Sensitive Question Techniques in Online Surveys: An Experimental Comparison of Different Approaches

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Marc Höglinger (ETH Zurich)
Ben Jann (University of Bern)

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The problem

Conventional questioning in surveys, so-called direct questioning (DQ), does often not work out well when asking sensitive questions…

…for instance on scientific misconduct such as plagiarism.
Eliciting truthful answers to sensitive questions – not an easy task

Direct questioning (DQ) does often not work when asking sensitive questions...
1218 plagiarized passages from 135 sources on 371 out of 393 pages (94.4%)

source: http://de.guttenplag.wikia.com
Outline

- Sensitive questions in survey research

- Some indirect approaches to elicit truthful answers
  - The Randomized Response Technique (RRT)
  - The Crosswise Model (CM): A new alternative to RRT

- Experimental comparison of the different approaches: a survey on students’ cheating and plagiarism

- Conclusion
Eliciting truthful answers to sensitive questions – not an easy task

- Survey respondents might not tell the truth if asked questions on sensitive issues. This leads to distorted results.
- Examples for proportion of ‘liars’ (respondents with a false negative response) in surveys that use direct questioning (estimates from validation studies):
  - Penal conviction: 42.5% (F2F, Wolter 2010)
  - Welfare and unemployment benefit fraud: 75% (F2F, van der Heijden et al. 2000)
  - Driving under influence: 54% (P&P, Locander et al. 1976)
  - Bankruptcy: 32% (Ibid.)
The Randomized Response Technique (RRT)  
(Warner 1965; Fox and Tracy 1986)  

- Main principle: privacy protection through randomization (i.e. add random noise to the answers)  
- A randomizing device, the outcome of which is only known to the respondent, decides whether...  
  - the sensitive question has to be answered  
  - an automatic ‘yes’ or ‘no’ has to be given or a surrogate question has to be answered  
- Since only the respondents knows the outcome of the randomization device, a ‘yes’ cannot be interpreted as an admission of guilt.  
- However, with knowledge of the probability properties of the randomizing device, a prevalence estimate for the sensitive question can be derived.
Prevalence estimate:

\[ Pr(\text{observed yes}) = Pr(\text{sensitive question}) \times \pi + Pr(\text{automatic yes}) \]

\[ \pi = \frac{Pr(\text{observed yes}) - P(\text{forced yes})}{Pr(\text{sensitive question})} \]
The Crosswise Model (CM): A new alternative to RRT (Yu, Tian, and Tang 2008)

- Simple idea: Ask a sensitive question and a nonsensitive question and let the respondent indicate whether …
  - answers to the questions are the same (both ‘yes’ or both ‘no’)
  - answers to the questions are different (one ‘yes’, the other ‘no’)

<table>
<thead>
<tr>
<th>sensitive question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>same</td>
<td>different</td>
</tr>
<tr>
<td>Yes</td>
<td>different</td>
<td>same</td>
</tr>
</tbody>
</table>

- Note: Questions must be uncorrelated and probability of ‘yes’ must be unequal 0.5 for the nonsensitive question.
The Crosswise Model (CM): A new alternative to RRT
(Yu, Tian, and Tang 2008)

- Prevalence estimate:

\[
Pr(\text{same}) = (1 - \pi) \times (1 - Pr(\text{nonsensitive yes})) + \pi \times Pr(\text{nonsensitive yes})
\]

\[
\pi = \frac{Pr(\text{same}) + Pr(\text{nonsensitive yes}) - 1}{2 \times Pr(\text{nonsensitive yes}) - 1}
\]

- Note: CM is formally identical to Warner’s original RRT model
Performance of RRT and Crosswise

- RRT does not seem to work well in online surveys.
  - no different prevalence estimates than with direct questioning (Coutts & Jann 2011, Peeters 2006, Snijders & Weesie 2008)
  - lower prevalence estimates than with direct questioning or even negative estimates (Coutts et al. 2011, Holbrook & Krosnick 2010, Coutts & Jann 2011)
- However, RRT implementations so far were often not well suited to survey mode.
  - random device not at respondents’ immediate reach
  - random device not trustworthy
Performance of RRT and Crosswise

