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STUDYING END-USER DOWNLOADING OF INDECENT SCANDAL PICTURES BY THE RANDOMIZED RESPONSE TECHNIQUE

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Abstract

With rapid advances in technological development, sensitive behaviors in relation to the ethical use of information systems have attracted more and more public attention. The widespread adoption of high-speed networking technologies has facilitated the timely dissemination of information, but it also opens up more opportunities for the unauthorized sharing of private information. One example is the unauthorized downloading of indecent scandal pictures. This paper reports an exploratory study in this behavior. Although such behavior is sensitive and secretive in nature, we draw on the randomized response technique to ensure respondent confidentiality and minimize response distortion in self-reported behaviors. An on-line survey was conducted and the methods introduced by Kwan, So and Tam (2010) was adopted for multivariate data analysis using the randomized data. Our findings confirm the anticipated underreporting of the sensitive behavior in a direct-questioning context. Furthermore, non-trivial distortions in the influences of the factors leading to the downloading behavior are also unveiled when comparing findings from direct responses with those based on randomized responses.

Keywords: Randomized Response Technique, Response Distortion, Respondent Confidentiality, Ethics.
1 INTRODUCTION

Modern information technology is having a growing impact on the lifestyle and social behavior of individuals. More and more sensitive behavioral issues pertaining to the use of information systems (IS) have come to light. More than two decades ago, Mason (1986) advocated that privacy, accuracy, ownership\footnote{Mason invented the acronym of PAPA for the four issues: Privacy, Accuracy, Property and Accessibility. In particular, the issue of property is actually about the question of “who owns the information?” (Mason 1986), and hence is referred to as “ownership” in this paper.}, and accessibility of information are the four main principles to guide the ethical uses of information systems (IS). Unfortunately, with rapid technological advances and widespread application of IS, violations of these principles has been on the rise in all walks of life. There is mounting evidence on the unethical uses of IS as reflected in the increasing activities related to digital piracy, denial of service attacks, unauthorized online gambling, web pornography, dissemination of indecent scandal pictures, etc. The ethical, business and societal impacts caused by these activities are increasing.

With the widespread adoption of peer-to-peer sharing platforms, files can be easily disseminated to a large population of users within a very short period of time. This has led to opportunities and risks. In some cases, copyrighted materials like software, movies or pictures were duplicated without due compensation to the copyright owner. In other cases, individuals’ private pictures or videos were maliciously exposed to a large group of unknown individuals on the net. Namely, indecent private pictures, mostly of celebrities, had been circulated around through peer-to-peer networks. There are reports of such incidents (e.g. Anne Curtis, Eddie Long, Brett Favre, Miley Cyrus, Edison Chen, Rihanna, Vanessa Hudgens, etc.) from time to time around the world. Apart from individual victims whose privacy rights were infringed and reputations undermined, the adverse effects of such incidents on the overall society also provoke much controversy.

Research in unethical IS behaviors in general often require the use of self-reported data due to the secretive nature of those behaviors. Ironically, the trustworthiness of self-reports of unethical IS behaviors appears to be questionable in the presence of anticipated response distortion due to the sensitive nature of such behaviors. Response distortion has long been a recognized problem in behavioral research that relies on self-reports (Himmelfarb 1993). It generally refers to situations where the answer provided by a subject does not accurately reflect his genuine opinion, belief, feeling, intention, or behavior.

The existence of response distortion poses threats to the conclusion validity of behavioral research. It forces researchers to study less relevant variables because the variables of primary interest may be too sensitive and evoke too much response distortion. More seriously, researchers often tend to avoid studies on sensitive topics merely because of anticipated response distortion. Such difficulty has resulted in a general lack of research in sensitive areas where objective investigations are most needed.

Kwan, So and Tam (2010) advocated the use of the randomized response technique (RRT) to study sensitive topics in IS. Through a number of behavioral studies on software piracy, they demonstrated innovative techniques to use self-reported data, collected using RRT to minimize response distortion, for univariate as well as multivariate analysis. In this paper, we attempt to apply these techniques to study the end-user behavior of downloading indecent scandal pictures.

