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New "Brainstorming" Principles

by
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Abstract:

This article presents six new principles emerging from four decades of academic and industry research on the generation of high-quality creative ideas by "brainstorming". The principles are: (a) brainstorming instructions are essential and should emphasize, paradoxically, number and not quality of ideas; (b) a specific, difficult target should be set for the number of ideas; (c) individuals, not groups, should generate the initial ideas; (d) groups should then be used to amalgamate and refine the ideas; (e) individuals should provide the final ratings to select the best ideas, which will increase commitment to the ideas selected; and, (f) the time required for successful brainstorming should be kept remarkably short. By following these principles, brainstorming will more dependably produce high-quality creative results.

Keywords:

CREATIVE IDEAS; GROUPS VS. INDIVIDUALS; TASK INSTRUCTIONS AND PROCEDURES; BRAINSTORMING; NOMINAL GROUP TECHNIQUE; COMPUTER APPLICATIONS IN MANAGEMENT

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1. Introduction

The generation of new ideas—especially creative ideas of high quality—is vital to business success. Booz, Allen and Hamilton, Inc., the consulting company that has studied new products for many years, concluded from a study of top management, published in 1965, that:

> Nowhere inside the business is there any factor as potentially valuable as the "Big Idea"—in *new products and in advertising* . . .
>
> At any given time, *an outstanding idea can produce more dollars of profits than years of cost reduction programs* (p.34).

The need for high-quality creative ideas is even greater in today's markets because competition has increased and new product success rates have fallen. The need goes beyond the obvious applications to new products and advertising. Many have argued that a high level of creativity is necessary for all areas of business, including strategic planning and management.

There is a large body of research, mainly in psychology but also in management, which addresses the problem of how to generate creative ideas. Much of this research was stimulated by Alex Osborn's (1953) book on "brainstorming". However, what is not widely realised is that brainstorming principles have evolved considerably since his still widely-cited principles were first published. Indeed, they are now quite different. Both academics and managers need to be brought up-to-date on the new principles of brainstorming, and this is the purpose of this review.

Updating is important because most of the new principles of brainstorming disprove conventional wisdom. There are six principles altogether. We present them as headings and review the main supporting evidence for each.

2. Principle One: Brainstorming Instructions are Essential

The use of brainstorming instructions is essential to the production of a large number of good ideas. Most brainstorming instructions are based on Osborn's original instructional components (1963, p.156) which are quoted directly below:

> (1) *Criticism is ruled out.* Adverse judgement of ideas must be withheld until later. (2) *"Free-wheeling" is welcomed.* The wilder the idea, the better; it is easier to tame down than to think up. (3) *Quantity is wanted.* The greater the number of ideas, the more the likelihood of useful ideas. (4) *Combination and improvement are sought.* In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into *better* ideas; or how two or more ideas can be joined into still another idea.

The fourth component, dealing with combination and improvement of ideas, will be taken up later in conjunction with our fourth guideline. But the important new point to emerge since Osborn's book is that the first three components all reduce to one, in practice. How? The second component is basically a re-statement of the

first. This leaves the first and the third, which have come to be called *deferred evaluation* and *quantity breeds quality*. But these two instructions reduce to the latter, in that it turns out that the easiest way to operationalise the brainstorming objective of deferred evaluation is simply to instruct: "Go for quantity, ignore quality".

The instruction to go for as many ideas as possible regardless of their quality has been shown to automatically defer evaluation (Parnes and Meadow 1959). When quality (Q) is defined according to the widely adopted dual criteria proposed by Parnes as jointly high ratings on *uniqueness* (statistically rare, original) and *value* (useful, feasible, implementable), the ratio of good-quality ideas (Q) to sheer number of ideas (N) has been found to be constant. For instance, Parnes and Meadow (1959) found that the correlation between N and Q under brainstorming instructions was 0.69 and that, even in the condition where subjects did *not* use brainstorming instructions but were instructed to "go for Q only", the correlation between N and Q was similar at 0.72. Moreover, Parnes (1961) showed that the ratio Q/N is constant for low-fluency (few ideas) individuals and high-fluency (many ideas) individuals.

For complex, real-world creative problem solving, where good ideas are presumably more difficult to generate in the first place, the correlation between N and Q is likely to be still higher. Diehl and Stroebe (1987, Experiment 1), in a German study that employed the complex problem of generating creative solutions for improving the relationship between the German population and foreign guest workers, observed a correlation between N and Q of 0.82, leading them to conclude that in experimental studies of creative idea production, the simple measure N would be the least equivocal for use in comparisons across studies.

In summary, "go for quantity, not quality" appears to be the essential component of brainstorming instructions.

3. Principle Two: A Specific, Difficult Target Should be Set

Creative idea generation is often thought to be a natural process that is self-motivated. But a substantial body of research indicates that it is more effective to give the brainstorming participants a specific, difficult target for the number of ideas to be generated during the brainstorming session. This procedure, known as "goal setting", works with any task that can be performed by individuals and is one of the most reliable effects ever discovered by organisational and industrial psychologists (Latham and Lee 1986; Wood, Mento and Locke 1987). Goal setting is eminently suitable for brainstorming tasks.

