

Thinking about Measures and Measurement in Positivist Research:

A Proposal for Refocusing on Fundamentals

Andrew Burton-Jones
The University of Queensland Business School and
Centre for the Business and Economics of Health
St. Lucia, Qld, Australia
abj@business.uq.edu.au

Allen S. Lee
School of Business
Virginia Commonwealth University
Richmond VA, USA
allenslee@alum.mit.edu

SUPPLEMENTARY APPENDIX

In this Appendix we provide further details on two topics discussed briefly in the main body: (1) methods for addressing method bias, and (2) measure and measurement practices in positivist qualitative research.

Methods for addressing method bias

In the main body, we noted that in a prior review of survey research in top IS journals during 1995-2005, King et al. (2007) found that only 37% of the studies mentioned method bias, let alone addressed it. To examine if practices had improved since this time, we conducted a review of survey research in the AIS Basket of Eight journals from 2006-2015 inclusive. We found such articles by using the keyword ‘survey’ and by scanning each article to confirm how it used the survey method. We found 193 survey papers. For each paper, we examined if it mentioned method bias and if so, how it addressed it.¹

We found that of the 193 papers, 32 papers (17%) did not mention method bias. Of those papers that did, some did so using procedural remedies (i.e., through research designs or research instruments) and/or statistical remedies. Specifically:

¹ The review was performed by an independent researcher (another faculty member familiar with the topic). One of the authors coded 56 of the 193 papers, where the 56 papers were selected randomly. Each coder coded each article against 19 codes (one for whether the article mentioned method bias, nine for procedural remedies, and nine for statistical remedies). Across the 19 codes, the percentage agreement between the coders’ assessments ranged from 95-100% (mean: 98.5%). The full coding spreadsheet and list of references are available from the authors upon request.

- In terms of procedural remedies:
 - The most common procedural remedy was to assure respondents that their survey responses are anonymous and/or confidential. 40 articles (21%) cited this practice, all of them referring to Podsakoff et al. (2003) for justification. While this practice can reduce bias in some cases, the literature on this topic is long and complex (e.g., Ash and Abramson, 1952) and we did not see recognition of this complexity in the articles we reviewed. Rather, it appeared that many authors saw this as a relatively simple way to indicate that they had taken steps to reduce bias (and presumably address other goals too such as meeting the requirements of ‘minimal risk’ research by Institutional Review Boards).
 - The second most highly used practice was to separate measurement of the independent and dependent variables temporally (e.g., using multiple survey waves), psychologically (e.g., by having different respondents rate different questions, as in matched-pair studies), or with different methods (e.g., questionnaires for independent variables and archival measures for the dependent variable). 25 papers (13%) used one of these practices. These practices are all impressive, but the percentage of articles using them (13%) is quite low.
 - Other practices (such as careful design of survey instruments and the use of multiple methods for some or all constructs) were used rarely (only found in 1-6% of the articles).
- In terms of statistical remedies:
 - The most common statistical remedy was to use the Harman’s single-factor test, with most authors citing Podsakoff et al. (2003) for justification. 114 papers (59%) used this test. It is well-known in the method bias literature that this test is ineffective, and Podsakoff et al. (2003) critiqued it, so it is unclear why authors cited their article for its use.
 - The next most common remedy was to use the marker variable technique. 39 papers (20%) used this practice. This technique has well-known problems (Podsakoff et al., 2003; Straub and Burton-Jones, 2007) and simple versions are ineffective (Richardson et al., 2009). More

sophisticated versions can be effective in some circumstances (Richardson et al., 2009; Simmering et al., 2015) but we saw little use of that approach in the sample we reviewed.

- The third most common remedy, used in 26 papers (13%) was the unmeasured latent method factor (UMLC) approach suggested by Liang et al. (2007). This approach is ineffective (Chin et al., 2012). Another 19 papers (10%) used the UMLC method with covariance-based methods, which is also largely ineffective (Richardson et al., 2009).
- Various other techniques (focusing on correlations) were used in a small number of papers. Notably, only 5 out of 193 papers actually measured potential causes of method bias and partialled out their effects, and only 1 out of 193 papers used the MTMM technique, which remains the gold-standard statistical approach (Simmering et al., 2015 p. 506).