2 RANDOMIZED RESPONSE TECHNIQUE FOR MULTIVARIATE ANALYSIS

Traditionally, researchers soliciting self-reports on sensitive topics would provide confidentiality assurance to respondents so as to encourage truthful responding. Usually this is accomplished by
convincing the respondents that a survey is completely anonymous or confidential. Over the years a number of good survey practices (e.g. physical separation of respondents, promises of confidentiality, emphasis on truthful responding rather than a “right” answer, etc.) has been identified for different types of survey administrations (see Paulhus 1991). Confidentiality assurance is a very powerful strategy in the sense that, if successful, should naturally eliminate most of the motivations behind response distortion (including socially desirable responding). The success of this strategy hinges on whether the assurance does look convincing to the respondent. When questions are considered threatening, credibility of such confidentiality assurance would be of prime importance as respondents may demand a more convincing assurance.

2.1 Randomized Response Technique: History and Main Concepts

Randomized response technique (RRT) is a questioning method that incorporates respondent confidentiality by design, rather than by trust or promise. It was originally developed for encouraging truthful responding on sensitive topics. First invented by Warner (1965), various forms of RRT have been designed (Warner 1965; Greenberg et al 1969; Himmelfarb and Lickteig 1982; Fox and Tracy 1986) to date for soliciting truthful responses to evasive or embarrassing questions. The core idea of RRT is to assure complete confidentiality of a participant’s response by contaminating it with a random “noise” value with known statistical properties.

For instance, in the unrelated-question randomized response model (Greenberg et al 1969), participants are instructed to choose among a set of questions to answer according to a randomizing device controlled by them privately (e.g. as simple as flipping a coin). Each sensitive question is paired with another unrelated and innocuous (i.e. non-sensitive) question such that the participants would answer either one of them depending on the outcome of the privately performed randomization procedure. As the researcher has no way to know exactly which question was answered, complete confidentiality can be assured and this should in turn help eliminate any possible stigma or embarrassment caused by the sensitive question, resulting in more truthful responses. On the other hand, as the probabilistic property of the randomization procedure is known, useful aggregate properties of the answer to the sensitive question can be estimated using statistical methods. For instance, if coin-flipping was used as the randomization procedure, researchers would know that about half of the respondents should have actually answered the sensitive question and may derive useful research conclusions.

Originally, RRT was limited to two-choice questions only. It was later extended to cover multiple-choice questions as well as quantitative answers. As the majority of literature on RRT focuses on univariate analysis (e.g. proportion of people committing a certain criminal behavior, mean value of a certain sensitive characteristic, etc.), there is a common misunderstanding that RRT is limited to univariate analysis. For example, the comments made by Sudman and Bradburn (1982, pp. 81) on randomized response technique reflects such an impression (see Fox and Tracy 1984, pp. 189; 1986, pp. 53). Fortunately, this is in principle not true although more sophisticated statistical estimators would be required for multivariate analysis (Fox and Tracy 1984; Kwan, So and Tam 2010).

2.2 The Unrelated-Question Design

In the following, we will focus on the unrelated-question design proposed by Greenberg et al (1971) for soliciting quantitative answers to sensitive questions. In the unrelated-question design, respondents are presented with a pair of unrelated questions consisting of a sensitive and an innocuous one. They are instructed to conduct a private randomization procedure themselves and then follow the outcome to choose a question from the pair to answer. A simple illustration using coin-flipping as the randomization procedure is shown below:

<table>
<thead>
<tr>
<th>Instruction:</th>
<th>Please flip a coin and answer Question X if it is a head, otherwise please answer Question Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question X:</td>
<td>I like to browse pornographic web sites.</td>
</tr>
<tr>
<td>Question Y:</td>
<td>I like to browse online newspaper web sites.</td>
</tr>
</tbody>
</table>
Only one sample would be needed if the distributional characteristics of the answers to the innocuous question are known. In practice, two samples using different probabilities in the randomization procedure would be easier because this would eliminate the need of prior knowledge of the distributional characteristics of the answers to the innocuous questions.

