

Comparing the Outcomes of Nominal Group, Round Robin and Open Discussion Fraud Brainstorming

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ABSTRACT: The current study examines the relative effectiveness of three brainstorming techniques (nominal group, round robin and open discussion) via a between-participant field experiment involving 150 audit clients and 2,614 auditors who participated in natural, hierarchical audit teams. The results indicate that nominal group and round robin brainstorming resulted in equivalent numbers of unique fraud risks and comparable increases in planned audit hours, while open discussion brainstorming yielded the least number of unique ideas and the smallest increase in planned audit hours. Furthermore, nominal group and round robin brainstorming resulted in more changes/additions to the nature and timing of substantive testing than open discussion brainstorming. In this study, nominal group and round robin brainstorming were equally effective, and open discussion brainstorming was least effective.

Keywords: *SAS 99, fraud, brainstorming, nominal group, round robin, open discussion, auditing, field experiment*

Data Availability: *Requests for data need to be specific as to the intended use and must be approved by the participating CPA firm.*

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I. INTRODUCTION

SAS No. 99 (AICPA 2002) requires audit teams to conduct a brainstorming session during audit planning to identify areas in which management could perpetrate and conceal fraud that might potentially lead to material misstatements. The Public Company Accounting Oversight Board (PCAOB 2007) recently emphasized the importance of the brainstorming standard and criticized audit firms for not always complying with the requirements.¹ SAS No. 99 (AICPA 2002) allows firms discretion with respect to the precise technique they employ for a brainstorming session, as the standard merely states “the discussion ordinarily should involve the key members of the audit team” and “a number of factors will influence the extent of the discussion and how it should occur” (AU 316.17). Most firms appear to have adopted the *open discussion* brainstorming technique, wherein audit team members exchange ideas in a relatively unstructured manner (Bellovary and Johnstone 2007). However, many psychology studies question the effectiveness of open discussion brainstorming, as this technique is associated with multiple sources of process losses (e.g., production blocking, free-riding and evaluation apprehension) that often overwhelm process gains (see Diehl and Stroebe 1987, 1991 for reviews).

Psychology research typically assesses the effectiveness of open discussion brainstorming by comparing the number and quality of ideas generated to *nominal group* outcomes. In a nominal group setting, members brainstorm individually and record all of their ideas, the composite list of which reflects the collective set of unique ideas generated by the

¹ The PCAOB has recently criticized audit firms for (1) not being able to demonstrate that brainstorming sessions were actually held, (2) holding brainstorming sessions too late (i.e., after planning and after substantial testing had begun), and (3) not always involving all levels of auditor ranks in the brainstorming team.

nominal group. Authoritative guidance in auditing does not support the nominal group technique, as this form of brainstorming does not involve *discussion*, which is explicitly mentioned in SAS No. 99; however, the outcomes of nominal groups provide an important benchmark against which to compare the efficacy of other brainstorming techniques that involve some form of discussion.

In the context of fraud brainstorming, Carpenter (2007) conducted a laboratory experiment using experienced auditors. Consistent with most brainstorming research in psychology, she found that open discussion fraud brainstorming resulted in a lower number of fraud risk ideas than nominal group brainstorming; however, contrary to most psychology studies, she reported that the quality of the ideas (and related fraud risk assessments) were greater with open discussion than nominal group brainstorming. Given the relative paucity of auditing studies examining the open discussion and nominal group techniques, our first research objective is to compare the effectiveness of these two techniques in a field setting with actual audit teams and real clients.

In their practitioner guidance, Beasley and Jenkins (2003) suggested another interactive brainstorming technique, which they label *round robin* brainstorming. During round robin brainstorming, team members share their ideas in a more structured manner than during open discussion brainstorming; that is, all members are required to express all their fraud risk ideas sequentially to the rest of the team. Round robin brainstorming can potentially eliminate some of the process losses inherent with open discussion, and ultimately lead to improved effectiveness. To our knowledge, no prior research in psychology or auditing has examined the round robin technique. Therefore, our second research objective is to investigate, in a field setting, the

relative effectiveness of round robin brainstorming, as compared to the open discussion and nominal group techniques.²

Managers at the national office of a large international CPA firm randomly selected 150 U.S. offices to participate in a field experiment, randomly assigned each office to one of the three brainstorming techniques, and set forth a standardized protocol for how to conduct each technique. At the local level, the office managing partner randomly selected one audit client, subject to client characteristic constraints imposed by the national office.³

Team members in all three treatment conditions were asked to sit alone, think about the client and write down all of the fraud risks they could envision. Open discussion team members spent less time and recorded fewer fraud risks in this preparatory brainstorming stage than nominal group and round robin team members. The number of unique fraud risks recorded at the interaction stage was greater than the initial set for the *round robin* teams, suggesting that process gains outweighed process losses, but smaller for the *open discussion* teams, suggesting the opposite. After brainstorming was completed, the nominal group and round robin techniques resulted in equivalent numbers of unique fraud risk ideas and similar increases in planned audit hours, while open discussion brainstorming yielded the lowest number of unique ideas and the smallest increase in planned audit hours. Furthermore, the nominal group and round robin techniques triggered more changes/additions to the nature and timing of substantive testing than open discussion brainstorming. Overall, study results indicate that the nominal group and round

² The impetus for the current study began with top-level CPA firm managers, who read the Beasley and Jenkins (2003) article and wanted to compare their existing brainstorming technique (open discussion) to the round robin brainstorming technique. The researchers further suggested that these techniques should be compared to nominal group brainstorming, which would serve as a benchmark.

³ The assignment of 150 offices was truly randomly selected (using a random number generator) from the firm's entire set of U.S. offices and the assignment of treatments to the selected offices was also truly randomly selected. Also, the selection of one client at each local office was truly random, however the population of clients from which one client was randomly selected was constrained by the national office, as described in the Research Method section.

robin techniques are similarly effective, and the open discussion brainstorming technique is least effective.

This study contributes to the auditing and fraud literature by conducting an experiment in a contextually rich field environment involving real clients and actual fraud brainstorming sessions among hierarchical audit teams; examining the round robin technique of fraud brainstorming, which to our knowledge has not been subjected to rigorous empirical examination in prior research; and comparing several outcomes of brainstorming (preparation time, number of unique ideas generated, changes in audit plan hours, and changes/additions to the nature, timing and extent of substantive testing). The next section describes the SAS No. 99 brainstorming procedure, reviews prior research, and develops hypotheses. Subsequent sections present the research method, analyze the results, and discuss the findings.

II. BACKGROUND AND HYPOTHESES

SAS No. 99 and the Brainstorming Procedure

In 2002, the Auditing Standards Board issued SAS No. 99 “Consideration of Fraud in a Financial Statement Audit” because standard setters believed that auditors needed additional guidance to improve fraud detection throughout an engagement. The major difference between SAS No. 99 and its predecessor, SAS No. 82 (AICPA 1997), is that the new standard requires the audit team to discuss the potential for material misstatement in the financial statements due to fraud before and during the evidence-gathering process (Ramos 2003). The purpose of fraud brainstorming is to establish a forum for audit team members to share experiences about the client, discuss how fraud might be perpetrated and concealed at the entity, and change audit procedures to improve fraud detection if necessary. The brainstorming requirement is based on

the assumption that collecting ideas from audit team members at varying rank and experience levels will result in effective fraud risk assessment and detection.