- The Crosswise Model seems to work better
  - higher prevalence estimates than with direct questioning in a p&p survey on plagiarism (Jann, Jerke, Krumpal 2011)
  - however, no empirical application in online mode so far

- Advantages of the Crosswise Model over RRT
  - easier to understand
  - no need for a randomizing device
  - respondent is not forced into giving a ‘false’ automatic response or a seemingly irrelevant response to an innocuous instead of a sensitive question
  - no obvious self-protective answering strategy (e.g. always say ‘no’)

12/03/15

Diekmann, Höglinger, Jann: Sensitive Question Techniques
The study: survey on student cheating and plagiarism

- Web survey among students of University of Bern and ETH Zurich in spring 2011
- Response rate 33%, N=6,485
- Comparing direct questioning (DQ) to three variants of RRT and two variants of the Crosswise Model (CM)
- Sensitive questions on
  - copying from other students in exam (copy)
  - using crib notes in exam (notes)
  - taking drugs to enhance exam performance (drugs)
  - partial paper plagiarism (partial)
  - severe paper plagiarism (severe)
Experimental conditions

- **DQ**: direct questioning
- **RRT wheel**: forced response RRT using virtual random wheel
- **RRT pick**: forced response RRT using ‘pick a number’ method
- **RRT Benford**: RRT using Benford distribution and innocuous questions
- **CW unr. ques.**: Crosswise Model using unrelated questions
- **CW pick**: Crosswise Model using ‘pick a number’ method
Respondents experience by experimental condition

I trust in anonymity
No disclosure risk
Protects my answers
I understand principle

Share of agreeing respondents (%)
Point estimates and 95%-CI by experimental condition

- **copy**
  - DQ
  - RRT wheel
  - RRT pick
  - RRT Benford
  - CW unr. quest.
  - CW pick

- **notes**
  - DQ
  - RRT wheel
  - RRT pick
  - RRT Benford
  - CW unr. quest.
  - CW pick

- **drugs**
  - DQ
  - RRT wheel
  - RRT pick
  - RRT Benford
  - CW unr. quest.
  - CW pick

- **partial**
  - DQ
  - RRT wheel
  - RRT pick
  - RRT Benford
  - CW unr. quest.
  - CW pick

- **severe**
  - DQ
  - RRT wheel
  - RRT pick
  - RRT Benford
  - CW unr. quest.
  - CW pick

- **no sign. difference to DQ (p<.05)**
- **sign. difference to DQ (p<.05)**
Point estimates and 95%-CI by experimental condition

- No significant difference to DQ (p<.05)
- Significant difference to DQ (p<.05)
Point estimates and 95%-CI by experimental condition

no sign. difference to DQ (p<.05)  sign. difference to DQ (p<.05)
Prevalence estimates by experimental condition

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Standard errors in parentheses
Prevalence estimates aggregated

- no sign. difference to DQ (p<.05)
- sign. difference to DQ (p<.05)
## Prevalence estimates aggregated

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Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001
### Determinants of sensitive behavior

#### Randomized response logistic regression

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<td>Stress at exams</td>
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Standard errors in parentheses

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

- The Crosswise Model clearly outperforms DQ (if we accept the ‘more-is-better’-assumption)
  - An exception is the last item (severe plagiarism) with a very low prevalence.
- RRT, on the other hand, does not yield higher estimates than direct questioning.
  - One reason might be the ‘self-protective no’ bias, which prevents respondents to say ‘yes’ if advised to do so by the randomizing device.
Methodological conclusions

- RRT does not seem to be a good method for self-administered surveys. Although we put a lot of effort into pretesting and finding good implementations, no convincing evidence could be found that RRT yields more valid estimates than DQ. (With RRT ‘Benford’ performing somewhat better than the other RRT implementations.)
- CM is a promising alternative, since it does not suffer from some of the deficiencies of RRT (“self-protective no” bias, complexity).
- Improvement of RRT estimates is possible by correcting for cheating respondents not complying with instructions (not shown). Such estimates, however, have low efficiency.
Substantive conclusions
(based on combined results from CM)

