Research Note. Electronic Brainstorming: Illusions and Patterns of Productivity

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In a recent article in Information Systems Research, Pinsonneault et al. (1999) present a thorough and compelling summary of theoretical factors that act to enhance and impair productivity in electronic brainstorming (EBS) groups as contrasted with traditional verbal brainstorming groups and nominal group brainstorming. They assume that all theoretical factors are equally important and remain constant, and therefore add the factors together to conclude that, from a theoretical standpoint, there should be no difference in idea generation performance between EBS and nominal groups.

They also present an equally thorough summary of previous empirical research comparing EBS and nominal group brainstorming to which they add additional empirical data from their own study. Their analysis suggests that there have been no clear patterns in the empirical research because nominal groups outperform EBS groups as often as EBS groups outperform nominal groups. They then conclude that group participants and "many researchers may also be under the illusion that EBS is superior to all other brainstorming approaches, when in fact this is not supported by empirical evidence" (Pinsonneault et al. 1999, pp. 127–128). They end by suggesting that more research is needed to understand the conditions under which EBS groups may outperform nominal groups.

We agree that EBS is not superior to all other brainstorming approaches—nominal group brainstorming in particular—under all conditions. Thus the goal of this research note is to extend Pinsonneault et al. (1999) by helping to clarify the empirical evidence and theoretical factors to better understand when EBS groups may be expected to perform more poorly than nominal groups and when EBS groups may be expected to perform better than nominal groups.

We agree with Pinsonneault et al. (1999) that most theoretical factors are likely constant and that summing them is appropriate. However, we disagree that all factors are constant and can therefore be summed. We have argued elsewhere that one of the most important differences between EBS and nominal group brainstorming is the synergy or cognitive stimulation that EBS participants receive from reading the ideas of other participants, and that this synergy is not constant of free riding (Diehl and Stroebe 1987)). So if social facilitation and free riding are important factors, our pooled nominal group approach should result in more ideas than the traditional nominal group approach, and thus make for a more conservative control group by which to test EBS performance than the traditional nominal group approach. As an aside, we note that—exactly as expected—in our studies, which used the pooling approach (Valacich et al. 1994), nominal groups did better relative to EBS groups than in those studies using the traditional approach (Dennis and Valacich 1993).

References

Pinsonneault et al. (1999) also take issue (p. 112) with the pooling approach to building nominal groups used in one of our studies (Valacich et al. 1994). With this pooling approach, nominal groups are built after the fact rather than during the experiment. In other nominal group research (e.g., Dennis and Valacich 1993, Pinsonneault et al. 1999), nominal groups are built in the same way as regular groups and work together as a "group" but without exchanging ideas. With the pooling approach, nominal group members work in the presence of each other (to benefit from any social facilitation effects (Levine et al. 1993, Zajonc 1965)), but are not informed they are working as a group (to reduce the negative effects of free riding (Diehl and Stroebe 1987)).
(Valacich and Dennis 1994). Synergy comes from the pool of ideas exchanged by participants in EBS (Nagsundaram and Dennis 1993). When that pool of ideas contains many stimulating ideas, they will stimulate group members to generate ideas that they would otherwise not have produced and performance will be improved. Ceteris paribus, a larger pool of ideas is more likely to contain more stimulating ideas than a smaller pool of ideas. Thus the gains from synergy should increase with the size of the idea pool.

We have argued elsewhere that under these assumptions, it is possible to develop a mathematical model to predict when the performance of EBS groups will and will not exceed that of nominal groups; we will not develop the model here, but instead refer interested readers to the source: Valacich and Dennis (1994). Simply put, we argue that the performance of EBS and nominal groups is related by the following equation:

$$\text{Group}(x) = (1 + g) \times \text{Nominal} (x) - c$$

where $x, g, c > 0$.

In this equation, $x$ is the size of the group, $\text{Group}(x)$ is the number of ideas produced by an EBS group of $x$ members, and Nominal $(x)$ is the number of ideas produced by the same $x$ individuals working as a nominal group. The term $g$ is the synergy factor which has multiplicative effects on performance. The term $c$ is the net sum of all the other process gains and process losses due to group interaction, and in general acts to reduce performance. Tests on our own data found support for

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**Figure 1** Previous Research Comparing Electronic and Nominal Group Brainstorming

<table>
<thead>
<tr>
<th>EBS &gt; Nominal</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>B</th>
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<tbody>
<tr>
<td>EBS = Nominal</td>
<td>A1</td>
<td>C</td>
<td>D</td>
<td>B</td>
</tr>
<tr>
<td>EBS &lt; Nominal</td>
<td>A3</td>
<td>F</td>
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**Studies**

A1 Experiment 1 from Valacich, et al., 1994
A2 Experiment 2 from Valacich, et al., 1994
A3 Experiment 3 from Valacich, et al., 1994
B Dennis and Valacich, 1993
C Gallupe, Bastianutti, and Cooper, 1991
D Gallupe, Cooper, and Bastianutti, 1990
E Cooper, Gallupe, and Lalonde, 1990
F Pinsoneault, et al., 1999
this model with an $R^2$ of 0.95 (Valacich and Dennis 1994).

In other words, synergy increases with the size of the group (or more accurately, with the number of ideas generated by a similarly sized nominal group), but other process gains and losses remain constant. Thus, for small groups, nominal groups should outperform EBS groups because the process losses from interaction and coordination exceed any synergy from the ideas of others. For larger groups, however, EBS groups should outperform nominal groups. It is inappropriate to generalize from our data to other EBS groups, but for the groups in our prior study (Valacich and Dennis 1994), the point at which EBS groups could be expected to noticeably outperform nominal groups was at around eight members; for groups of seven or fewer members, there would likely be no significant differences or nominal groups would produce more ideas than EBS groups.

If we turn from our data to the prior empirical data summarized by Pinsonneault et al. (1999), we see a similar pattern. If we rearrange Figure 1 from Pinsonneault et al. (1999) using group size as one axis (and add in the new data from their study), we get Figure 1. This shows that, for groups of eight or fewer members, every previous experiment has found nominal groups to generate as many or more ideas than EBS groups. We find this rather compelling and reach the same conclusion as Pinsonneault et al. (1999): for small groups (approximately 2–8 members) any perceptions of productivity gains from EBS are likely to be illusions.

However, Figure 1 also shows that for groups of nine or more members, every previous experiment has found EBS groups to outperform nominal groups. We find this rather compelling too. Thus we conclude that for large groups (approximately nine or more members) any perceptions of productivity gains from EBS are likely to be a pattern—not an illusion.

In summary, we believe that the theoretical arguments and the pattern of empirical data present a rather clear and succinct message, first made in 1994, for managers and researchers (Valacich et al. 1994). For small groups, any benefits for EBS are indeed an illusion; groups would be no worse and possibly better off to work as nominal groups. For large groups, however, EBS offers clear performance benefits over nominal group brainstorming, as well as verbal brainstorming (Gallupe et al. 1992).

References