Based on Bellovary and Johnstone (2007) and Beasley and Jenkins (2003), the typical fraud brainstorming procedure can be summarized as follows: In the preparation stage, auditors are asked to develop an initial set of potential fraud risks individually, without speaking to each other. During this stage, auditors are guided to think about the client with reference to the fraud triangle (opportunities, incentive, and rationalizations/attitude) (AICPA 2002). This preparatory activity is known as *nominal brainstorming*, as there is no communication among team members during this stage. In the current study, the nominal brainstorming teams would move to the evaluation stage (below)⁴, while the open discussion and round robin teams would participate in the interaction stage, as described next.

Relevant to the current study, two forms of the interaction stage are described—*open discussion brainstorming* or *round robin brainstorming* (Beasley and Jenkins 2003).^{5, 6} During open discussion brainstorming, auditors discuss their fraud risk ideas in an unstructured manner. The rationale behind this technique is that team members should be able to express all ideas that come to their mind, “in a kind of free-for-all” (p. 36) and with as little interruption as possible (Beasley and Jenkins 2003). The other interactive technique examined in this study is round robin brainstorming, reflecting a structured sharing of ideas where each team member is called

⁴ SAS No. 99 does not support nominal group brainstorming alone, as this technique does not meet the criterion of a ‘discussion’; however, outcomes of individual auditor deliberations (i.e., nominal groups) provide an important benchmark against which to compare the relative efficacy of open discussion and round robin brainstorming.

⁵ Beasley and Jenkins (2003) discuss a third interaction technique – electronic brainstorming – which essentially reflects open discussion brainstorming via electronic groupware.

⁶ Beasley and Jenkins (2003) recommend a procedure for open discussion brainstorming that deviates somewhat from most brainstorming experiments in psychology; that is, they suggest that the interaction stage take place subsequent to nominal brainstorming activity, whereas most open discussion brainstorming experiments in psychology do not include pre-interaction nominal brainstorming activity. In the current study, the CPA firm desired to mirror the procedures suggested by Beasley and Jenkins (2003) to the extent possible; hence, participating auditors in the round robin and open discussion treatments engaged in nominal deliberation prior to interaction.

on one at a time to read his/her ideas to the rest of the group. After the first round of idea sharing, each team member is afforded a second opportunity to express additional ideas that might have come to mind while listening to the other members' first-round ideas.

The third and final brainstorming phase reflects the evaluation stage, which entails the development of fraud risk assessments on the basis of ideas identified in the first two stages and response to the fraud risk assessments, which may or may not result in a modification of the nature, timing, and extent of planned audit procedures. While preliminary audit planning prior to the brainstorming session may have already resulted in a number of anticipated fraud detection tests, the purpose of the evaluation stage is to potentially adjust the preliminary audit plan on the basis of new ideas generated during brainstorming—ideas that had not been impounded into the preliminary plan. We next offer a brief review of extant research on brainstorming in psychology and auditing.⁷

Brainstorming Research

Typical brainstorming experiments in psychology assess the effectiveness of open discussion brainstorming by comparing the outcomes of this technique to those of nominal group brainstorming, as reviewed next.

Open Discussion Brainstorming

Originally conceived by Osborn (1957), open discussion brainstorming should be conducted using the following four principles: (1) criticism is limited, (2) coming up with “wild” ideas is welcomed (“freewheeling”), (3) a great number of ideas is wanted, and (4) combination

⁷ It is important to note that selection and examination of the open discussion and round robin techniques in this study was motivated by top-level CPA firm managers on the basis of their reading the Beasley and Jenkins (2003) article. Once the CPA firm contacted the researchers about studying these two techniques in a scientifically rigorous and methodical manner, we requested the addition of nominal group technique as a benchmark comparison.

and improvement of mentioned ideas is sought. As a result, open discussion brainstorming is a technique that involves a limited degree of structure and maximum interaction among team members, such that immediate feedback to new ideas is sought. Open discussion brainstorming is often intuitively assumed to result in a larger number of high-quality ideas than nominal group efforts because it supposedly enhances team members' creativity and spontaneity. Furthermore, other team members' ideas are supposed to trigger associations that would not come to mind during nominal deliberation (Paulus et al. 2000).

Despite the many potential process gains supposedly associated with open discussion brainstorming and the frequent use of this technique for SAS No. 99 fraud brainstorming (Bellovary and Johnstone 2007), most research has found that open discussion groups are less productive (i.e., generate fewer and lower quality ideas) than nominal groups (e.g., Diehl and Stroebe 1987, 1991, Mullen et al. 1991, Paulus et al. 1995, Rietzschel et al. 2006). Three major explanations have been offered to account for the failure of open discussion brainstorming groups to reach greater productivity levels than nominal groups (see Diehl and Stroebe 1987). First, in open discussion brainstorming groups, only one member can speak at a time, which may cause other members to forget or suppress their ideas because they are not allowed to verbalize them as they come to mind—a phenomenon known as *production blocking* (e.g., Brown and Paulus 2002, Nijstad and Stroebe 2006). Second, *evaluation apprehension* means that open discussion brainstorming members may refrain from voicing their ideas because they are afraid of negative evaluations from their peers and superiors (e.g., VanGundy 1983). Third, the open discussion brainstorming technique can dampen individual team members' motivation to exert maximal effort by relying on other team members—a phenomenon known as *free riding* or *social loafing* (e.g., Karau and Williams 1993, Shepperd 1993).

A possible fourth explanation for the failure of open discussion brainstorming to produce high numbers of unique ideas is an interacting group's tendency to focus on only a few lines of thought in one subcategory (Dennis et al. 1999, Lamm and Trommsdorf 1973), as the discussion format stimulates immediate feedback toward uttered ideas. This tendency of 'cognitive narrowing' has been found to hinder brainstorming groups from developing an exhaustive consideration of ideas (Dennis and Valacich 1994). Related to this notion is the concept of 'common information sampling bias', where interacting groups are more likely to discuss information that is already known by all members (i.e., commonly-held information), less likely to discuss information that is known by some, but not all, members (partially-held information) and least likely to discuss information that is known by only one group member (i.e., uniquely-held information) (e.g., Hunton 2001, Stasser and Titus 1985). In contrast, none of the described process losses are inherent with nominal group brainstorming.

To our knowledge, only one published study in auditing has compared the open discussion and nominal group techniques in the context of fraud brainstorming. Carpenter (2007) conducted a two-phase lab experiment wherein 120 auditors (40 three-person, experimentally assigned, hierarchical teams) responded to a case scenario. In the first phase, participating auditors engaged in nominal group brainstorming, where they were familiarized with case materials, and asked to think about and document possible fraud risks. In the second phase of the experiment, auditors participated in face-to-face brainstorming groups and were instructed to brainstorm and list fraud risks. Carpenter compared auditors' fraud ideas and fraud risk assessments before and after the open discussion brainstorming session. Consistent with many studies in psychology, she found that open group discussion resulted in a smaller quantity of ideas; however, contrary to most psychology research of this nature, Carpenter found that open

discussion led to higher quality fraud ideas. The author suggests that the hierarchical and professional nature of audit teams creates synergies and process gains not present in student teams commonly employed in psychology studies.