For instance, Mento, Locke and Klein (1992) used goal setting for the experimental brainstorming task of generating uses for common objects such as a tyre or a book. In industry, this would be similar to generating new uses for an existing product, two highly successful examples of which are Arm and Hammer baking soda used as a refrigerator deodoriser and a not-very-sticky 3M adhesive becoming Post-it Notes. In the first experiment conducted by Mento and his colleagues, different groups of undergraduate business students were asked to generate ideas for common objects, with a one minute time limit. One group, the

control group, was given no specific target but were told to "do your best"; a second group was given an "easy" target of four uses; a third group, a "moderate" target of seven uses; and a fourth a "difficult" target of twelve uses in one minute. The no-target and the easy-target groups averaged 2.9 and 2.8 ideas per object. The moderate-target groups and the difficult-target group averaged significantly more ideas, 3.4 and 3.8, respectively. In a second experiment, MBA students were given the same task but this time without a control group and with the same students given (successively) the easy, moderate, and difficult targets. The number of ideas per object increased significantly as the target became more difficult, averaging 2.7 with the easy target, 3.5 with the moderate target, and 4.0 with the difficult target. Another study by Earley and Lituchy (1991) suggests that assigning difficult goals works because individuals set a higher personal goal than they would otherwise.

The target for brainstorming idea generation has to be specific numerically and it has to be difficult. A specific, difficult target for a particular brainstorming task can be operationalised as the number of ideas that can be attained by only 20% of brainstorming participants working on the task under *no target* conditions (Hirst and Yetton 1990). A couple of practice sessions with a total of twenty or so brainstormers under no-target conditions should be sufficient to set a specific, difficult target for subsequent brainstorming sessions.

4. Principle Three: Individuals, Not Groups, Should Generate the Initial Ideas

Despite the popular notion of a "brainstorming *group*", the research evidence strongly suggests that initial creative idea generation should be undertaken by individuals. The individuals should work alone, or privately if in the same room (see fourth principle below). Osborn originated the notion of groups as being superior for brainstorming by claiming in his early work (1957, p.229) that "the average person can think up twice as many ideas when working with a group than when working alone". His hypothesis was immediately tested by Taylor, Berry and Block (1958) and there have now been at least 25 tests of groups' versus individuals' idea production. Diehl and Stroebe (1987) have reviewed these tests as well as contributing three recent tests.

The 25 tests in Diehl and Stroebe's review of group versus individual creative idea production were confined to those studies in which real groups (RG) consisting of two to nine freely interacting people were compared with what is called "nominal groups", that is, statistically formed, after-the-fact "groups" composed of an equal number of individuals to the regular groups, but working entirely alone with no interaction, and for which the clearer terminology "pooled independent effort" (PIE) has come to be preferred. In the studies, brainstorming instructions were given to both the RG and PIE brainstorming participants so that only the group versus individual manipulation was varied. All of the studies used as the outcome variable the measure of quantity of ideas, *N*, but only four studies used an acceptable definition of quality of ideas, *Q*, that was consistent with the Parnes dual-criterion measure; however, given the high correlation between *N* and

Q, the lack of complete observations of *Q* should not be of material consequence. For *N*, across the 25 tests, PIE (individual brainstorming) was found to be superior to RG (regular groups) in 21 tests, with PIE equal to RG in the remaining four. For *Q*, PIE was found to superior in three tests and PIE was equal to RG in the other test. In none of the 25 tests was group brainstorming found to be superior to individual brainstorming.

For initial idea generation when dealing with real-world, complex problems, the superiority of PIE is massive. For instance, Diehl and Stroebe found, using the German worker problem, with a time limit of only fifteen minutes for idea production and in real-world conditions where the brainstormers were expecting to have their ideas evaluated subsequently by experts (1987, Experiment 1, personal assessment condition), that the average number of ideas, *N*, produced by four-person PIE "groups" (statistically pooled individuals) was 84 and the average number of *Q* ideas was thirteen, compared with four-person RG (real) groups who produced an average *N* of only 32 and a *Q* of three. In keeping with the earlier principle of "quantity breeds quality", notice that the *Q*/*N* ratios were similar, at 15% and 9%, and indicate that high-quality ideas are hard to come by. Nevertheless, compared with groups, individuals produced four times as many high-quality ideas.

Why are groups inferior to individuals for initial idea production? Diehl and Stroebe (1987) designed a series of experiments to test the three most widely posited explanations for the creative idea production loss that occurs in group brainstorming. "Free riding", an explanation whereby individuals working in groups perceive their own contributions to be relatively anonymous and therefore free ride or "socially loaf" (Latané, Williams and Harkins 1979) on others' ideas, was shown to have a statistically significant but very small effect. "Evaluation apprehension", whereby the presence of other group members inhibits the individual from voicing his or her more wild and original ideas, was also shown to have a statistically significant but still quite small effect. The largest effect on creative idea production loss in groups, by far, was "production blocking", whereby individuals, after thinking of some initial ideas, are "blocked" from reporting all of these initial ideas, and from thinking up further ideas, by having to wait for other people to report *their* ideas.