2.3 Multivariate Analysis

Kwan, So and Tam (2010) has derived a set of statistics estimators, based on the method of moments, for the mean, variance and covariance of a set of question pairs. Without loss of generosity, consider the following setup with 2 question pairs asked using RRT and another question asked directly:

1. Sensitive question $q_{X_1}$ paired with innocuous question $q_{Y_1}$
2. Sensitive question $q_{X_2}$ paired with innocuous question $q_{Y_2}$
3. Directly asked question $q_{X_3}$

Assuming two samples are taken with different probabilities of answering the sensitive question, we denote the following terms:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_{(1)}$</td>
<td>probability of answering sensitive questions (i.e. $q_{X_1}$ and $q_{X_2}$) in sample 1</td>
</tr>
<tr>
<td>$p_{(2)}$</td>
<td>probability of answering sensitive questions (i.e. $q_{X_1}$ and $q_{X_2}$) in sample 2</td>
</tr>
<tr>
<td>$Z_{1(1)}$</td>
<td>observed response to the first question pair ($q_{X_1}$ and $q_{Y_1}$) in sample 1</td>
</tr>
<tr>
<td>$Z_{1(2)}$</td>
<td>observed response to the first question pair ($q_{X_1}$ and $q_{Y_1}$) in sample 2</td>
</tr>
<tr>
<td>$Z_{2(1)}$</td>
<td>observed response to the second question pair ($q_{X_1}$ and $q_{Y_1}$) in sample 1</td>
</tr>
<tr>
<td>$Z_{2(2)}$</td>
<td>observed response to the second question pair ($q_{X_1}$ and $q_{Y_1}$) in sample 2</td>
</tr>
<tr>
<td>$X_1$</td>
<td>underlying (unobserved) response to sensitive question $q_{X_1}$</td>
</tr>
<tr>
<td>$X_2$</td>
<td>underlying (unobserved) response to sensitive question $q_{X_2}$</td>
</tr>
<tr>
<td>$X_3$</td>
<td>response to normal question $q_{X_3}$</td>
</tr>
</tbody>
</table>

**Table 1. Definition of Terms**

Then, the method-of-moments estimators are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method-of-Moments Estimator</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_{X_1}$</td>
<td>$\frac{(1 - p_{(2)})Z_{1(1)} - (1 - p_{(1)})Z_{1(2)}}{p_{(1)} - p_{(2)}}$</td>
</tr>
<tr>
<td>$\sigma^2_{X_1}$</td>
<td>$\frac{(p_{(2)}^2 - p_{(1)}^2)(1 - p_{(2)})S^2 + (1 - p_{(1)})S^2}{p_{(1)} - p_{(2)}} - (1 - p_{(2)})(1 - p_{(1)})Z_{1(1)}Z_{1(2)}$</td>
</tr>
<tr>
<td>$\sigma^2_{X_1 X_2}$</td>
<td>$\frac{(1 - p_{(2)})^2 S^2_{Z_2(Z_2)} - (1 - p_{(1)})^2 S^2_{Z_2(Z_2)}}{p_{(1)} + p_{(2)} - 2p_{(1)}p_{(2)}(p_{(1)} - p_{(2)})}$</td>
</tr>
<tr>
<td>$\sigma^2_{X_1 X_3}$</td>
<td>$\frac{S^2_{Z_2 X_3}}{p}$ where $p$ is the larger one between $p_{(1)}$ and $p_{(2)}$</td>
</tr>
</tbody>
</table>

**Table 2. List of Univariate and Multivariate Statistics Estimators**
With these method-of-moments estimators for mean, variance and covariance for any two variables collected either as direct or randomized responses; we can effectively construct a covariance matrix, in a pair-wise manner, using the randomized responses. Such a matrix can be used in more complicated multivariate analysis. In the next section, we will apply this method to study the end-user behavior of indecent scandal picture copying.

