Storytelling through Statistics

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The Structure of Methods & Results

M&R section of a typical 30 page quantitative paper is highly structured. A review of top tier publications reveals common components typically including:

- Study Design, Sample & Procedure
- Variables and Measures
- Analyses
- Results
- Tables
- Graphs and Figures
Writing the Methods & Results

There is remarkably little guidance on how to write M&R sections. The most detailed descriptions are from the American Psychological Association (e.g. APA Manual 6th edition; Journal Article Reporting Standards 2018).

“Describe”
(used 21 times in 3 ½ pages in the 6th)
“Identify”
“Detail”
“Report”

“Give the number”
“State”
“Include”
“Specify”
“Present”

APA guidelines imply that there is no room for interpretation, certainly no room for a story.
An Academic Publication is a Story

Academic writers are encouraged to...

• Develop the interesting story in their manuscripts (Davis, 1971),
• Tell stories about characters and their actions (Williams & Bizup, 2014)
• Challenge assumed knowledge by shifting consensus or creating consensus (Hollenbeck, 2008),
• And create a “hook” to capture readers’ attention (Grant & Pollack, 2011).
The Structure of Methods & Results

M&R presents the information that should persuade your readers that the story you are telling may be true. This is a critically important component of the paper.

The tension in your story has been building from the introduction, through the theoretical development of the hypotheses.

As an author, it is your chance to show how to solve the mystery, put the puzzle pieces together, resolve the contradictions, and reveal the truth.

It is time for the exciting part of the story – the M&R!
The Structure of Methods & Results

Yet, in most papers, the M&R is a dull and dry description divorced from the story. What a letdown.

Readers are not only bored but, more importantly, remain unpersuaded by your evidence for your story.

What should an author do?
An Academic Publication is a Story

Words about relationships between variables in an empirical manuscript should tell a story.

• The front end of the manuscript e.g. introduction, theoretical development and hypotheses, is a **verbal story**
• The verbal story must be supported by empirical evidence that shows that the verbal story is not false

The empirical evidence presented in the Methods & Results section is a **statistical story**
My Focus Today

Tell your statistical story with your Methods & Results section using four principles

- Maintain the narrative
- Write for multiple audiences
- Create transparency
- Seek correspondence

The four principles may not be revelatory, but should be applied to every component of the M&R., and are often violated in practice
Four Principles for Writing Methods & Results

Applying these four principles ...

will increase the likelihood you will publish your story,

enter your chosen academic conversation, and

contribute your bit to the body of knowledge.

Target audience – those who are still learning the craft of writing.
(The rest of you can take a nap, or go write another paper)
### Examples: Applying Principles

<table>
<thead>
<tr>
<th></th>
<th>Maintain the Narrative</th>
<th>Write for Multiple Audiences</th>
<th>Create Transparency</th>
<th>Seek Correspondence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design, sample &amp; procedure</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Measures &amp; variables</td>
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<tr>
<td>Analyses</td>
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<td>Results</td>
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<tr>
<td>Tables, graphs &amp; figures</td>
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</table>

Don’t worry, I won’t go through the whole grid but will cherry pick violations and positive examples.
The First Principle

Maintain the Narrative

Despite the apparently rigid structure of the M&R section, you have latitude in how you tell your story and should be reminding readers of the progress in the story.

Every number, every statistic, every piece of description has a role to play in telling your story. If you don’t tell your story, readers and reviewers will construct their own story of your paper.
Results - Maintain the Narrative

“Table 1 displays means and standard deviations of the variables, their correlations, and includes Cronbach’s alpha for the scales along the diagonal.”

Violation:
This statement is common but how does it help tell your story?
Table 1 is included for a reason.
Use words to link the results to the verbal story.
Inspecting the correlation table can often preview the results, can reveal correlations so high as to suggest a lack of discrimination, raise questions about ceiling or floor effects.
Results – Maintain the Narrative

Positive Example - Explain to your reader what is relevant to your story.

“Table 1 displays descriptive statistics for the full sample as well as subsets of NYC-born attorneys and their officemates. Comparing NYC metro-born attorneys and their officemates, we see predictable differences. NYC metro-born attorneys are more likely to have attended a top and/or NYC-based law school, and they are slightly more likely to be licensed to practice in NY.” (Carnahan, Kryscynski, & Olson, AMJ 2016, p1942)
“Results are reported in Table 2 and in Figures 2a and 2b. These results show that the mean of the experimental group was significantly higher than the mean of the control group supporting H1a.”

