# The Effects Of Experience And Data Presentation Format On An Auditing Judgment

John C. Anderson, (E-mail: janders@mail.sdsu.edu), San Diego State University
Jennifer M. Mueller, (E-mail: jmueller@business.auburn.edu), Auburn University

**ABSTRACT**

*Prior research has examined the effects of information presentation format on decision outcomes in various settings, but has led to inconclusive results as to whether a tabular or graphical format is superior for decision making. An important methodological difference in these studies is the use of inexperienced versus experienced participants. This study examines the interaction of experience with presentation format in the application of auditing judgments (specifically, analytical review judgments) and finds that participant experience does matter. In particular, where tabular information was most extensively used (i.e., in the task of correlation assessment), the performance advantage from using graphs was not as great for practitioners as for students, perhaps because of the experience practitioners possess with the use of tables. Implications of this study for the interpretation of prior findings are discussed as well as directions for future research.*

## 1.0 INTRODUCTION

Analytical procedures are recognized as a means by which auditors may more effectively and efficiently collect audit evidence. Not only are the procedures required by auditing standards, but field study research by Hirst and Koonce (1996) concluded that all auditors interviewed used analytical procedures in some manner as a form of evidence collection. Analytical procedures "consist of evaluations of financial information made by a study of plausible relationships among both financial and non-financial data" [*Statement of Auditing Standards No. 56* (SAS 56), "Analytical Procedures"; AICPA, 1988]. Analytical procedures are often preferable to other audit procedures because they "require relatively little auditor time and resources" (Blocher and Willingham 1988). They generally involve comparisons of recorded amounts, or functions of recorded amounts, to expectations developed by the auditor using knowledge of the client and the client's industry. These expectations are often based on individual judgment due to constraints on time, cost, or data (Biggs and Wild 1985).

Studies have examined the manner in which data presentation format—graphical, tabular or a combination of both—affects the judgment development process in an analytical procedures auditing context (Kaplan 1988, Anderson and Reckers 1992, Anderson and Kaplan 1992, Schulz and Booth 1995). These studies build upon previous literature investigating the effects of presentation format in various decision settings (see DeSanctis 1984, Vessey 1991 for a review). Results of these previous studies, however, are inconsistent due to the lack of consistent methodology among them. One such complicating methodological factor is the varied use of students versus practitioners as participants. The purpose of this study is to examine, in an auditing context, whether *student* participants (who have little or no experience with either tables or graphs) would show relatively more improvement in analytical procedures tasks with graphs, compared to *auditor* participants who may already have substantial experience with tables. The answer to this question has implications for both academic research and practice.
The remainder of the paper is organized as follows. The following sections review the pertinent literature and develop the hypotheses. The sections thereafter contain the methodology, results, discussion, and related future research.

## 2.0 REVIEW OF LITERATURE AND HYPOTHESIS DEVELOPMENT

The hypotheses in this study are supported by the theory of cognitive fit (Vessey 1991) and previous research on presentation format and the effects of experience.

### 2.1 Previous Research On Presentation Format In The Context Of Analytical Procedures

This study builds upon a stream of literature examining a realistic, complex task environment for the application of analytical procedures. When applying analytical procedures, auditors may be confronted with a mass of information from which to gather evidence. The environmental complexity model (Schroder, Driver, and Streufert 1967) suggests that having large amounts of information available may impair performance in decision making. Hence, auditors may wish either to organize the data before considering it in the judgment process or utilize data that has already been compiled and organized, such as that given by a decision aid or provided elsewhere in client-prepared documents. The outcome of this compilation process is the presentation of the data in some organized format, such as tabular or graphical. It is important to determine the presentation format that will best facilitate the judgment process.

Three studies have examined the effect of presentation format on analytical procedures judgments with somewhat varying results (Kaplan 1988, Anderson and Reckers 1992, Schulz and Booth 1995). Kaplan (1988) found that presentation format had no effect on the accuracy of assessing expected sales dollars. Anderson and Reckers (1992) suggested this result might be due to the experimental task, which involved trend analysis, a task perhaps too simplistic for the application of analytical procedures to an income statement account. The materials provided only seven periods of historical data for sales, which may be regarded as limited information, on which to build a judgment about an expected value.

