

# Check Mate: Preferred Data Checking Methods

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## ABSTRACT

Data checking increases the accuracy of research. However, data checking can be tedious (Aborg, Ferstrom, & Ericson, 1998) and boring (Healy, Kole, Buck-Gengler, & Bourne, 2004). The purpose of this study was to determine which data checking method is most preferred. We compared four different methods: solo read-aloud, partner read-aloud, double entry, and visual checking. A total of 154 undergraduates checked data using one of these four methods and then evaluated their data checking method using 16 adjectives. Participants rated visual checking as more pleasant than partner read-aloud. Future research should consider using a within-subject design to increase power, and should examine data checking method preferences in additional types of data enterer, such as graduate students, faculty, and paid data entry personnel.

## INTRODUCTION

Data checking can be physically and mentally strenuous. It is sometimes considered tedious (Aborg, Ferstrom, & Ericson, 1998) and those who check data experience fatigue and boredom (Healy, Kole, Buck-Gengler, & Bourne, Jr., 2004), which can cause cognitive errors and oversight of incorrectly inputted data (Healy et al, 2004). Data checking is an important part of data cleaning (Tabachnick & Fidell, 2013), and so it is important to find a data checking method that leads to less physical and mental discomfort for those doing the data checking.

Barchard and Verenikina (2013) compared subjective opinions of three data checking methods: partner read-aloud, double entry, and visual checking. Participants with prior data entry experience significantly preferred double entry over visual checking. The researchers attributed this finding to the fact that double entry does not require as much careful attention. Users can rely on the computer to identify the errors.

More research is needed to compare additional data checking methods. This current study included four data checking methods: the three methods included in the previous study plus solo read-aloud. We hypothesized that double entry would once again be the most preferred data checking method.

## METHOD

### Participants

A total of 154 undergraduates (103 females, 49 males, and 2 undisclosed) participated in this study in return for course credit. Ages ranged from 18 to 50 years (mean 21.56, SD 6.42). Participants identified themselves as the following: 10.4% African American, 20.1% Asian, 36.4% Caucasian, 26.0% Hispanic, 0.6% Native American, 1.9% Pacific Islander, and 3.9% other.

### Procedures

During this study, participants checked the data from 25 data sheets (see Figure 1). These data sheets had already been entered into the Excel when participants arrived. However, when we entered the data, we deliberately introduced data entry errors. The participant's job was to locate and correct these errors.

Participants completed the study during a single 90-minute session. First participants watched a video explaining how to use the basics of Excel since the study itself uses Excel as its platform. Then the computer randomly assigned them to one of the four data checking methods (described below). Next, participants watched a video that explained their assigned data checking method. To practice their method, participants checked five data sheets, while the study administrator helped them. Finally, participants checked 20 additional data sheets without any help from the administrator.

Participants were randomly assigned one of four data checking methods: solo read aloud, partner read aloud, double data entry, and visual checking. If a participant was assigned the solo read aloud method, they read the paper sheet aloud. While doing so, the participant checked whether the data on the Excel file matched what they were reading. If the data did not match, the participant corrected the Excel file.

If a participant was assigned the partner read aloud method, the study administrator read the data sheet aloud while the participant checked the data on the Excel sheet. If the participant noticed that the study administrator said something other than what was on the screen, the participant asked the administrator to read the data again. If the entry was incorrect, the participant corrected the data.

Participants assigned the visual checking method silently looked back and forth between the paper data sheet and the Excel file. If they noticed any errors, they corrected the Excel file.

If a participant was assigned the double entry method, participants entered data a second time. The Excel file notified the participant if their entry and the previously entered entry did not match. If the participant noticed they did not match, the participant compared both entries to the paper data sheet and fixed whichever entry was incorrect (or fixed both entries, if both were incorrect).

At the end of the study, an online survey asked participants how they felt about the data checking method they used. There were 16 adjectives: satisfying, comfortable, pleasant, relaxing, accurate, enjoyable, fun, calming, reliable, frustrating, painful, boring, tedious, uncomfortable, and annoying. Using a five-point Likert scale (where 1 = Strongly Disagree and 5 = Strongly Agree), participants were asked if they agreed that an adjective was associated with the data checking method they used.

### Data Analysis

We ran 16 one-way ANOVAs comparing the four data checking methods on the 16 adjectives. When the omnibus ANOVA was significant, we used Tukey's HSD to determine which groups differed from each other.

## RESULTS

One-way ANOVAs were used to compare the four groups on the 16 adjectives (see Table 1). Of these ANOVAs, only one was significant ( $F(3, 148) = 4.50, p < .005$ ). Participants rated the visual checking method as more pleasant than partner read aloud (Tukey's HSD  $p = .002$ ).

## DISCUSSION

Data checking is necessary to provide accurate results. However, data checking can be boring and tedious (Aborg, Ferstrom, & Ericson, 1998). This study analyzed different data checking methods (solo read aloud, partner read aloud, double data entry, and visual checking) in order to find the most preferred method. We hypothesized that double entry would be the most preferred data checking method. Our results showed, however, that visual checking was rated as more pleasant than partner read-aloud. Visual checking was not significantly more pleasant than solo read-aloud or double data entry. We did not find significant differences on any of the other 15 adjectives we examined.

Given that we found significant differences on only one of 16 adjectives and tested all hypotheses using alpha = .05, it is possible that this one significant result is a Type I error, and that there are no differences between any of the data checking methods. However, it is also possible that the study had inadequate power and that there are more differences between the methods than we were able to detect. If there are medium-sized differences between the groups, then to have power = .80 with four groups, a study would need 45 participants in each group (for a total of 180 participants), which is close to the sample size we had. However, if the differences are small, 274 participants are needed in each group (for a total of 1096 participants).