Violation:
By the time readers reach the results, they have forgotten the numbering and perhaps the substance of the hypotheses. Include phrases to remind readers of the substance of the hypothesis and what the results mean.
Positive Example

The authors’ story was focused on how entrepreneurs are simultaneously over confident and under confident in their expectations presented a puzzle they resolved through experiments.

“Did overconfidence drive participants’ entry choices? If so, which type of overconfidence was responsible? We compared easy market entrants with difficult market entrants, examining their beliefs about themselves and their relative placements on each quiz. As Figures 2a and 2b show, ...“ (Cain, Moore & Haran, SMJ, 2015 36:1, p6)
Tables, Graphs & Figures – Maintain the Narrative

Table 2: Results

<table>
<thead>
<tr>
<th></th>
<th>CONX</th>
<th>STX</th>
<th>THW</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFF</td>
<td>.04*</td>
<td>.34†</td>
<td>.23**</td>
<td>.44***</td>
</tr>
<tr>
<td>BFF</td>
<td>.12</td>
<td>.40**</td>
<td>.09</td>
<td>.36***</td>
</tr>
</tbody>
</table>

Violation:

Tables should be interpretable on their own without reference to the text. Tables should not require repetitive flipping back to other sections, variables should be written with full label names. The table should indicate the type of analysis and the relationship between the statistics and the hypotheses.
Tables, Graphs & Figures – Maintain the Narrative

Positive Example: Figures can be a useful way to communicate the story.

Woolum, Foulk, Lanaj, & Erez, JAP 2017 p1662

Figure 1. The moderating effects of core self-evaluation on the relationship between witnessed rudeness and workplace outcomes as mediated by perceived workplace rudeness. Unstandardized coefficients are reported. *p < .05, **p < .01.
The Second Principle

Write for Multiple Audiences

Readers vary in their expertise and familiarity with a topic, and their reasons for reading your paper vary.

_Everybody wants to know the story and how it turns out – but you may get only 30 seconds to convince a reader that you have a story worth reading further. Different readers attend to different parts of your paper._
The Second Principle

Write for Multiple Audiences

Write for expert and novice audiences, simultaneously. When describing your analytical technique use common language explanations and include useful citations. Your reviewer may not know the technique and may get confused or annoyed when explanations are not understandable.

Write for my mother...or your cousin or your neighbor.
Violation:
“The endogenous dependent variable of interest is Organizational Citizenship Behavior (OCB) with the focal entity on the individual (individual level). OCB is conceptualized as the employee intention to commit OCB in the future, how likely an employee is to commit an act of OCB and the unit of analysis is the employee’s intention consisting of one item on a 7-point Likert scale. This should be measured at the individual level to reflect the intention level within each individual.”

Simple sentences are usually better.

Revised:
The dependent variable is Organizational Citizenship Behavior Intentions measured at the individual level with a single item on a 7-point Likert scale.
Analyses – Write for Multiple Audiences

Positive Example:
Explain your choice of analytical strategy by comparing the advantages and disadvantages of different approaches in simple, straight-forward language.

Igic, Keller, Elfering, Tschan, Kalin, & Semmer (JAP, 2017, 102:8, p 1319, 1324) defend their choice of growth mixture modeling by explaining its match to their theoretical objectives, after describing three other approaches used to examine similar questions.
Tables, Graphs & Figures – Write for Multiple Audiences

Positive Example: Include a table summarizing practical implications

*Lacerenza, Reyes, Marlow, Joseph & Salas, JAP 2017 p1704*

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**Table 8**

Evidenced-Based Best Practices for Designing a Leadership Training Program

1. Resist the temptation to think that leaders cannot be trained; evidence suggests leadership training programs are effective.
2. Conduct a needs analysis and identify the desired outcome(s) based on stakeholder goals before designing the program.
3. Use multiple delivery methods when possible (e.g., information, demonstration, and practice) and if limitations prevent this, choose practice instead of other delivery methods.
4. Use caution when spending additional resources on 360-degree feedback (evidence indicates that it might not be more effective than single-source feedback).
5. Provide multiple training sessions that are separated by time rather than a single, massed training session.
6. Use caution when implementing self-administered training and instead, choose an internal or external trainer (evidence shows no differences in the effectiveness of internal and external trainers but indicates that self-administered training is less effective).
7. Consult with others outside of your field to ensure the program is both evidence-based and practically relevant (e.g., if you are a practitioner, collaborate with an academic).
8. Ensure the program is designed appropriately according to the desired outcome using the guidelines provided below.