Round Robin Brainstorming

The current study considers a second interactive brainstorming technique—round robin. While examined to a far lesser extent in prior research than open discussion brainstorming, Beasley and Jenkins (2003) suggest that round robin brainstorming might eliminate some of the process losses often found in open discussion brainstorming, because members are called on and take turns reading their ideas out loud during the fraud brainstorming meeting. The inherent structure of this technique forces all members to contribute to idea generation, thus considerably dampening the free-riding potential; furthermore, the round robin technique prohibits immediate discussion of ideas, hence cognitive narrowing and the common information sampling bias are eliminated because team members do not become entrapped into spending excessive meeting time on a limited number of ideas (Beasley and Jenkins 2003, Van de Ven and Delbecq 1971).

In addition, round robin brainstorming is potentially superior to nominal group brainstorming, because each team member is afforded a second opportunity to add new ideas that might have come to mind while listening to the first-round ideas. These considerations suggest that round robin brainstorming has the potential of leading to improved efficacy relative to either open discussion or nominal group brainstorming.

Some research evidence on idea generation in groups supports this notion. In their review of nine studies conducted in the 1970s and 1980s, Hegedus and Rasmussen (1986) conclude that an interaction format conceptually very similar to Beasley and Jenkins' (2003) notion of round robin brainstorming (“modified nominal group technique”) is superior to a technique comparable

to open discussion brainstorming (“unstructured group work”). However, on whole, nominal group brainstorming (“pooled individual efforts”) appears to remain the most effective technique for generating ideas (Hegedus and Rasmussen 1986).

More recently, Paulus and Yang (2000) tested the effectiveness of brainwriting, a technique similar to round robin brainstorming. In brainwriting, team members share their ideas sequentially on multiple pieces of paper, which are passed around, read and complemented by the next members. Paulus and Yang (2000) found that brainwriting produced even more ideas than the nominal technique, and suggested a cognitive and a social explanation for their result: First, the sequential exposure to others’ ideas cognitively stimulate idea generation, and second, the sense of competition induced by knowledge sharing of this nature creates social pressure to continue generating more ideas.

In summary, the round robin technique holds the potential to reduce some of the process losses inherent with open discussion brainstorming by offering all members the opportunity to contribute their ideas in a structured manner. With few exceptions (e.g., Paulus and Yang 2000) though, nominal group brainstorming appears to be superior to both open discussion and round robin brainstorming (see Hedegus and Rasmussen 1986). Whereas Beasley and Jenkins (2003) suggested round robin as a realistic alternative to open discussion brainstorming, to our knowledge, audit research has not yet considered the outcomes of the round robin technique in the context of fraud brainstorming. Furthermore, it appears as though this technique is not commonly being used in audit practice (Bellovary and Johnstone 2007), despite its potential to provide benefits superior to open discussion brainstorming.

Hypothesis Development

The current study considers three dimensions of brainstorming outcomes. First, we examine the time spent in the preparation stage, during which auditors brainstorm individually in a nominal manner. Second, we measure the number of unique fraud risks identified during the preparation stage and the interactive stage. Third, we investigate the extent to which fraud brainstorming results in adjustments to preliminary audit plans during the evaluation stage.⁸

Preparation stage

The audit teams in this study engage in a preparation stage, during which they contemplate individually about potential fraud risks (Beasley and Jenkins 2003, Bellovary and Johnstone 2007). We expect that auditors who know they will participate in subsequent open discussion brainstorming will likely spend less time on this preparatory activity and, as a result, identify fewer unique fraud risks, relative to nominal group brainstorming and round robin brainstorming auditors. While we are not aware of prior research evidence directly supporting a prediction in this regard, the concept of ‘free riding’ (see Diehl and Stroebe 1987) provides a potential theoretical explanation. That is, some auditors anticipating an open discussion might be less motivated to spend substantial preparatory time on the task of generating fraud risk ideas because they know that they can freely ride on others’ preparatory efforts during the upcoming discussion. Furthermore, the prospect of open discussion might motivate some auditors to postpone idea generation to the interaction stage, as they anticipate developing fraud risk ideas as the discussion unfolds.

On the other hand, auditors who are engaged in nominal group brainstorming (only) are aware there will be no subsequent opportunity to discuss potential fraud risks with members of

⁸ The brainstorming outcome variables reported herein are the only data the CPA firm will allow to be reported.

the brainstorming team, thus they are aware that all of their efforts must be focused on the preparation stage. Also, free riding cannot exist with nominal group brainstorming.

Finally, auditors who know that they will be involved in round robin brainstorming understand that they will be asked to express all of their fraud risk ideas to the group. Since the team members do not know *a priori* when (in what order) they will be called on to express their ideas, the likelihood of free riding is lower than in open discussion, although it cannot be ruled out entirely. Furthermore, the unknown order of turn-taking does not allow auditors to postpone idea generation to the interactive stage (as could be the case in open discussion).

As a result, auditors who are participating in nominal or round robin brainstorming are more motivated to spend a significant amount of time preparing for the interaction stage, relative to open discussion brainstorming participants. Consequently, one can also expect that the number of unique fraud risks will be relatively higher for auditors expecting to participate in nominal or round robin brainstorming, as compared to open discussion brainstorming participants.⁹

Accordingly, we offer the first two hypotheses:

- H1:** Auditors in the open discussion brainstorming group will spend less time in the preparation stage than auditors in the nominal brainstorming or round robin brainstorming groups.
- H2:** During the preparation stage, auditors in the open discussion brainstorming group will generate a lower number of unique fraud risks than auditors in the nominal brainstorming or round robin brainstorming groups.

⁹ Theoretically, there is no reason to expect that nominal group brainstorming participants are motivated to spend more or less time or generate more or less unique fraud ideas during the preparation stage than round robin brainstorming participants, or vice versa, as participants in both techniques are motivated to expend considerable time and effort in this stage.

Interaction stage

The next stage in the brainstorming procedure for open discussion and round robin brainstorming involves interaction among audit team members. Regarding open discussion brainstorming, prior research in psychology and auditing has generally found that the act of open discussion brainstorming results in fewer unique ideas than nominal group brainstorming (Carpenter 2007, Diehl and Stroebe 1987, 1991, Mullen et al. 1991, Paulus et al. 1995, Rietzschel et al. 2006). We similarly expect that an open discussion brainstorming session will further reduce the (already limited) set of unique fraud risks identified during the preparation stage, because some auditors may fail to voice their ideas, due to the following process losses: They may forget or suppress their ideas while others talk (production blocking, e.g., Brown and Paulus 2002, Nijstad and Stroebe 2006), feel uncomfortable voicing their ideas in the presence of others (evaluation apprehension, e.g., VanGundy 1983), use the potential of free riding on others' efforts (e.g., Karau and Williams 1993, Shepperd 1993), focus the discussion on a reduced set of ideas because of the potential for immediate feedback (cognitive narrowing, Dennis et al. 1999, Lamm and Trommsdorf 1973) and/or be less likely to disclose partially-held and uniquely-held ideas as compared to commonly-held ideas (common information sampling bias, e.g., Hunton 2001, Stasser and Titus 1985).