- A substantial proportion of students have cheated on an exam (copying: about 25 percent, crib notes: about 15 percent)
- Using drugs to enhance exam performance is not uncommon (10 percent)
- Rates for partial plagiarism (using a passage from someone else's work without providing proper citation) are 8 percent. The prevalence of severe plagiarism (hand in someone else's work) is 3 percent.
- These numbers may not seem too high, but we have to keep in mind that they most likely still underestimate the real prevalence.
Thank you!
References


Appendix: Items
<table>
<thead>
<tr>
<th>Item</th>
<th>Frageformulierung</th>
</tr>
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<tbody>
<tr>
<td>Abschreiben</td>
<td>Haben Sie während Ihrem Studium jemals während einer Prüfung von Mitstudierenden abgeschrieben?</td>
</tr>
<tr>
<td>Spicken</td>
<td>Haben Sie während Ihrem Studium jemals unerlaubterweise einen Spickzettel (auch Handy-, Taschenrechner-Notizen und Ähnliches) in einer Prüfung verwendet?</td>
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<tr>
<td>leistungsfördernde Substanzen</td>
<td>Haben Sie während Ihrem Studium jemals rezeptpflichtige Substanzen/Medikamente eingenommen, um Ihre Leistung an Prüfungen zu steigern?</td>
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<td>(„Doping“)</td>
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<td>Teilplagiat</td>
<td>Haben Sie während Ihrem Studium jemals bei einer eingereichten Arbeit bewusst eine ganze Textpassage aus einem fremden Werk übernommen, ohne diese als Zitat zu kennzeichnen?</td>
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<td>Vollplagiat</td>
<td>Haben Sie während Ihrem Studium jemals einen Grossteil einer Arbeit durch eine andere Person schreiben lassen oder eine fremde Arbeit als Ihre eigene ausgegeben?</td>
</tr>
</tbody>
</table>
Appendix: additional graphs & tables
Respondents experience by experimental condition

- I trust in anonymity
- No disclosure risk
- Protects my answers
- I understand principle

Legend:
- DQ
- RRT wheel
- RRT pick
- RRT Benford
- CW unr. quest.
- CW pick
Respondents experience by experimental condition

- I trust in anonymity
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Graph showing trends with 95%-CI.
### Prevalence estimates and differences to DQ

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<td>0.2</td>
<td>5.3*</td>
<td>-5.1**</td>
<td>0.6</td>
<td>-6.3***</td>
</tr>
<tr>
<td></td>
<td>(2.4)</td>
<td>(2.2)</td>
<td>(1.8)</td>
<td>(2.2)</td>
<td>(1.9)</td>
</tr>
<tr>
<td>RRT Benford - DQ</td>
<td>-0.3</td>
<td>4.1*</td>
<td>1.0</td>
<td>5.4*</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>(2.3)</td>
<td>(2.1)</td>
<td>(1.7)</td>
<td>(2.1)</td>
<td>(1.9)</td>
</tr>
<tr>
<td>CM unr. quest. - DQ</td>
<td>12.0***</td>
<td>9.9***</td>
<td>11.2***</td>
<td>4.7</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>(3.2)</td>
<td>(3.0)</td>
<td>(2.9)</td>
<td>(3.2)</td>
<td>(3.1)</td>
</tr>
<tr>
<td>CM pick number - DQ</td>
<td>6.8*</td>
<td>1.8</td>
<td>1.4</td>
<td>6.1*</td>
<td>-1.9</td>
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<tr>
<td></td>
<td>(3.0)</td>
<td>(2.7)</td>
<td>(2.5)</td>
<td>(3.0)</td>
<td>(2.8)</td>
</tr>
</tbody>
</table>

| Observations         | 5734 | 5735  | 5719  | 4232    | 4230   |

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001
Point estimates and 95%-CI by experimental condition

- **copy**
- **notes**
- **drugs**
- **partial**
- **severe**

- No sign. difference to DQ at 95% level
- Sign. difference to DQ at 95% level
Point estimates and 95%-CI by experimental condition

- No significant difference to DQ at 95% level
- Significant difference to DQ at 95% level
Point estimates and 95%-CI by experimental condition

severe

- no sign. difference to DQ at 95% level
- sign. difference to DQ at 95% level
Prevalence estimates aggregated

- no sign. difference to DQ at 95% level
- sign. difference to DQ at 95% level