3 ANTECEDENTS TO THE COPYING OF INDECENT SCANDAL PICTURES

In this paper, we attempt to study individual’s behavior of copying such indecent scandal pictures. The norm in modern society regards privacy as one of basic human rights, and indecency as something undesirable. Therefore, the act of peeking in other’s indecent privacy can be embarrassing, if not unethical. When soliciting self-reports on this sensitive behavior, RRT should be an appropriate method to minimize possible response distortion.

3.1 Research Model

The act of downloading indecent scandal pictures from the net is a volitional behavior involving moral decision making. As such, we draw on the seminal works by Kohlberg (1971, 1981) and Rest (1979) on moral reasoning. In essence, Kohlberg identified six stages of cognitive moral development that affect a person’s moral reasoning. These six stages are further grouped into three moral reasoning levels.

Simply put, people reasoning at the pre-conventional level are mainly driven by punishment and reward. Those reasoning at the conventional level are more concerned about “law and order” and the maintenance of the social contract. At the highest level, people employing post-conventional moral reasoning strive for the well being of mankind and emphasize adherence to universal ethical principles.

According to Kohlberg’s original theory, the three levels of moral reasoning follow a chronological development process. Adults possess the highest moral judgment capacity and tend to reason at a higher level than children. However, Rest (1979) suggested that when faced with a moral issue, individuals actually use a combination of these three levels of moral reasoning, depending on their own moral judgment capacities and the issue at hand. The outcome of moral judgment would depend on whether these different levels of moral reasoning are actually complying or conflicting with each others.

In the context of indecent scandal picture downloads, we attempt to identify different factors that may be at work at different levels of moral reasoning. At the pre-conventional level, individuals concern about punishment or reward for a certain behavior. Although legal punishment is unlikely, we figure that individual’s attitude toward indecent pictures would serves as either a driver or an inhibitor to the copying behavior. We capture this attitude as individual’s tolerance or acceptance of indecent materials.

At the conventional level, the compliance to social norm is the major concern. In the Theory of Planned Behavior (TPB) developed by Ajzen (1991), individual’s behavior can be largely predicted by attitude toward performing the behavior as well as perceived social approval regarding performing the behavior. The latter is referred to as subjective norm that focuses on the perceived approval by the important others of an individual.

Post-conventional moral reasoning focuses on the compliance with universal ethical principles. As mentioned earlier, the principle that one should respect the privacy rights of others is generally accepted in modern society. As such, we expect those who agree with this universal principle of privacy rights would be less likely to engage in the copying behavior.
By capturing different factors at different levels of moral reasoning, an exploratory research model is developed as depicted in Figure 1.

![Research Model Diagram]

**Figure 1. Research Model**

### 3.2 Methods

An online survey was designed to examine the research model in Figure 1. Due to the exploratory nature of this study, the questions used were determined based on findings from several focus group discussions with faculty members and students. Three versions of online questionnaires were designed. The first one employs direct questioning (DQ) method. The second and third ones use RRT for the sensitive questions. The probability of answering the sensitive question is set to 0.75 in the second questionnaire (i.e., $p_1 = 0.75$) and 0.5 in the third (i.e., $p_2 = 0.5$).

The survey was launched to the public through an e-Government portal company, shortly after a widely publicized incident of indecent scandal pictures involving several celebrities. Participants were unaware of the topic of study at the time of recruitment. They were simply invited to participate in an academic survey for 15 minutes. They were also informed that a lucky draw would be offered to those who finished the online questionnaire as a token of gratitude for participation.

Participants were randomly assigned to one of the three online questionnaires according to the ratio of 2:6:3. The ratio of 2:1 between the second and third RRT questionnaire should achieve optimal sampling properties according to the analysis by Kwan, So and Tam (2010).

In the beginning of the survey, participants were asked to recall the recent scandal picture incident first and then provide their truthful opinions about the behavior of copying of indecent scandal pictures in general. For participants answering the second and third questionnaire, detailed illustration of the RRT method was provided, together with a guided exercise. Participants were further asked to recall the steps of the RRT procedure so as to ensure they fully understood the procedure before answering the questionnaires.