H3a: The number of unique fraud risks identified during the interaction stage of open discussion brainstorming will be smaller than the initial set of ideas generated during the preparation stage.

On the other hand, we expect that auditors engaging in round robin brainstorming will increase the initial set of fraud risks during the interaction stage. Recall that the round robin technique involves a structured second-round of idea sharing, wherein team members can

express further ideas that might have come to mind as they listened to the first-round ideas. Due to the idea stimulation potential of the second round, we predict the following hypothesis:

H3b: The number of unique fraud risks identified during the interaction stage of round robin brainstorming will be greater than the initial set of ideas generated during the preparation stage.

Comparing the number of unique fraud risks that will be available in the evaluation stage (post-interaction for open discussion and round robin brainstorming, and post-preparation for nominal group brainstorming), we expect that open discussion brainstorming will result in the lowest number of unique fraud risks because of (1) reduced time and effort spent on the preparatory stage (see H1 and H2) and (2) process losses during the interaction stage (see H3a). Nominal groups should generate a greater number of ideas than the open discussion technique, but fewer ideas than the round robin technique, because nominal groups are not given the opportunity of additional idea stimulation in a structured interactive setting. Round robin brainstorming should lead to the greatest number of fraud risks, due to (1) greater time and effort spent on nominal deliberation during the preparation stage (see H1 and H2) and (2) the potential of additional idea stimulation during the second round of the interaction stage (see H3b). Accordingly, we offer our fourth hypothesis.

H4: The number of unique fraud risks available during the evaluation stage will be ordered as follows: Round Robin > Nominal Group > Open discussion.

Evaluation stage

The third and final stage of fraud brainstorming reflects evaluation, during which the audit team determines whether the fraud risks identified during brainstorming warrant a modification of the nature, timing, and extent of planned audit procedures. For purposes of this

study, we examine several aspects of audit plan adjustments: increases in planned audit hours and changes in the nature, timing and extent of substantive tests. The preliminary audit plans already impounded some fraud detection tests, based on the experience and knowledge of the audit partner and in-charge manager who developed the plans. Thus, any changes to the preliminary audit plans would be based on unique fraud risk ideas that arose during brainstorming that had not already been incorporated into the preliminary (pre-brainstorming) plans.

Research on the common information sampling bias (e.g., Hunton 2001, Stasser and Titus 1985) suggests that unstructured discussions are most likely to reveal information that is already known by all members (commonly-held information), less likely to reveal information that is held by some members (partially-held information) and least likely to reveal information that is known by only one member (uniquely-held information). We expect that auditors in an open discussion brainstorming group will exhibit a discussion bias toward ideas that are already reflected in the preliminary audit plan, because these ideas likely constitute commonly-held or partially-held information. Even though uniquely-held ideas could form the basis for effective audit plan modifications, they may not arise during open group discussion because the group can become cognitively narrowed by the common information sampling bias. Given the already reduced set of unique fraud ideas arising from the preparation and interaction stages, we expect that open discussion brainstorming will result in the lowest number of audit plan adjustments.

By their procedural nature, nominal group and round robin brainstorming are not threatened by the common information sampling bias; hence, these techniques are expected to result in greater audit plan adjustments than open discussion. Given our expectation that round robin brainstorming will result in a greater number of unique fraud risks than nominal group

brainstorming (H4), we predict that audit plan adjustments will similarly be greater for round robin as compared to nominal group brainstorming. Accordingly, we offer the final hypothesis.

H5: The extent of audit plan adjustments will be ordered as follows:

Round Robin > Nominal Group > Open discussion.

III. RESEARCH METHOD

Design

The current study was conducted at the request of a large audit firm. Management of the firm was interested in finding the most effective method of fraud brainstorming. After discussing many approaches with the researchers, the firm decided to compare the relative effectiveness of nominal group, round robin and open discussion brainstorming.¹⁰

Managing partners at the national level of the CPA firm used a random method to select 150 offices from among the entire set of all U.S. offices to participate in the study and randomly assigned each local office to one of three treatment conditions (nominal group, round robin or open discussion brainstorming). At each local office, the managing partner randomly selected one client,¹¹ subject to the following criteria imposed at the national level: the clients must be in the retail, manufacturing and service industries; only clients with a December 31, 2007 fiscal year-end would be considered (so that the fraud brainstorming activities could take place at about the same time in early 2008); only publicly listed companies would be included, and only firms with gross revenues less than \$1 billion would be allowed.¹² Fifty of the randomly selected

¹⁰ As with any field experiment, the researchers are limited by management in many ways, such as the precise independent variables to examine, the types of dependent variables to analyze, sample selection procedures, and so on.

¹¹ The managing partners involved in selecting offices and clients for inclusion in the study were not part of the audit teams examined in the current study.

¹² Due to privacy and confidentiality, the firm will not provide further data regarding the total number of offices in the U.S. or across the globe, or the total number of potential clients included in the sampling frame at each office location.

offices conducted fraud risk brainstorming sessions using open discussion, 50 offices used the nominal group technique and the remaining 50 used the round robin technique.

Procedure

The fraud brainstorming process described herein took place during the preliminary planning phase of the audit (before substantive testing had begun). The study began immediately after key members of the audit team had discussed the upcoming audit with the client, performed analytical procedures, reviewed the prior year audit work papers, and established a preliminary audit plan. The audit partner for each client involved in the study sent a guidance memorandum to select members of the audit team explaining how fraud brainstorming would take place for the client.¹³ The guidance memorandum was crafted at firm headquarters and was standardized for all auditors within each of the treatment conditions.¹⁴

The guidance conveyed the following information that was common to all treatments: the memorandum asked the auditors to consider potential fraud risks in the context of guidance provided by SAS No. 99, the fraud triangle, and firm policies and procedures related to fraud detection and prevention (all of which were described in the memorandum); every member of the brainstorming teams was asked to sit alone, think about fraud risks related to the client and write-down as many fraud risks as they could identify; the memorandum asked the auditors to keep track of the number of minutes they spent considering and documenting potential fraud risks during this preparatory stage; finally, each team member was asked to submit their time along with their list of fraud risks to a designated administrative assistant at the local office. In addition

¹³ Brainstorming team members were judgmentally selected by the audit partner and in-charge audit manager on each engagement and consisted of members at all ranks (staff, senior, manager, partner), thus constituting a typical hierarchical audit team.

¹⁴ The audit firm will not allow the researchers to publish the guidance memorandum since it includes firm-specific guidance, policies and procedures.

to the common instructions, treatment groups were provided with the following specific information.