Anderson and Reckers (1992) extended Kaplan's study in two ways. First they examined a more complex task, that is perhaps more appropriate for deriving an income statement account. Participants were required to establish the expected value for sales based upon the historical relationship of sales with five other variables (representative of financial, operating, and economic data) before making a sales prediction. The materials provided data for each of the variables for 27 periods. Secondly, Anderson and Reckers included field independence as a variable to grant consideration to individual differences in cognitive style. They considered this control necessary as individuals with different cognitive styles have varying degrees of difficulty processing and combining information cues (Witkin and Goodenough 1981). In their study, participants with graphs performed significantly better than participants with tables in both components of the task—assessing the correlation between sales and the five other variables and making sales predictions.

A third study, conducted by Schulz and Booth (1995), extended Anderson and Reckers (1992) by including eight related variables rather than five and provided data for 60 periods rather than 27. They furthermore required a less structured task based upon the view that the relevance of Anderson and Recker's findings might be limited due to the use of a highly-structured task. Schulz and Booth's task was less structured in that it required participants to make a prediction of the sales account balance without first requiring them to assess correlations between sales and the other eight variables. Schulz and Booth found that when the actual audited sales account balance for the year was used as a normative or "correct" value, participants with graphs performed significantly better than participants with tables, however this result did not hold when the normative value was created using univariate regression.[1]

Schulz and Booth (1995) and Anderson and Reckers (1992) also differed methodologically on whether to label the sales-related variables. In Anderson and Reckers (1992), the variables were identified as letters (e.g., A,B,C) rather than naming the actual type of data (e.g., advertising expense, retail square feet). Alternatively, Schulz and Booth chose to descriptively label the variables. Anderson and Reckers may have achieved greater internal validity, in their use of non-descriptive labeling, by controlling for participants' biases due to past experience with certain clients' sales accounts external to the data relationships in the experiment, a phenomenon referred to as illusory correlation (Chapman 1967, McArthur 1980). Participants in Schulz and Booth (1995) may have used an item other than budgeted sales (used in a univariate regression benchmark) to predict actual sales, not

because of a higher amount of correlation present in the experiment, but because of individual audit experience of the alternative item generally being more highly correlated with actual sales.

### 2.2 Theory Of Cognitive Fit

The theory of cognitive fit (Vessey 1991) provides a basis for the outcome of graphical presentation format resulting in a more accurate correlation assessment and subsequent prediction of sales in an analytical procedures task. The theory of cognitive fit proposes that *a problem* may be represented either spatially (i.e. graphically) or symbolically (i.e. tabular). Moreover, *the task required* of the decision-maker may also be described as spatial or symbolic. A spatial task requires that one glean information from a global or 'big picture' setting of data, where the meaningfulness of all the pieces of data taken together is greater than the sum of meaningfulness of the pieces taken separately, or gestalten. A symbolic task requires that one extract an individual data value. According to the theory, if the type of presentation "matches" the type of task, decision makers will be both more efficient and more effective in decision making because the task, in a relative manner, will become less complex.

Although the theory of cognitive fit has not been applied directly to an analytical procedures task, a recent study by Tuttle and Kershaw (1998) extended the theory beyond a decision-choice task to a judgment task. The authors point out that:

*Judgment often precedes and aids choice, but is neither necessary nor sufficient for choice. Likewise, judgments are often made without a corresponding choice. Judgment requires an evaluation of the alternatives, whereas choice only requires that an alternative be selected (Tuttle and Kershaw 1998, p. 2).*

They incorporated judgment strategy into the model using Amer's (1991) two broad categories of judgment strategies: holistic and analytic. When using a holistic judgment strategy, data is perceived as a single unit. Alternatively, when using an analytic judgment strategy, one tends to extract and act on a single dimension of the data or on discrete data values. In relation to the theory of cognitive fit, Tuttle and Kershaw hypothesized that a holistic judgment strategy utilizes spatial processes (e.g. comparing multiple pieces of information, identifying relationships among the data, and looking at multiple values simultaneously) and is therefore improved with the use of spatial data representation (i.e. graphs). An analytic judgment strategy utilizes symbolic processes (e.g. extracting or analyzing discrete data values, decomposing data into separable elements, and using data to perform computations), and is therefore improved with the use of symbolic data representations (i.e. tables). Tuttle and Kershaw (1998) supported the hypothesis that a matching of data representation to judgment strategy facilitated improved judgments, thus extending the theory of cognitive fit to incorporate judgment strategy.