Three sensitive questions were used to measure the dependent variable “Copying Behavior”. In the RRT group, these questions are paired with innocuous questions as shown in Table 3. In addition, an insensitive question pair is added for control comparison in the RRT group.

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2 After the introductory text, indecent scandal pictures were referred to as “such files” or “those files” in the questionnaire.
Table 3. Sensitive Questions and Pairing Innocuous Questions for the Dependent Variable

The measurement items used for the independent variables, namely “Tolerance for Indecency”, “Privacy Rights” and “Subjective Norm”, are shown in Table 4.

Table 4. Measurement Items for Independent Variables

We received a total of 2,029 completed and valid responses, namely 396 valid responses for the first version, 1,127 for the second (i.e. $n_{(1)} = 1127$) and 506 for the third (i.e. $n_{(2)} = 506$).

3.3 Results

The estimated means of randomized responses and direct responses are compared in Table 5. For the non-sensitive control question, there is no significant difference between the means estimated from the direct and randomized responses. This helps to address the worry that the use of RRT may introduce method bias by itself. For the sensitive questions about copying behaviors, however, statistically significant differences are observed in all cases, with notable effect sizes as reported in Table 5. Namely, respondents giving randomized responses admitted significantly more copying of indecent scandal pictures than those giving direct responses. Given the sensitive nature, underreporting of the behavior can be anticipated.

Table 5. Estimated Means based on Direct and Randomized Responses
The model in Figure 1 was empirically tested using covariance-based structural equation modelling (SEM) by LISREL. Figure 2 shows the results for the DQ and RRT samples. It also presents overall model fit statistics as well as standardized path loadings. Assessment of the overall model fit is based primarily on the RMSEA of the approximate fit statistics, as recommended by MacCallum et al. (1996). This is supplemented by a number of heuristics-based descriptive fit indices suggested by Gefen et al. (2000) for IS research. In both groups, the RMSEA is below the 0.08 threshold, indicating a fair model fit (Browne and Cudeck 1993). The descriptive fit indices, including the NFI, GFI and AGFI, are higher than the recommended 0.90 or 0.80 levels (Gefen et al. 2000; Hu and Bentler 1999), indicating satisfactory overall model fit.

![Figure 2](http://aisel.aisnet.org/pacis2011/102)

**Table 6. Construct Reliability and Validity**

<table>
<thead>
<tr>
<th>Composite Reliability</th>
<th>Tolerance for Indecency</th>
<th>Privacy Rights</th>
<th>Subjective Norm</th>
<th>Copying Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE</td>
<td>0.70</td>
<td>0.69</td>
<td>0.64</td>
<td>0.73</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construct</th>
<th>Standardized Loading</th>
<th>Inter-Construct Correlation (diagonal item shows the square root of AVE of the corresponding construct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance for Indecency</td>
<td>1* 0.83 0.81 0.84</td>
<td>0.83 0.83</td>
</tr>
<tr>
<td>2* 0.90 0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 0.77 0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privacy Rights</td>
<td>1* 0.75 0.65 -0.31 0.80 0.69</td>
<td></td>
</tr>
<tr>
<td>2* 0.85 0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>1* 0.80 0.74 0.65 0.63 -0.43 -0.39 0.81 0.80</td>
<td></td>
</tr>
<tr>
<td>2 0.81 0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copying Behavior</td>
<td>1 0.90 0.81 0.38 0.44 -0.50 -0.34 0.49 0.47 0.86 0.83</td>
<td></td>
</tr>
<tr>
<td>2 0.84 0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 0.83 0.84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Figures for the RRT group are shown in shade.