Nominal Groups

Nominal group members were told that fraud brainstorming would be conducted using a technique called nominal group. This was generally explained as a technique where each team member is asked to sit alone and think about potential fraud risks related to the client, as explained in the common guidance. Team members were made aware that there would not be a meeting of the entire team (face-to-face or electronically), and that their lists of fraud risks would be the only means by which they could convey their risks to the audit partner and in-charge manager. They were also made aware that their lists would be specifically identifiable to them by the partner and in-charge manager.

Round Robin

Round robin team members were told that fraud brainstorming would be conducted using a technique called round robin brainstorming. In addition to the common instructions, the guidance further conveyed the following: there would be a face-to-face brainstorming meeting where each person would read from his/her list of fraud risks while the others listened; following this first round of idea sharing, there would be a second round-robin opportunity for each auditor to mention any additional risks he/she might have thought of during the first-round, while the others listened. It was made clear that there would be no unstructured open discussion during the brainstorming meeting and, obviously, there was no anonymity. An administrative assistant who was not privy to the initial brainstorming lists was assigned to each brainstorming group. The administrative assistant's task was to attend the face-to-face meeting and write down all of the brainstorming ideas that were mentioned during the meeting.

Open Discussion

Open discussion team members were told that fraud brainstorming would be conducted via open discussion.¹⁵ The memorandum explained that there would be a face-to-face brainstorming meeting where the team would openly discuss the clients' potential fraud risks, thereby precluding the possibility of anonymity. An administrative assistant who was not privy to the initial brainstorming lists was assigned to each brainstorming group. The administrative assistant's task was to attend the face-to-face meeting and write down all of the brainstorming ideas that were mentioned during the meeting.

Dependent Measures

First, the current study assesses the mean number of minutes that auditors on the brainstorming team spent individually thinking about and documenting fraud risks (preparation stage). The second and third dependent measures consist of the total number of unique fraud risks identified during the preparation stage (all three treatment conditions) and after the interaction stage (open discussion and round robin conditions). Recall, an administrative assistant at each local office received the time spent and the initial set of fraud risks from the team members (preparation stage), and a different administrative assistant recorded fraud risks that arose during the round robin and open discussion meetings (interaction stage).

In the nominal group treatment, the audit partner and in-charge manager for each client reduced the individual team members' lists of fraud risks to a composite set of unique risks. They used the composite set of risks as the basis for modifying the preliminary audit plan. In the other two conditions, audit partner and in-charge manager for each client reduced the meeting

¹⁵ Open discussion was the usual fraud brainstorming technique used at the firm; however, typical open discussion brainstorming at the firm was not preceded by a nominal activity and did not include the recording of the number of minutes they spent considering and documenting potential fraud risks prior to the meeting, as is the case with the experimental open discussion technique.

notes to a set of unique risks, which was used as the basis for modifying the preliminary plan. The purpose of not exposing the partner and manager to the initial lists generated by team members (in the round robin and open discussion treatments) was to remain consistent with the firm's extant procedure of taking notes during fraud brainstorming meetings, and using such notes to identify and evaluate unique fraud risks post-interaction.¹⁶

The fourth dependent variable, percentage increase in planned audit hours, is calculated as follows: number of additional planned audit hours due to identified fraud risks (i.e., after the complete brainstorming process) divided by the total number of planned audit hours before the brainstorming process (i.e., before the preparation stage).¹⁷ The audit firm provided three additional audit plan-related variables, each focusing on a different aspect of substantive testing. To compute these metrics, the audit partner and in-charge manager counted the number of substantive test changes/additions to the preliminary audit plan that were directly related to fraud brainstorming. Each affected substantive test was analyzed and categorized as a change in the nature, extent or timing of testing.

IV. RESULTS

Participants, Clients and Groups

Table 1 includes descriptive statistics regarding the study participants (panel A), selected clients (panel B) and group sizes (panel C). As shown in panel A, there were 2,614 auditor

¹⁶ Once the preliminary audit plan was adjusted based on the unique ideas arising from meeting notes in the open discussion and round robin treatments, the audit partner and in-charge manager were provided with the initial lists of fraud risks (preparation stage) and they reduced the lists to a composite set of unique risks, as had been done in the nominal group condition. They were then afforded an opportunity to further change the (already revised) preliminary audit plan based on additional unique risks that arose from the preparation stage. As will be shown in the results section, there were fewer unique risks arising from the preparation stage relative to the interaction stage in the round robin condition, thus the revised preliminary plans were not further modified. However, there were more unique risks arising from the preparation stage in the open discussion treatment relative to the interaction stage, and the (already revised) preliminary audit plans were further modified. Statistical analyses of the additional audit plan modifications were non-significant; thus the results were qualitatively and inferentially unchanged.

¹⁷ The audit firm would not allow the researchers to have access to the number of audit hours involved.

participants, of which there were 150 audit partners (one partner per selected client).¹⁸ The mean years auditing the selected clients was about nine, the mean total client revenues were around one-half billion dollars (panel B), and the mean number of brainstorming participants in each treatment condition was about 17 (panel C).

[Insert Table 1 about here]

Dependent Variables

Shown on Table 2 are means and standard deviations for the time spent on the preparation stage (panel A), the number of unique fraud risks identified during brainstorming (panel B) and preliminary audit plan adjustments following the brainstorming process (panel C). All variables were divided by the same constant, which was selected by the audit firm and is unknown to the researchers. The constant reflects a number between 1.1 and 1.9. The audit firm divided the metrics by a constant for competitive and legal reasons.

[Insert Table 2 about here]

Preliminary Testing

Manipulation Checks

After the fraud brainstorming process was completed, the national partner at firm headquarters who coordinated the field experiment sent an email to all participating auditors asking two manipulation check items. One manipulation check asked all respondents which fraud brainstorming technique they used for the selected client (nominal group, round robin or

¹⁸ Participating auditors were unaware that there were other treatments being tested at other offices. However, they were likely aware that the firm was testing a procedural change related to brainstorming since one client in their office was being treated differently from the others. This would be the case even with the open discussion brainstorming treatment, as the auditors received a firm memorandum regarding the selected client that was procedurally different from the existing open discussion process for all other clients in the office.

open discussion brainstorming). All participants answered correctly in accordance with their treatment condition.

The second question asked the auditors to respond to the following statement: “I believe that the fraud risks I provided to the brainstorming team could not be specifically identified to me; meaning, my fraud risks were anonymous” (1 = strongly disagree, 4 = not sure, 9 = strongly agree). The mean (standard deviation) response across all three treatment conditions was 1.11 (0.39). An ANOVA analysis indicated a significant difference among the treatment means ($F = 14.41, p < .01$). Further pairwise testing (Bonferroni, $\alpha = .01$) indicated that the nominal group mean (standard deviation) of 1.34 (.063) was significantly greater than the round robin mean (standard deviation) of 1.00 (0.00) or the open discussion mean of 1.00 (0.00), the latter two which are not significantly different from each other. The likely reason for a small absolute difference in the nominal group was that the auditors in this condition sent their lists to an administrative assistant at the local office, who eventually forwarded the lists to the partner and in-charge manager; hence, there was likely some uncertainty whether the partner and in-charge manager could link the lists to the submitting auditors.