In this study, the experimental analytical procedures task may be described as a spatial task requiring a holistic judgment strategy in order to reach an outcome. Therefore, based on the theory of cognitive fit (Vessey 1991) and the recent findings of Tuttle and Kershaw (1998), we expect to replicate the main effects found by Anderson and Reckers (1992):

***H1:*** Participants using a graphical presentation format will be more accurate when assessing correlation in an analytical review task.

***H2:*** Participants using a graphical presentation format will be more accurate when predicting current sales in an analytical review task.

### 2.3 Interaction Of Experience With Presentation Format

Of particular interest in this study is the whether a performance advantage from using graphical format is dependent upon experience level, particularly since studies in the area of presentation format have utilized different participant groups. Although some studies have used practitioners (e.g. Wright 1995, Anderson and Reckers 1992, Schulz and Booth 1995), many others have used students as "surrogates" for practitioners (e.g. DeSanctis and Jarvenpaa 1985, MacKay and Villarreal 1987, Wright 1989a, Davis 1989, Tuttle and Kershaw 1998, Frownfelter-Lohrke 1998). Research outside the context of auditing has shown that participants will vary in problem solving

approach and performance, according to background and experience (Lucas 1975, Lucas and Nielsen 1980, and Wright 1989b). Thus, in studies utilizing student participants, it is unclear to what extent the implications of earlier research can be generalized. Practitioners, who have experience with such media as working papers and financial statements, may have significantly more experience than students utilizing data presented in tables if it is considered a more familiar format. Schulz and Booth (1995) reasoned that the practitioners in their study did not consistently receive an advantage from utilizing a graphical presentation format because they were more familiar with using tables (the normal working paper format for the participants' firm) and less familiar with using graphs in this particular analytical procedures setting. They furthermore suggested that prior experience with the tabular format may have enabled the auditors using a tabular format to match any effectiveness advantage of those using a graphical format.

This study incorporates both students and practitioners as participants in the analytical procedures task of Anderson and Reckers (1992) to examine the interactive effect of presentation format and experience on judgment effectiveness. The following research questions are posed:

**RQ1:** Will the advantage which comes from using a graphical presentation format differ for experienced versus inexperienced participants when assessing correlation in an analytical review task?

**RQ2***:* Will the advantage which comes from using a graphical presentation format differ for experienced versus inexperienced participants when predicting current sales in an analytical review task?

## 3.0 METHODOLOGY

This study was conducted as a 2x2 between-subjects design. We manipulated *data presentation format* as either graphical or tabular and included both auditors and students to evaluate *experience*. Each of these variables will be discussed further below.

### 3.1 Participants

Eighty-two senior auditors from an international accounting firm and 130 accounting students at a large southeastern university participated in the experiment under controlled conditions. Thus, the total number of participants was 212.

### 3.2 Task

Analytical procedures are more effective when used to analyze income statement accounts, which reflect "flows", rather than balance sheet accounts, which reflect "stocks" and are the net effects of one or more flows (Blocher and Willingham 1988). This study, therefore, in accordance with Anderson and Reckers (1992), Anderson and Kaplan (1992), and Schulz and Booth (1995), will focus on an income statement account, sales. In deriving an expected value judgment about an income statement account, its activity is generally compared to that of other factors such as other accounts, operating data, or economic indicators (Blocher and Willingham 1988 p.149). Once the related factors are identified, the derivation of an expected value is essentially a two-step process (Blocher and Willingham 1988): (1) assess the strength of the relationships (correlations) between the related factors and the income statement account and (2) evaluate the current and historical relationship between the most highly correlated variable and the income statement account to estimate the current activity of the income statement account (prediction). As in Anderson and Reckers (1992), this two-step process is the basis for the experimental task used in this study.