Overall, we conclude that practices have not improved much since the review of King et al. (2007). Given the influence of the Podsakoff et al. (2003) paper (now cited over 20,000 times on Google Scholar), more researchers mention method bias than reported by King et al. (2007). However, this is reminiscent of Fiske and Campbell's (1992) point that citations do not solve problems. We see three underlying problems: (1) method bias is very hard to address in a single study (Burton-Jones, 2009), but (2) authors are under pressure to do so (e.g., to pre-empt or respond to reviewers' concerns), and (3) the method bias literature is profuse and conflicting, offering no 'silver bullet' (Bagozzi, 2011 p. 288; Simmering et al., 2015 p. 503). Under these conditions, we believe it is understandable that many authors perform the simplest checks available (which often indicate no bias). Unfortunately, this trend means that the IS field is not producing the most dependable research. We hope this paper can encourage a shift towards more programmatic treatments, i.e., a return to fundamentals (Campbell and Fiske, 1959). For one example of such efforts, see the programmatic work of Ortiz de Guinea and colleagues (Ortiz de Guinea, 2016; Ortiz de Guinea et al., 2013, 2014; Ortiz de Guinea and Webster, 2013).

Practices in Qualitative Positivist Research

Mirroring our review of the survey literature above, we conducted a search of positivist, qualitative papers in the AIS Basket of Eight journals from 2006-2015 inclusive. To find these articles, we first

searched each journal using the keyword 'qualitative' and we then examined each retrieved article for whether it was a qualitative article, and whether it used positivist assumptions. We looked for two types of positivist articles: those that explicitly adopted positivist assumptions, and those that did not do so explicitly, but appeared to do so implicitly, as indicated by the techniques they used and the texts they cited. For instance, interpretive qualitative papers tend to cite different texts (e.g., Denzin and Lincoln, 1994; Klein and Myers, 1999; Walsham, 1995) than positivist qualitative papers (e.g., Benbasat et al., 1987; Dube and Pare, 2003; Eisenhardt, 1989; Yin, 1994). By following these procedures, we found 49 positivist qualitative papers (the full list can be obtained from the authors upon request).

We indicated in the body of the paper that it is rare for qualitative researchers to use the language of measures and measurement. This proved to be true in the 49 papers that we retrieved. 19 of the 49 papers (39%) mentioned 'measure,' and only five of the 49 papers (10%) referred to 'measurement.'

We then examined scanned the 49 papers for exemplar treatments of measure and measurement issues irrespective of whether or not authors used those terms explicitly. For illustrative purposes, we refer to four papers (Chua et al., 2012; Leonardi, 2014; Ravishankar et al., 2011; Su, 2013). Despite the lack of discussion of measures and measurements, we found that each of them provided excellent treatments of some of the issues we covered. We describe the practices for each primary issue in turn.

Practices for Primary Issue I: Individual variable

The primary issue for individual variables is whether the individual variable reflects the theoretical concept. All four papers addressed this issue by clearly specifying their constructs and operationalizations and providing clear illustrative evidence for the codes they developed.

Ravishankar et al. (2011) provide a particularly clear explanation of their coding hierarchy, from data to theoretical categories. They also provide extra clarity by distinguishing the meaning of their codes vis-à-vis other possible codes (in their case, between orthogonal and chameleon subcultures).

Leonardi (2014) similarly contributes by distinguishing between the meanings of different codes in his study (in his case, distinguishing between transparency and translucence). Leonardi (2014) also

took the extra step to conduct inter-rater agreement tests to provide assurance that the mapping he proposed between data and concepts was reliable.

Practices for Primary Issue II: Statement variable

The primary issue for statement variables is whether the statement variable reflects the theoretical relationship. The studies by Chua et al. (2012) and Leonardi (2014) provide useful illustrations.

Chua et al. (2012) studied how IS project groups can move from having no clan to having a well-functioning clan. They developed their account using social capital theory and case study findings. In addition to specifying the theoretical relationship clearly (in terms of developing and leveraging social capital), the authors clearly mapped their high-level theoretical relationship to intermediate codes, to operational data. The authors also explained (p. 596) how the theoretical relationship they developed was consistent with the assumptions underlying the general theory.