Potential Covariates

The following covariates were included in all MANCOVA and ANCOVA models reported herein: perceived anonymity, brainstorming team size, mean age of the brainstorming team, mean years experience of the brainstorming team, number of years auditing the client, total revenues of the client, percent female auditors on the brainstorming team and client industry.

Hypothesis Testing

The results of statistical analyses on the dependent variables are shown on Table 3. The multiple pairwise comparisons reflect both Bonferroni and Scheffe testing, both of which agreed in all instances ($\alpha = .05$).¹⁹

[Insert Table 3 about here]

The first hypothesis (H1) posits that open discussion brainstorming will yield less preparation time than nominal group or round robin brainstorming. The reasoning behind H1 is that some auditors in the open discussion treatment will likely expend less effort in the preparation stage (compared to auditors in the other two treatments), as they try to ‘free ride’ on the other auditors’ preparatory efforts during the upcoming discussion stage and/or they postpone their efforts to the interaction stage. Table 3 (panel A) shows that the mean number of preparation minutes per team member was significantly lower with open discussion brainstorming (48.00) than nominal group (60.61) or round robin brainstorming (58.22); further, there is no significant difference in preparation time between nominal group and round robin brainstorming. Hence, H1 is supported.

While we did not hypothesize time variation across auditor ranks in the preparation stage, it is interesting to note where significant differences exist (see Table 3, panel A). The mean number of minutes for *staff* in the nominal group, round robin and open discussion conditions are not significantly different. The mean individual number of minutes for *seniors* in the open discussion condition (33.57) was significantly lower than nominal group (60.35) and round robin

¹⁹ A MANCOVA analysis was conducted using the three treatment conditions as the independent variable, and the following dependent variables: mean number of minutes spent in the preparation stage across staff, senior, manager and partner team members, number of unique ideas, percent change in planned audit hours, and change in the nature, timing and extent of substantive audit tests. Pillai’s Trace ($F = 32.36$), Wilks’ Lambda ($F = 43.09$), Hotelling’s Trace ($F = 56.11$) and Roy’s Largest Root ($F = 99.52$) were all significant at $p < .01$, thereby indicating a treatment effect. None of the covariates was significant (smallest p -value = .12 for mean years experience of the brainstorming team).

(57.44) conditions, and the latter two means are statistically equivalent. The mean individual number of minutes for *managers* in the open discussion condition (31.95) was significantly lower than the nominal group (53.76) and round robin (43.98) conditions, and the latter two means are not significantly different. The number of mean individual minutes for *partners* in the nominal group (57.68), round robin (53.70) and open discussion (56.88) conditions are not significantly different. It appears that particularly seniors and managers in the open discussion condition were reducing their efforts in anticipation of the upcoming unstructured discussion forum.

The second hypothesis (H2) suggests that open discussion brainstorming will generate a lower number of unique fraud risks than either nominal group or round robin brainstorming during the preparation stage. As indicated on Table 3 (panel B), the number of unique fraud risks identified during the preparation stage is significantly lower with open discussion brainstorming (13.62), relative to nominal (16.45) or round robin (15.43) brainstorming, which supports H2.

The third hypothesis predicts that the number of unique fraud risks identified by audit teams using the open discussion brainstorming technique will further decrease during the interaction stage (H3a), while the number of unique fraud risks identified by round robin brainstorming teams will increase during the interaction stage (H3b). Indeed, the interaction stage of open discussion brainstorming decreased the number of unique ideas from the initial set of 13.62 to a reduced set of 11.44 ($t = 11.17, p < .01$). Conversely, a comparison of the round robin pre-interaction number of ideas (15.43) and interaction number of ideas (17.59) indicates that the second round iteration was effective in adding unique ideas to the initial set ($t = -9.651, p < .01$). These findings support H3a and H3b.

The fourth hypothesis (H4) posits that the number of unique ideas arising from brainstorming will be lowest for open discussion brainstorming and highest for round robin brainstorming, with nominal group brainstorming falling in the middle. As indicated on Table 3 (panel B), open discussion brainstorming resulted in a significantly lower number of unique fraud risks (11.44) than round robin (17.59) and nominal group brainstorming (16.45); however, contrary to our predictions, the number of unique ideas arising from the round robin technique was not statistically greater than the nominal group technique; accordingly, H4 is only partially supported.

Hypothesis five (H5) suggests that adjustments to the preliminary audit plan will be greatest for round robin brainstorming and smallest for open discussion brainstorming, with nominal group brainstorming falling between the two interactive techniques. We examine this proposition using multiple metrics (percent increase in planned audit hours, and number of changes/additions to substantive testing, subdivided into the nature, extent and timing of substantive tests), all of which are shown on Table 3, panel C.

The mean percent increase in planned audit hours in the open discussion brainstorming treatment (0.83%) is significantly lower than in the nominal group (1.81%) and round robin (1.65%) treatments. Further, the total number of substantive tests that were changed or added as a result of fraud brainstorming is greater in the nominal group (23.36) and round robin (27.76) conditions than the open discussion condition (13.86). The number of affected substantive tests involving 'nature' is greater with nominal (8.04) and round robin brainstorming (10.10), as compared to open discussion brainstorming (2.62). Similarly, the number of affected tests involving 'timing' is greater with nominal (10.22) and round robin brainstorming (10.56), as compared to open discussion brainstorming (4.26). However, there is no significant difference in

any of the aforementioned metrics between round robin and nominal group brainstorming. Finally, the number of changes/additions focusing on 'extent' is lower in the nominal group condition (5.10) when compared to the round robin (7.10) and open discussion (6.98) brainstorming conditions, with the latter two being statistically equivalent.

Some researchers and practitioners have suggested that modifying nature and changing the timing of standard audit plans are valuable fraud detection procedures (AICPA 2002, Albrecht et al. 2001, Asare and Wright 2004, Glover et al. 2003, Zimbelman 1997). The reasoning is that fraudulent managers are often prepared to deal with standard audit procedures, while unexpected changes to the types and timing of substantive tests can reveal evidence that might be otherwise consciously hidden. Because nominal group and round robin brainstorming resulted in greater numbers of changes/additions involving the nature and timing of substantive testing, and higher percent changes to the preliminary audit plans, we suggest that these two brainstorming techniques were generally more effective than open discussion brainstorming. However, H5 was only partially supported since there was (generally) no difference in audit plan adjustments between the nominal group and round robin treatments.

DISCUSSION

While fraud brainstorming is required by SAS No. 99, little is known about the relative effectiveness of different brainstorming techniques, particularly in the field environment. In an attempt to further inform theory and practice in this regard, the field experiment reported herein compares the most commonly used brainstorming technique in practice (open discussion) to nominal group brainstorming, and introduces a second, relatively novel interactive technique termed as round robin brainstorming. In this study, the nominal group and round robin techniques were equally effective from the perspective of the number of unique fraud risks

identified, percent increase in planned audit hours, and number of changes to the nature and timing of substantive testing, whereas the open discussion brainstorming technique was the least effective technique.