The experimental materials first provided a discussion of the concepts of correlation and prediction, in order to familiarize the participants with the analytical review task. Participants were then presented with the actual experimental data. To manipulate presentation format, the presentation of historical sales data and data relating to the other five activity variables was presented in either tabular or graphical format, in a between-subjects design. In graphical form, five two-dimensional graphs were provided, one for each activity variable. Each graph consisted of 27 plotted points with the level of sales activity on the *x* axis and the related activity variable on the *y* axis. All five

graphs were shown on the same page. In tabular form, the information for the 27 observations was presented in 27 rows organized into six columns, with one column for sales dollars and one column for each of the five variables. For both graphical and tabular forms, the names of the five variables were identified as letters (e.g., A, B) rather than naming the actual source of the data (e.g., advertising expense, retail square feet) to strengthen the internal validity of the study. Participants performed the following analytical review steps: (1) assess the level of correlation between sales dollars and units of five different variables, based on observations over the 27 time periods, and (2) make a prediction of sales dollars for the current period, based on the level of activity of the variable estimated to have the highest correlation with sales in step 1.

Following the completion of these two steps, participants completed the Embedded Figures Test (EFT), which allowed us to measure whether a participant possessed field dependent or field independent cognitive style. Field independent participants are better able to provide organization to a disorganized field of information, restructure information, and sample more fully from available cues (Witkin and Goodenough 1981, Goodenough 1976). Measurement of this cognitive style is important given then the experimental task requires that participants summarize underlying data relationships and provide organization to a set of disorganized stimuli. Once participants had completed the EFT, they responded to various demographical questions. Participants were not limited on the time needed to complete the materials.

### 3.3 Dependent Measures

The dependent measure used to evaluate participants' accuracy in assessing correlation (H1 and RQ1) was computed as the absolute difference between the factual correlation and the participant's assessed correlation. The factual value was a computed correlation coefficient based on the 27 prior observations. The dependent measure for H2 and RQ2, regarding participants' sales predictions, was computed as the absolute difference between the normative value of sales and participants' sales predictions. The normative value was determined (using regression) to be $900 million.

## 4.0 RESULTS

### 4.1 Accuracy In Assessing Correlations

Results of a repeated measures analysis of covariance (ANCOVA), used to test both H1 and RQ1, is presented in Panel A of Table 1. The independent variables were presentation format (table versus graph) and participant experience (practitioner versus student) and the dependent measure for analysis was the absolute difference between the factual value and the participant's assessed correlation, where the factual value was a computed correlation coefficient based on the 27 prior observations. A repeated measures model was required as the participants assessed correlation five times, once for each of the variables associated with sales. Further, field independence was used as a covariate to control for individual differences in cognitive style.[2] The factual correlations and the mean assessed correlations of participants are presented for each of the five income-related variables in Panel B of Table 1.

The repeated measures ANCOVA shows a main effect for presentation format ($p<.0001$), where participants provided with graphical presentations tended to assess correlations more correctly. This result provides support for H1. However, this main effect must be interpreted with consideration given to the significant interaction of presentation format and experience ($p = .019$). RQ1 led us to explore whether the advantage provided by graphs would be tempered by experience. From the differences between cell means (lower Panel B), it can be observed that, *among students*, the accuracy of those using graphs in assessing correlations was .134 greater (more accurate) than those using tables. By contrast, a smaller improvement existed *among practitioners*, with the accuracy of those using graphs being only .057 greater (more accurate) than those using tables. Practitioners were helped less with graphs than were students, as practitioners performed significantly better than students when both were using tables (lower Panel B, mean error for practitioners is .240 versus .294 for students, $p = .04$).

**Table 1**
**Accuracy in Assessing Correlations**
Dependent Measure = Absolute Value of (Subject's Correlation Assessment - Normative Value)
*where* Normative Value = Correlation Coefficient

**Panel A: Repeated Measures ANCOVA Analysis of Results**

| *Source of Variation* | *Sum of Squares* | *df* | *Mean Square* | *F-statistic* | *Tail Prob.* |
|---|---|---|---|---|---|
| Format | 22002.600 | 1 | 22002.600 | 27.407 | <.0001 |
| Experience | 573.153 | 1 | 573.153 | 0.714 | 0.399 |
| Format x Experience | 4511.921 | 1 | 4511.921 | 5.620 | 0.019 |
| Field Independence | 2215.506 | 1 | 2215.506 | 2.760 | 0.098 |
| Error | 166182.000 | 207 | 803.000 | | |

