, both Randomized Response methods give a more accurate estimate of the extent of fraud committed. If the level of understanding is insufficient, the randomized response estimates are considerably lower.

The psychological variables trust and understanding may provide an explanation for the mixed results that have been reported in the past (Umesh & Peterson, 1991; Soeken & MacReady, 1982; Edgell et al., 1982). The hypothesis of Fox and Tracy that innocent respondents develop less trust, because they can less easily show their innocence, could not be confirmed. Perhaps an improved measurement of trust would produce more convincing results in this respect.

Although the questionnaires are indicative of problems in the trust/understanding field specific to the randomized response instructions, it is also clear that the questionnaires can be improved. Further improvement of the reliability should not cause great problems, as this insufficiency can be remedied by extending the questionnaires with parallel items. The outcome also indicates that the selection and training methods used for the interviewers have been inadequate. The differences between interviewers are too great.

The Randomized Response methods aim to provide better protection against exposure, and in this way to enhance willingness to answer questions about socially less acceptable behavior. The main question therefore, is whether the Randomized Response method adequately achieves this goal. In particular, research should be directed at improving the methods of instruction and the way in which the interviewer deals with respondents.

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