Another revealing finding from the current study is reflected in the mean time spent per team member in the preparation stage of fraud brainstorming. The results indicate that the mean time spent was significantly less with the open discussion technique, relative to the other two techniques, suggesting that auditors who were anticipating unstructured group discussion reduced their preparatory effort, perhaps because they were attempting to ‘free ride’ on other auditors’ efforts or because they postponed idea generation to the open discussion stage. Interestingly, the lower preparation time can be attributed to senior and manager auditors in the open discussion treatment, as they expended considerably less time in the preparation stage of brainstorming than senior and manager auditors in the other two conditions. Future research should attempt to uncover reasons why preparation time differences across the treatment conditions were observed generally, and particularly for seniors and managers.

Results from the current study are consistent with Carpenter (2007) regarding the number of unique ideas generated by brainstorming, as we similarly find that the nominal group technique generated more unique fraud risks than the open discussion technique. On the other hand, while Carpenter reported that open discussion brainstorming generated higher quality fraud risk ideas than nominal brainstorming, findings from the current study suggest the opposite, such that we observed fewer audit plan adjustments following the open discussion technique. In general, because the contexts (laboratory versus field experiment), tasks (case scenario versus actual clients) and team compositions (artificial versus natural) differ between the Carpenter study and the current study, it is difficult to draw direct comparisons.

One particular difference between these two studies, though, is noteworthy, as it holds future research potential. Carpenter (2007) directly measured the quality of fraud risk ideas, while the current study assessed a second-order effect of quality—audit plan adjustments. While the quality of ideas generated during open discussion brainstorming in the Carpenter study was judged to be greater than for nominal brainstorming, it is possible that some of the ideas generated already would have been impounded in the preliminary audit plan (pre-brainstorming); thus, the extent to which such ideas might have affected the audit plan is unknown. Comparing and contrasting these two studies suggests future research to directly measure the quality of fraud risk ideas generated through brainstorming, categorize the ideas as common, partially-held or unique, and follow the ideas through audit plan adjustments. Research of this nature might help future brainstorming teams to minimize the effects of common information sampling bias. Obtaining a better understanding of fraud brainstorming processes and consequences can help audit firms in striking a balance between minimizing the consumption of valuable resources expended during fraud brainstorming, and improving auditors' ability to detect and prevent fraud.

This study is limited by several factors and conditions. First, the participating audit firm set several restrictions on the nature of clients that could be included in the sample. Without further information on the complete set of possible clients that could have been included in the sample frame, one cannot know the nature and extent of bias that these restrictions might have placed on the study results. Second, the audit partner and in-charge manager chose the audit team members who would participate in the brainstorming process, identified the unique fraud risks from the entire set of risks provided by the brainstorming team and decided what changes (if any) to make to substantive testing and planned audit hours. While leaving such discretion to the

audit partner and in-charge manager could have biased the study results, randomization of client selection and treatments to clients alleviates the concern that such potential biases were systematically different among the treatment conditions. Third, the firm restricted the researchers as to the nature and extent of data allowed for this study; hence, the research findings are restricted to the data provided. Fourth, while Carpenter (2007) measured fraud risk idea quality as an important effectiveness indicator, the current field-experimental approach does not allow us to directly assess idea quality. Finally, although participants in a given treatment were unaware of the other treatments, they likely knew that the firm altered the brainstorming process for one client, since other clients in their office were not subjected to the same conditions. Such awareness could have resulted in hypothesis guessing and demand effects. After considering the study limitations and offsetting strengths of a field experiment, researchers and practitioners can gain some insight into the relative effects of the nominal group, round robin and open discussion fraud brainstorming techniques, which can inform future research and practice in this area.

The current study contributes to extant fraud brainstorming research in the following ways. First, we administered an experiment in a contextually rich field setting that involved hierarchical teams of practicing auditors and existing clients. Despite the noise commonly present in field experiments, we found significant results, suggesting a powerful effect size. Furthermore, by testing different brainstorming techniques with real audit teams conducting actual fraud brainstorming sessions with real clients, we contribute to experimental brainstorming research, since different risks, motivations and incentives are at stake in the field as compared to laboratory settings. Second, we examined the round robin technique of fraud brainstorming, which (to our knowledge) has not been subjected to empirical investigation in prior research. Third, as far as we can determine, this is the first field study to document the

effect of fraud brainstorming on planned audit hours. Finally, we report brainstorming-related changes/additions to substantive tests, subdivided by the nature, timing and extent of testing. While the current study adds a few more pieces to the extensive and complex puzzle of fraud brainstorming, there remains much more to learn.

Epilogue

Although the participating CPA firm has yet to finalize its fraud brainstorming procedures, it is considering using a modified version of the round robin technique. While the preparation stage and evaluation stage of brainstorming would take place as described in this study, the interaction stage would be expanded from two to three phases, as follows: During phase one, each team member, in turn, will be asked to voice their risks to the entire team while the other team members listen; during phase two, after all team members have had the opportunity to voice their risks, there will be a second round of expressing new risks that might have come to mind during the first round; and, during phase three, there would be an unstructured open discussion about fraud risks. The reason the firm is considering the third phase is because they wish to provide an opportunity for the less experienced members of the team to learn from the more experienced members, as the more experienced members will be able to explain their reasoning processes.

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Table 1 – Descriptive Statistics for Participants, Clients and Groups

Panel A: Participants ¹

	<u>Partners</u>	<u>Managers</u>	<u>Seniors</u>	<u>Staff</u>	<u>Total</u>
Number of Participants	150	337	679	1,448	2,614
Number (%) Female	4 (2.67)	57 (16.91)	236 (34.76)	818 (56.49)	1,115 (42.65)
Mean (S.D.) ² Age	46 (7.78)	31 (4.65)	27 (1.78)	24 (1.42)	32 (2.29)
Mean (S.D.) Experience	23 (6.66)	9 (1.88)	5 (1.67)	1 (0.50)	10 (1.74)

Panel B: Clients ³

Number of Clients in Study	150
Mean (S.D.) Years Auditing Client	8.99 (5.50)
Mean (S.D.) Total Revenues (millions)	\$545.91 (\$288.36)
Percent of Clients in Retail Industry	28%
Percent of Clients in Manufacturing Industry	17%
Percent of Clients in Service Industry	55%

Panel C: Groups ⁴

	<u>Nominal Group</u>	<u>Round Robin</u>	<u>Open Discussion</u>
Mean (S.D.) Number of Partners	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Mean (S.D.) Number of Managers	2.22 (0.86)	2.34 (0.75)	2.18 (0.75)
Mean (S.D.) Number of Seniors	4.66 (1.14)	4.30 (0.97)	4.62 (1.03)
Mean (S.D.) Number of Staff	9.66 (2.92)	10.00 (3.25)	9.30 (2.87)

¹ None of the participant attributes is significantly different across the three treatment conditions (p > .10).