<table>
<thead>
<tr>
<th>Learning</th>
<th>Transfer</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use multiple delivery methods</td>
<td>• Use multiple delivery methods</td>
<td>• Use multiple delivery methods</td>
</tr>
<tr>
<td>• Conduct a needs analysis</td>
<td>• Conduct a needs analysis</td>
<td>• Hold on-site</td>
</tr>
<tr>
<td>• Include hard skills (i.e., business skills)</td>
<td>• Provide feedback</td>
<td>• Require mandatory attendance</td>
</tr>
<tr>
<td></td>
<td>• Use a face-to-face setting</td>
<td>• Have multiple sessions</td>
</tr>
<tr>
<td></td>
<td>• Make attendance voluntary</td>
<td>• Provide as much training as possible</td>
</tr>
<tr>
<td></td>
<td>• Have multiple sessions</td>
<td>(longer programs are more effective)</td>
</tr>
<tr>
<td></td>
<td>• Include hard (i.e., business skills) and soft skills (i.e., leadership skills)</td>
<td>• Include soft skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i.e., intrapersonal, interpersonal, and leadership skills)</td>
</tr>
</tbody>
</table>
The Third Principle

Create Transparency

This is science. Full and accurate description is necessary and you have a special obligation to be clear about complicated analyses, mistakes in the procedures, weaknesses in your data, and results that are contrary to your predictions.

Academic audiences are a particularly skeptical bunch. Hiding, disguising, and omitting pertinent information tends to make readers and reviewers disinterested, distrustful, and angry.
Tables, Graphs & Figures – Create Transparency

Violations:

Omitting the regression results and only presenting simple slopes in graphs, or mediated results. Omitting important information from tables.

Don’t pretend that outdated or inappropriate statistical standards or analytical procedures are ok. Apply the appropriate standard and learn the new technique.
Results – Create Transparency

Positive Example: Come clean about problems with data or results.

“However, Study 1 also has some limitations. First, we were unable to disentangle the causal ordering among our independent and mediator variables because they were collected at the same time. Although longitudinally separated, the causal relationship between our mediators and dependent variables could also be strengthened. Second, our measure of identity conflict and enhancement may not reflect the underlying values associated with brand identities. Last, the unexpected negative relationship between perspective-taking and performance also requires further investigation. To address the above limitations, in Studies 2a and 2b we conduct experiments using a between subjects design to isolate and better examine the mechanisms we find in the field study.” (Ramarajan, Rothbard, and Wilk, AMJ 2017, Dec p2222)
The Fourth Principle

Seek Correspondence

The statistical story should correspond in every way to the verbal story.

*Easy to say, but hard to do. Every element of your M&R section (design, procedures, analyses and results, tables etc.) must match and support the story you have set up in the front end of the paper.*
Design, Procedure & Sample – Seek Correspondence

Violations:

Verbal story is about a causal relationship but design and data lend very weak support for causes.

Timing of the measurements is weakly related or unrelated to the timing of the causal processes.
Tables, Graphs & Figures – Seek Correspondence

Violation:
Figures representing a causal process that differs from the equations used to test the hypotheses.

\[ M = a_0 + a_1X + a_2Z + a_3XZ \quad (1) \]

\[ Y = b_0 + b_1M \quad (2) \]
Common Violations of Correspondence:

- Verbal story emphasizes prevalence of a phenomena and practical implications associated with answering the research question when design and data show the phenomenon is possible but says nothing about prevalence and practical impact.

- Verbal story is about a broad population of all firms or all employees, but sample is narrow and embodies idiosyncrasies that perhaps suggest it is not appropriate for a general test of hypotheses.

- It appears that the verbal story and statistical story were written by different people on the author team.
Positive Example:

“It is important to note that although we recognize that leaders and managers are not always synonymous (Zeleznik, 1992), sales managers must exhibit leadership to be effective (e.g., Rich, 1997). Thus we feel confident generalizing results from this sample of sales managers to leaders in general.”

(Hernandez et al JAP 2016, p71)
Analyses – Seek Correspondence

Positive Example:
An analytical plan can help readers see the connection between the verbal story and the statistical story. Such a plan offers a map that links the story to the statistical tests, explaining how the results will be related to the research question motivating the paper.

Argyres, Bigelow & Nickerson (SMJ, 2015, 36:2, p228) offer a detailed explanation of their analytical model, how variables correspond to their theoretical model, which firms were included and excluded from their data, how the time frame of the data set corresponds to the theory and why a coefficient on a variable was expected to be positive rather than negative, etc.
The Statistical Story

Only a few examples were presented here - many more positive examples exist in premier journals.

- Maintain the narrative
- Write for multiple audiences
- Create transparency
- Seek correspondence

If you follow these four principles, your writing will resemble the writing in premier journals, your verbal story will be better supported by your statistical story, and readers will understand and remember your story more easily.
through Statistics

Thank you