**Panel B: Cell Means for Dependent Measure**

| | Format → | Graphs | Graphs | Table | Table |
|---|---|---|---|---|---|
| | Experience → | Practitioner | Student | Practitioner | Student |
| *Variable* | *Normative Value* | *Assessed Value* | *Assessed Value* | *Assessed Value* | *Assessed Value* |
| D | 0.96 | 0.129 | 0.093 | 0.308 | 0.366 |
| O | 0.83 | 0.245 | 0.213 | 0.210 | 0.292 |
| G | 0.72 | 0.157 | 0.124 | 0.188 | 0.259 |
| L | 0.63 | 0.148 | 0.162 | 0.260 | 0.274 |
| T | 0.58 | 0.268 | 0.206 | 0.235 | 0.280 |
| | Cell Means: | 0.183 | 0.160 | 0.240 | 0.294 |
| | *n* = | 44 | 68 | 38 | 62 |

**Differences Between Cell Means**

| | *Experience:* | | | |
|---|---|---|---|---|
| *Presentation Format:* | Practitioner | Student | *Difference* | |
| Table | 0.240 | 0.294 | *0.054* | (*p* = .0400) |
| Graphs | 0.183 | 0.160 | *0.023* | *(not signif.)* |
| *Difference* | *0.057* | *0.134* | | |
| | (*p* = .0185) | (*p* < .0001) | | |

**Panel C: Treatment Means**

| | | *Means* | *n* |
|---|---|---|---|
| Presentation Format: | Graphs | 0.173 | 112 |
| | Tables | 0.274 | 100 |
| Experience: | Practitioner | 0.213 | 82 |
| | Student | 0.224 | 130 |

## 4.2 Accuracy in Predicting Sales

ANCOVA was used to test H2 and RQ2. This model tested the influence of data presentation format and experience on participant's accuracy in predicting sales. The dependent measure for the analysis was the absolute difference between the normative value of sales and participants' sales predictions, where the normative value was determined (using regression) to be $900 million. Once again, field independence was entered as a covariate.

Results of the ANCOVA, presented in Panel A of Table 2, indicate that presentation format was significant, where participants provided with graphical presentations tended to be more accurate in predicting sales ($p$<.0001).[3] From Panel B of Table 2, participants provided with graphical data erred by $16 million compared to participants with tabular data who erred by $56 million. Thus, H2 is supported. RQ2 questioned whether the advantage of

graphical format, shown in the main effect, would be different according to experience. An interaction, however, was not found in the sales prediction task.

**Table 2**
**Accuracy in Predicting Sales**
Dependent Measure = Absolute Value of (Subject's Sales Prediction - Normative Value)
*where* Normative Value = Predicted Value from Regression ($900 million)

**Panel A: ANCOVA Analysis of Results**

| *Source of Variation* | *Sum of Squares* | *df* | *Mean Square* | *F-stat.* | *Tail Prob.* |
|---|---|---|---|---|---|
| Format | 841.641 | 1 | 841.641 | 86.507 | <.0001 |
| Experience | 30.589 | 1 | 30.589 | 3.144 | 0.078 |
| Format x Experience | 2.117 | 1 | 2.117 | 0.218 | 0.641 |
| Field Independence | 92.249 | 1 | 92.249 | 9.482 | 0.002 |
| Error | 2013.935 | 207 | 9.729 | | |

**Panel B: Treatment Means**

| | | *Means* | *n* |
|---|---|---|---|
| Presentation Format: | Graphs | 16.161 | 112 |
| | Tables | 56.200 | 100 |
| Experience: | Practitioner | 30.730 | 82 |
| | Student | 37.770 | 130 |