**Figure 2.** Results based on Direct Responses and Randomized Responses
Having assessed the overall model fit, we continue to assess the construct reliability and validity. Table 6 shows the detailed statistics pertaining to construct reliability and validity, for both the DQ and RRT groups. The composite reliabilities of most constructs are above 0.7, suggesting satisfactory internal consistency of these constructs. The only exception is “Privacy Rights” in the RRT group where the composite reliability is barely acceptable. This weakness is also reflected in AVE that falls slightly below 0.5. For all other cases, the AVEs are well above 0.5, suggesting satisfactory convergent validity of the constructs.

Discriminant validity was tested by comparing the $\chi^2$ of the original model with an alternative model where the constructs in question are united as one construct (Gefen et al. 2000). We tested all possible pairings of the four constructs and the difference in $\chi^2$ was found to be highly significant in all cases. Overall, the construct validity is regarded as acceptable.

We now consider the results in Figure 2. The standardized path loadings are shown together with the T-statistics in the bracket underneath. Comparing the result of the DQ group with that of the RRT group, we can see that the path from “Subjective Norm” to “Copying Behavior” is fairly consistent across both groups (i.e. 0.29 for DQ group and 0.26 for RRT group).

However, this is not the case for “Tolerance for Indecency” and “Privacy Rights”. Namely, the effect of “Tolerance for Indecency” is insignificant (i.e. 0.09, T-statistics = 1.24) in the DQ group, but becomes significant (0.22, T-statistics = 4.84) in the RRT group. On the contrary, the effect of “Privacy Rights” drops from 0.35 for the DQ group to 0.16 for the RRT group.

These findings suggest that participants in the direct questioning context report a smaller influence of their tolerance for indecency on their actual copying of the indecent scandal pictures. As we found no statistically significant differences among the responses on “Tolerance for Indecency” across the DQ group and the RRT group, we figure one possible explanation is that participants who did copy those indecent pictures denied doing so in the survey when asked directly. In other words, this can be explained as a consequence of socially desirable responding (Paulhus 1991).

We also note that the proportion of variance explained, as reflected from the $R^2$ figures, is on the low side for both the DQ and the RRT group. This indicates some other important determinants may have been missed out in the research model.

4 DISCUSSION AND CONCLUSION

Comparative research showed that RRT had led to higher admission of sensitive characteristics. Validation studies deploying participants whose sensitive characteristics were known in advance also revealed that RRT does outperform other techniques in soliciting valid responses to sensitive questions (Umesh & Peterson 1991; Scheers 1992; Hosseini & Armacost 1993).

Although underreporting of sensitive behaviors could be anticipated in direct questioning, the magnitude of distortion is not clear. It is also unclear to what extent such underreporting may lead to distorted conclusions about causal relationships, especially when the extent of the distortion differs across variables. The results of this study reveal that response distortion accounts for non-trivial and convoluted distortions in research findings. Namely, the influence of one’s agreement with privacy rights may be over-reported whereas the effect of one’s tolerance for indecency may be underreported.

4.1 Limitations

We acknowledge a number of limitations of this research. First, this research is exploratory in nature and the theoretical research model is subject to further improvement. The explanatory power of the research model is small. Future research in this area may have to consider some other determinants that are missed out in the research model.
Second, by using RRT, there is an additional sampling error due to the randomization procedure. This would inevitably reduce the overall measurement reliability and a larger sample size would normally be needed. As the loss of statistical power would depend on (i.e. decrease with) the probability of respondents answering the sensitive question, researchers have to trade off between a higher perceived confidentiality protection and a higher data collection efficiency (Fox & Tracy 1986). Hosseini & Armacost (1993) thus concluded that RRT should only be used for questions of sensitive nature. We believe that questions pertaining to the copying behavior of indecent scandal pictures should belong to this category.

4.2 Concluding Remarks

The results of our study show that response distortion can be a real threat in research on sensitive behaviors that relies on self-reports. This problem may not be limited to the problem domain that we studied, but may also exist in the context of other sensitive topics such as cyberslacking, hacking, online gambling and pornography viewing, etc. RRT is recommended as a method to tackle response distortion in research related to sensitive topics. In view of its potential, we hope to see more investigation aimed at improving the application of RRT in IS research.

References