² S.D. = Standard Deviation

³ None of the client attributes is significantly different across the three treatment conditions (p > .10)

⁴ Group sizes, by rank and in total, are not significantly different across the three treatment conditions (p > .10)

Table 2 –Descriptive Statistics for the Dependent Variables ¹

	<u>Nominal Group</u>	<u>Round Robin</u>	<u>Open Discussion</u>
Panel A: Mean (Standard Deviation) Individual Minutes			
Preparation Stage ²			
Staff	70.67 (15.75)	77.77 (19.00)	69.62 (17.62)
Seniors	60.35 (10.44)	57.44 (13.72)	33.57 (8.56)
Managers	53.76 (12.02)	43.98 (11.85)	31.95 (4.51)
Partners	57.68 (20.10)	53.70 (30.01)	56.88 (27.00)
Total	60.61 (8.23)	58.22 (10.46)	48.00 (7.96)
Panel B: Mean (Standard Deviation) Number of Unique Fraud Risks			
Number of Unique Risks Pre-Interaction	16.45 (4.31)	15.43 (4.21)	13.62 (3.45)
Number of Unique Risks During-Interaction	n/a (n/a)	17.59 (4.32)	11.44 (3.16)
Panel C: Mean (Standard Deviation) Audit Plan Adjustments			
% Increase in Planned Audit Hours	1.81 (1.23)	1.65 (1.18)	0.83 (0.62)
Total # of substantive tests affected	23.36 (11.47)	27.76 (11.95)	13.86 (6.83)
# of substantive tests: Nature	8.04 (4.56)	10.10 (5.85)	2.62 (2.54)
# of substantive tests: Timing	10.22 (6.10)	10.56 (5.40)	4.26 (4.97)
# of substantive tests: Extent	5.10 (3.47)	7.10 (5.48)	6.98 (4.03)
% of Substantive Tests: Nature	33.66 (11.93)	36.45 (13.13)	17.38 (13.03)
% of Substantive Tests: Timing	42.40 (9.80)	37.08 (8.39)	24.49 (25.18)
% of Substantive Tests: Extent	23.94 (15.19)	26.47 (15.93)	58.13 (26.76)

¹ The metrics provided by the audit firm and shown in Panels A, B and C have been divided by a constant, which was selected by the audit firm. The constant reflects a number between 1.1 and 1.9. The audit firm divided the metrics by a constant for competitive and legal reasons. Thus, the means are comparable across the treatment conditions, but they cannot be interpreted in an absolute sense.

² The auditors were asked to think about and write-down client fraud risks in the context of SAS No. 99, the fraud triangle, and firm policies and procedures, and note the number of minutes spent in this activity. This metric reflects mean individual number of minutes the auditors spent in the preparation stage by rank across the three brainstorming techniques.

Table 3 – Results of ANCOVA and Multiple Pairwise Comparisons ^{1,2}

	<u>Nominal Group</u>		<u>Round Robin</u>		<u>Open Discussion</u>	<u>F-Ratio</u>	<u>p-value</u>
Panel A: Mean Collective Minutes							
Preparation Stage							
Staff ³	70.67	=	77.77	=	69.62	3.15	.05
Seniors ⁴	60.35	=	57.44	>	33.57	75.36	.01
Managers ⁵	53.76	=	43.98	>	31.95	50.60	.01
Partners ⁶	<u>57.68</u>	=	<u>53.70</u>	=	<u>56.88</u>	0.24	.80
Total ⁷	60.61	=	58.22	>	48.00	22.44	.01
Panel B: Number of Unique Fraud Risks							
# Unique Risks – Pre-Interaction ⁸	16.45	=	15.43	>	13.62	5.99	.01
# Unique Risks – During-Interaction ⁹	16.45	=	17.59	>	11.44	34.26	.01
Panel C: Audit Plan Adjustments ¹⁰							
% Increase in Planned Audit Hours ¹¹	1.81	=	1.65	>	0.83	86.12	.01
Total # of Substantive Tests Affected ¹²	23.36	=	27.76	>	13.86	23.58	.01
# of Substantive Tests: Nature ¹³	8.04	=	10.10	>	2.62	3.59	.03
# of Substantive Tests: Timing ¹⁴	10.22	=	10.56	>	4.26	12.53	.01
# of Substantive Tests: Extent ¹⁵	5.10	<	7.10	=	6.98	14.88	.01

Notes to Table 3

¹ In all cases, the Scheffe and Bonferroni multiple pairwise comparison tests provide the same results ($\alpha = .05$)

² The following covariates were included in all ANCOVA models: perceived anonymity of fraud risks, size of the brainstorming team, mean age of the brainstorming team, mean years audit experience of the brainstorming team, number of years auditing the client, client revenues, percent female auditors on the brainstorming team, client industry. Significant covariates are indicated in the following notes.

³ There were no significant covariates.

⁴ Percent female auditors on the brainstorming team was significant ($F = 3.25, p = .07$)—greater percent female team members is associated with more time spent in the preparation stage.

⁵ Number of years auditing the client was significant ($F = 3.79, p = .05$)—more years is associated with less time spent in the preparation stage.

⁶ Brainstorming team size was significant ($F = 3.58, p < .06$)—larger team size is associated with more time spent in the preparation stage; client revenues was significant ($F = 3.70, p = .06$)—larger client size is associated with more time spent in the preparation stage; and mean years audit experience of the brainstorming team was significant ($F = 2.84, p = .09$)—less audit experience is associated with more time spent in the preparation stage.

⁷ There were no significant covariates.

⁸ There were no significant covariates.

⁹ There was no ‘interaction stage’ for the nominal group technique, but the number of unique ideas generated during the preparation stage was used to compare against the number of unique ideas arising from interaction stage of round robin and open discussion brainstorming. There were no significant covariates.

¹⁰ In addition to the covariates mentioned in Note #2 (above), the ANCOVA models used to assess variables shown in Panel C also included the ‘number of unique ideas’ as an additional covariate.

¹¹ Mean years experience of the brainstorming team was significant ($F=7.48, p = .01$)—greater mean experience is associated with higher percent changes in audit hours; the number of unique ideas was significant ($F = 2,338.62, p = .01$)—more unique ideas is associate with higher percent changes in audit hours.

¹² Number of years auditing the client was significant ($F = 3.37, p = .07$)—more years auditing the client is associated with fewer numbers of total additional substantive tests; the number of unique ideas was significant ($F = 3,361.31, p = .01$)—more unique ideas is associate with greater numbers of total additional substantive tests.

¹³ The number of unique ideas was significant ($F = 1,430.87, p = .01$)—more unique ideas is associate with greater numbers of additional substantive tests involving the nature of tests.

¹⁴ Number of years auditing the client was significant ($F = 2.86, p = .09$)—more years is associated with fewer numbers of additional substantive tests involving the timing of tests; the number of unique ideas was significant ($F = 1,373.68, p = .01$)—more unique ideas is associate with greater numbers of additional substantive tests involving the timing of tests.

¹⁵ Client revenues was significant ($F = 3.37, p = .07$)—higher revenues are associate with greater numbers of additional substantive tests involving the extent of tests; the number of unique ideas was significant ($F = 46.27, p = .01$)—more unique ideas is associate with greater numbers of additional substantive tests involving the extent of tests.