## 5.0 DISCUSSION

In this study, consistent with the Theory of Cognitive Fit (Vessey 1991), participants using graphs were shown to perform significantly better both in assessing correlations and in making predictions during analytical review of the sales account. This performance advantage was found across experience levels for students and auditors. This finding contributes to the research in analytical procedures by showing that student "surrogate" participants as well as practitioners are aided with graphs. However, the study finds some evidence that inexperienced student participants are helped more with graphs than are practitioners via the significant interaction of presentation format and experience in the correlation assessment task. While both students and audit practitioners were aided with graphs in assessing correlations, students were aided relatively *more* than were practitioners. This interaction is consistent with the suggestion by Schulz and Booth (1995) that their results (no performance advantage for auditors with graphs) may have been influenced by prior experience that practitioners have with tables. For the task of predicting sales, however, the interaction of presentation format and experience was not significant for the present study, perhaps because this second task required far less work with tabular information as compared to the first task of correlation assessments. Auditors' experience with tables would not be as relevant in tasks requiring less work with tabular information.

The results of this study have methodological implications for future research. First, the interaction of experience with format of presentation suggests that when students are used as "surrogates" for practitioners, results need to be interpreted with caution. Specifically, in this study, where tabular information was most extensively used (i.e., in the task of correlation assessment), the performance advantage of using graphs was not as great for practitioners as for students, perhaps because of the experience practitioners may possess with the use of tables. Studies finding a performance advantage with graphs, where students are used as surrogates, may therefore want to

exercise caution in generalizing the results to implications for practice. Second, the consistent finding of a performance advantage with graphs is a validation of the methodology and results of Anderson and Reckers (1992), incorporating varied levels of experience. This validation is important given the relatively weak results for graphs over tables found in the more recent study by Schulz and Booth (1995).

We believe that the results of the study also have implications for practice. Firms continuously invest in their technology and methodology to improve the effectiveness and efficiency of their audits. During the process of developing or selecting decision aids, electronic workpapers, and the like, firms should consider the data presentation format that would provide the most familiarity for the level of auditor performing the analytical review task. (Or, perhaps options for format should be presented such that auditors with varying levels of experience with tabular data, i.e. staff versus managers, may select the most familiar format.) Firms might also consider what type of training might be necessary for their auditors, particularly when implementing new technology/methodology, such that it would provide the greatest advantage to all auditors.

## 6.0 SUGGESTIONS FOR FUTURE RESEARCH

Avenues for future research include investigating additional aspects of the task environment, such as the volume of data presented and other forms of presentation. Future research might also consider the interactive effect of presentation format and experience on other auditor judgments. Finally, we considered only one type of individual difference in cognitive style (field independence/dependence). Future research might investigate additional aspects of personality and individual differences in cognitive style, as some forms of presentation are likely better for particular types of individuals.

*We gratefully acknowledge the support of the KPMG Peat Marwick Research Opportunities in Auditing Program.*

## ENDNOTES

1. In Schulz and Booth (1995), when a statistical regression model was used to derive the benchmark, no significant performance advantage was achieved by participants using graphs. This finding may have been attributable to the manner in which the regression-based benchmark was derived. Participants were given eight items of data for 60 periods, but multiple regression was not used to build the model to be used as the dependent measure. Instead, only one of the variables, budgeted sales, was used in univariate regression. Because participants might have incorporated any or all of the eight variables, perhaps a different normative value would have been derived from the inclusion of the corresponding variables, using multiple regression.
2. Consistent with Anderson and Reckers (1992).
3. Although we were not particularly interested in the effects of experience on this task overall, the ANCOVA shows a marginally significant *(*p=.078) performance advantage for practitioners, regardless of data presentation format.

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**NOTES**

**ENDNOTES**

1. In Schulz and Booth (1995), when a statistical regression model was used to derive the benchmark, no significant performance advantage was achieved by participants using graphs. This finding may have been attributable to the manner in which the regression-based benchmark was derived. Participants were given eight items of data for 60 periods, but multiple regression was not used to build the model to be used as the dependent measure. Instead, only one of the variables, budgeted sales, was used in univariate regression. Because participants might have incorporated any or all of the eight variables, perhaps a different normative value would have been derived from the inclusion of the corresponding variables, using multiple regression.
2. Consistent with Anderson and Reckers (1992).
3. Although we were not particularly interested in the effects of experience on this task overall, the ANCOVA shows a marginally significant *(*p=.078) performance advantage for practitioners, regardless of data presentation format.