Leonardi (2014) provided a similarly careful description of theoretical and operational relationships in his study of how staff in a financial institution used a social networking system to share knowledge. He provided a particularly clear explanation of how the relationships in his theory depended on not just the technology, but also a combination of its features (e.g., the ability to make messages transparent) and users' actions (e.g., the ability to make inferences based on messages read). For each of the relationships in his theory, he provided clear theoretical explanations and clear examples of how the theoretical relationship (or 'mechanism') was operationalized in his data.

Practices for Primary Issue III: Individual constant

The primary issue for individual constants is whether the individual constant reflects the empirical referent being theorized *as it is actually instantiated in the real world*. As we indicated in the body of the paper, qualitative studies offer researchers the ability to give strong justification for the individual constants in their work due to researchers' greater ability to perform intensive observations of the focal phenomenon. These four studies were no exception. All four studies involved extensive interviews (60-95). Several of the studies also engaged in extensive corroboration of data, both among data sources, such

as by comparing interviews with documents to check for accuracy, and externally, such as by confirming descriptions with participants (i.e., member-checking) (Chua et al., 2012; Ravishankar et al., 2011).

The study by Su (2013) is particularly notable as he conducted 95 interviews, spent a month on site, examined numerous internal and external documents, and attended several major events at both his case site and in the broader industry ecosystem. Discrepancies among the findings from different cases were also explored through increasingly fine-grained analyses. For all of these reasons, readers can have much more faith in the accuracy of Su's (2013) findings.

Practices for Primary Issue IV: Statement constant

The primary issue for statement constants is whether the statement constant reflects the empirical relationship being theorized *as it is actually instantiated in the real world*. Again, all four studies provide evidence along these lines, in the form of practices to ensure the accuracy of the statements they draw (e.g., such as the statement that 'x leads to y' in a particular setting). Interestingly, as we examined the four studies, we found that the types of practices they used could be described in terms of Mill's classic criteria for causality: covariation, absence of other causal factors, and temporal precedence. Specifically:

Su (2013) provides readers with comfort from the perspective of covariation. In addition to learning from one major site, he studied 12 other sites and reported very similar findings. Although he did not make predictions before examining each additional site (e.g., using Lee and Hubona's 2009 logic of prediction intervals), his study does provide readers with confidence that the relationships he found are accurate or 'true' because they appear so consistently across his sample.

Ravishankar et al. (2011) and Leonardi (2014) provide readers with confidence from the perspective of the absence of other causal factors. Specifically, Ravishankar et al. (2011) measured several factors that could have contributed to variations in subgroup alignment (their outcome of interest). These measurements allowed them to show (p. 49) that the only factor that varied amongst the subunits in their study was subculture (which was the causal factor of interest); the other factors were constant and thus unlikely to have caused differences. Ravishankar et al. (2011) also explained how they followed-up on any comments that implied the existence of other potential causes to test them or rule them out.

Leonardi (2014) eliminated other causal factors by using a quasi-experimental design. Specifically, he took measurements from two similar divisions at two points in time, with one of the divisions going live with an implementation of the focal system in between the two time-points. This design enabled him to provide readers with confidence in the accuracy of the conclusions he drew from his data (both of the form ‘if p, then q’ and of the form ‘if not p, then not q’).

Finally, Chua et al. (2012) provide readers with comfort from the perspective of temporal precedence. Alternatively, using the language in the body of our paper, they provided readers with confidence in the truth of the underlying process. They did so by following the relationships of interest in their study longitudinally, in real-time in the field, and they kept returning regularly to ensure that the insights they were obtaining about the process were accurate and not affected by retrospective biases.

Summary

Overall, none of these four studies gave detailed treatments of measures and measurements. However, all four provided illustrations of good practices regarding measures and measurements. By adopting similar practices, researchers will enhance the dependability of their research. By extending them, using both the language and insights offered in this paper, qualitative researchers can enhance the dependability of their research even further.