This study used a between-subjects design, where each participant checked data using just one of the four methods. It is possible that a within-subjects design would have more power, both because it would control for between-subject differences and because it would allow participants to do direct comparisons of the four methods. However, using all four data checking methods would be time consuming. If participants continued to use five data sheets to practice but then checked the data on only 10 sheets (rather than 20), we estimate that it would take about 215 minutes (more than 3.5 hours) for participants to check the data using all four data checking methods. Participants would probably need to complete data checking on multiple days, rather than completing the entire study during a single session. We are uncertain if a study that compares 10 data sheets using a within-subject design would be more powerful than the current study which compares 20 data sheets using a between-subjects design.

| Adjective     | Data Checking Method |      |                 |      |                    |      |                 |      | F       |
|---------------|----------------------|------|-----------------|------|--------------------|------|-----------------|------|---------|
|               | Double Entry         |      | Solo Read Aloud |      | Partner Read Aloud |      | Visual Checking |      |         |
|               | M                    | SD   | M               | SD   | M                  | SD   | M               | SD   |         |
| Satisfying    | 3.75                 | 0.81 | 3.38            | 1.13 | 3.31               | 1.12 | 3.54            | 0.91 | 1.43    |
| Comfortable   | 3.61                 | 0.87 | 3.56            | 0.99 | 3.58               | 1.03 | 3.68            | 1.19 | 0.11    |
| Pleasant      | 2.91                 | 0.90 | 2.88            | 0.95 | 2.56               | 0.89 | 3.31            | 1.00 | 4.50 ** |
| Relaxing      | 2.72                 | 0.97 | 2.62            | 0.92 | 2.36               | 0.91 | 2.85            | 1.06 | 1.96    |
| Accurate      | 3.75                 | 0.73 | 3.35            | 1.01 | 3.49               | 1.04 | 3.44            | 1.14 | 1.05    |
| Enjoyable     | 2.86                 | 0.76 | 2.76            | 0.96 | 2.42               | 0.81 | 2.69            | 1.00 | 1.87    |
| Fun           | 2.68                 | 0.99 | 2.32            | 0.91 | 2.31               | 0.87 | 2.44            | 0.97 | 1.16    |
| Calming       | 2.89                 | 0.87 | 2.76            | 0.99 | 2.47               | 0.99 | 3.00            | 1.00 | 2.39    |
| Reliable      | 3.50                 | 0.85 | 3.50            | 0.83 | 3.20               | 0.99 | 3.33            | 1.03 | 0.97    |
| Frustrating   | 3.75                 | 1.00 | 3.38            | 0.92 | 3.40               | 1.25 | 3.82            | 1.32 | 1.54    |
| Painful       | 3.83                 | 0.91 | 3.94            | 1.14 | 3.98               | 1.03 | 4.31            | 0.98 | 1.54    |
| Boring        | 2.81                 | 1.14 | 2.35            | 1.12 | 2.36               | 1.11 | 2.23            | 0.93 | 2.03    |
| Tedious       | 2.53                 | 1.11 | 2.15            | 1.10 | 2.18               | 1.15 | 2.10            | 1.10 | 1.12    |
| Uncomfortable | 3.50                 | 0.85 | 3.56            | 1.08 | 3.44               | 1.08 | 3.67            | 1.22 | 0.32    |
| Annoying      | 3.19                 | 0.92 | 2.82            | 1.03 | 3.07               | 1.05 | 3.23            | 1.22 | 1.06    |
| Depressing    | 4.10                 | 0.97 | 3.82            | 0.97 | 4.11               | 0.96 | 4.10            | 1.02 | 0.71    |

\*\*  $p < .01$   
 Note. Degrees of freedom vary between tests. However, they were usually 3, 100.  
 M = Mean. SD = Standard Deviation.

Future studies should examine data checking method preferences among additional groups. Our study used undergraduates with a mean age of 21.56. However, many different groups check research data (undergraduates, graduate students, faculty, and paid data entry professionals). Therefore, future research should look at preferred data checking methods within these groups.

## REFERENCES

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ID: 739925

Sex: (M) F

### Learning Style

- 1 1 2 3 4 5
- 2 1 2 3 4 5
- 3 1 2 3 4 5
- 4 1 2 3 4 5
- 5 1 2 3 4 5
- 6 1 2 3 4 5
- 7 1 2 3 4 5
- 8 1 2 3 4 5

### Study Habits

1. SD D N A SA
2. SD D N A SA
3. SD D N A SA
4. SD D N A SA
5. SD D N A SA
6. SD D N A SA
7. SD D N A SA
8. SD D N A SA

### Spelling Test

1. ACCOMMODATE
2. AMATEUR
3. CALENDAR
4. CEMETERY
5. CONSHENCE
6. EMBARRASS
7. EXHILARATE
8. MAINTAINANCE

### Math Test

1. 156
2. 235
3. 485
4. 493
5. 364
6. 327
7. 203
8. 347

Figure 1:  
Example Data Sheet



## The Learning Study

**ID: 739925**

Sex:  M  F

### Learning Style

1. 1 2 3  4 5
2. 1 2 3 4  5
3. 1 2 3 4  5
4. 1 2  3 4 5
5. 1 2 3 4  5
6. 1 2 3  4 5
7. 1 2 3 4  5
8. 1 2  3 4 5

### Study Habits

1. SD D N A  SA
2. SD D  N A SA
3. SD D N A  SA
4. SD D N A  SA
5. SD D N  A SA
6. SD D N  A SA
7. SD  D N A SA
8. SD  D N A SA

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