References

- Ash, P, Abramson, E (1952) The Effect of Anonymity on Attitude-Questionnaire Responses. *J. of Abnormal and Social Psychology*, 47(3): 722-723.
- Bagozzi, RP (2011) Measurement and Meaning in Information Systems and Organizational Research: Methodological and Philosophical Foundations. *MIS Quart.*, 35(2): 261-292.
- Benbasat, I, Goldstein, DK, Mead, M (1987) The Case Research Strategy in Information Systems. *MIS Quart.*, 11(3): 369-386.
- Burton-Jones, A (2009) Minimizing Method Bias Through Programmatic Research. *MIS Quart.*, 33(3): 445-471.
- Campbell, DT, Fiske, DW (1959) Convergent and Discriminant Validity by the Multitrait-Multimethod Matrix. *Psychological Bulletin*, 56: 81-105.
- Chin, WW, Thatcher, JB, Wright, RT (2012) Assessing Common Method Bias: Problems with the ULMC Technique. *MIS Quart.*, 36(3): 1003-1019.
- Chua, CEH, Lim, W-K, Soh, C, Sia, SK (2012) Enacting Clan Control in Complex IT Projects: A Social Capital Perspective. *MIS Quart.*, 36(2): 577-602.
- Denzin, NK, Lincoln, YS (Eds.) (1994) *The SAGE Handbook of Qualitative Research*: Sage Publications.
- Dube, L, Pare, G (2003) Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations. *MIS Quart.*, 27(4): 597-635.

- Eisenhardt, KM (1989) Building Theories from Case Study Research. *Academy of Management Review*, 14: 532-550.
- Fiske, DW, Campbell, DT (1992) Citations Do Not Solve Problems. *Psychological Bulletin*, 112(3): 393-395.
- King, WR, Liu, CZ, Haney, MH (2007) Method Effects in IS Survey Research: An Assessment and Recommendations. *Communications of the Association for Infor. Syst.*, 20: 457-482.
- Klein, HK, Myers, MD (1999) A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quart.*, 23(1): 67-93.
- Leonardi, PM (2014) Social Media, Knowledge Sharing, and Innovation: Toward a Theory of Communication Visibility. *Infor. Syst. Res.*, 25(4): 796-816.
- Liang, H, Nilesh, S, Hu, Q, Xue, Y (2007) Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management. *MIS Quart.*, 31(1): 59-87.
- Ortiz de Guinea, A (2016) A Pragmatic Multi-Method Investigation of Discrepant Technological Events: Coping, Attributions, and 'Accidental' Learning. *Information & Management*, 53: 787-802.
- Ortiz de Guinea, A, Titah, R, Leger, P-M (2013) Measure for Measure: A Two Study Multi-Trait Multi-Method Investigation of Construct Validity in IS Research. *Computers in Human Behavior*, 29: 833-844.
- Ortiz de Guinea, A, Titah, R, Leger, P-M (2014) Explicit and Implicit Antecedents of Users' Behavioral Beliefs in Information Systems: A Neuropsychological Investigation. *Journal of Management Infor. Syst.*, 30(4): 179-210.
- Ortiz de Guinea, A, Webster, J (2013) An Investigation of Information System Use Patterns: Technological Events as Triggers, the Effects of Time, and Consequences for Performance. *MIS Quart.*, 37(4): 1165-1188.
- Podsakoff, PM, MacKenzie, SB, Lee, J-Y, Podsakoff, NP (2003) Common Method Bias in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *J. of Applied Psychology*, 88(5): 879-903.
- Ravishankar, MN, Pan, SL, Leidner, D (2011) Examining the Strategic Alignment and Implementation Success of a KMS: A Subculture-Based Multilevel Analysis. *Infor. Syst. Res.*, 22(1): 39-59.
- Richardson, HA, Simmering, MJ, Sturman, MC (2009) A Tale of Three Perspectives: Examining Post Hoc Statistical Techniques for Detection and Correction of Common Method Variance. *Organiz. Res. Methods*, 12(4): 762-800.
- Simmering, MJ, Fuller, CM, Richardson, HA, Ocal, Y, Atinc, GM (2015) Marker Variable Choice, Reporting, and Interpretation in the Detection of Common Method Variance: A Review and Demonstration. *Organiz. Res. Methods*, 18(3): 473-511.
- Straub, D, Burton-Jones, A (2007) Veni, Vidi, Vici: Breaking the TAM Logjam. *J. of the Association for Infor. Syst.*, 8(4): 223-229.
- Su, N (2013) Internationalization Strategies of Chinese IT Service Suppliers. *MIS Quart.*, 37(1): 175-200.
- Walsham, G (1995) The Emergence of Interpretivism in IS Research. *Infor. Syst. Res.*, 6(4): 376-394.
- Yin, RK (1994) *Case Study Research: Design and Methods* (2nd ed. Vol. 5). Thousand Oaks, CA: Sage Publications.