The production-blocking explanation is supported by the general finding that the larger the brainstorming group, the *fewer* the ideas produced compared with the same number of brainstormers working individually. As we shall see shortly, a partial remedy to this problem can be achieved by having individuals write down their ideas as they occur or key them in to a personal computer, a procedure known as "electronic brainstorming" (Gallupe, Bastianutti and Cooper 1991). This saves individuals having to remember their initial ideas and should reduce production loss.

The conclusion is evident that group brainstorming should not be used to generate creative ideas, at least for the initial ideation output. Individuals are more productive than groups for initial generation of creative ideas.

5. Principle Four: Use Group Interaction to Amalgamate and Refine Ideas

Despite the superiority of individuals for generating initial ideas, group conditions may be better for amalgamating and refining ideas—and thus implicitly introducing evaluation—*after* the initial ideas have been generated (Delbecq, Van de Ven and Gustafson 1986). Following the amalgamating and refining step, *final* selection of creative ideas is achieved most objectively by reverting to private individual evaluation (Gustafson, Shukla, Delbecq and Walster 1973; Armstrong 1987). Accordingly, we refer to the three recommended overall phases of brainstorming as the I-G-I (Individual-Group-Individual) procedure. Van de Ven and Delbecq (1971), were, to our knowledge, the pioneers of the I-G-I procedure in brainstorming, although they called it by a different name. Based on their work, its six steps are summarised in Table 1.

Groups of five to seven of the original individuals brainstormers appear to work best for the amalgamation and refinement phase (Delbecq et al. 1986). Groups of less than five expose individuals too much, whereas groups of more than seven people tend to prevent everyone from participating.

The group phase is best conducted by the group leader taking one idea serially from each brainstorming participant; putting all the ideas on a common, anonymous list (made easier by electronic brainstorming where ideas can be sent to a single screen); and then allowing equal time for discussion of each idea (Delbecq et al. 1986). During this discussion, refinement of initial ideas and "hitchhiking" by combining ideas are encouraged. As well, everyone is given an opportunity to offer reasons for agreement or disagreement with each idea. Thus, in contrast with the strict "deferred evaluation" of the initial brainstorming phase, this second phase is decidedly evaluative, but constructively so. The purpose is to improve all of the ideas without yet passing a final vote on the best one.

6. Principle Five: Select Final Ideas by Individual Votes

I-G-I brainstorming procedure, with its passive chairperson and its "rotational" format, has been shown to result in excellent group cohesion and a greater likelihood of final idea acceptance and implementation (Kaiser and Woodman 1985). The key to this seems to be that final ideas are selected by individual voting in which all participants have an equal say.

The autocratic, directive leadership that is typical of company or advertising agency "new ideas" meetings is especially detrimental to acceptance and implementation. In an experiment examining directive versus participative leadership during a real-world evaluation problem analogous to which ideas to select or reject in the "G" phase of the I-G-I procedure, Leana (1985) found that directive-leader groups (where the leader is instructed to state his or her own preference early, discourage discussion of contrary alternatives, and emphasise consensus rather than quality of decision) are inferior to participative-leader groups (in which the leader is instructed to refrain from stating his or her own preferences until all members had expressed theirs, encourage discussion of alternative solutions, and emphasise the importance of reaching a correct solution). Directive

Table 1

Outline of Van de Ven and Delbecq's (1971) I-G-I Procedure for Producing, Refining, and Evaluating Creative Ideas

1. Chairperson announces problem and gives brainstorming instructions to five to seven individuals seated around a table in the same room. (*Rationale*: this "silent groups" format preserves individuality but introduces a possible social facilitation effect from the presence of others.)
2. Individuals, with no talking, write down or key into personal computers as many ideas as they can in the specified time period, usually fifteen minutes. (*Rationale*: immediate recording of ideas helps to remove the "production blocking" problem whereby mental rehearsal of initial ideas blocks the production of further ideas.)
3. Chairperson records individuals' ideas, in rotation, one idea per person per rotation, on a group-visible flip chart or electronic screen. (*Rationale*: the rotation procedure removes some of the anonymity of a "talk in any order" group while at the same time producing a list of ideas that are recorded without authorship.)
4. Group clarifies and discusses ideas, combining or refining them as it sees fit. Ideas are taken one at a time, and each individual is asked for reasons of agreement or disagreement as well as to make constructive suggestions for improvement. (*Rationale*: groups are efficient and usually superior for combining and refining ideas.)
5. The revised ideas are then recorded by the chairperson in a group-visible final list. (*Rationale*: memory reliance is again minimised and also a degree of democratic anonymity is reinstated.)
6. Revised ideas are rated or ranked by individuals privately, with no discussion. Best idea or ideas chosen by pooled individual votes. (*Rationale*: democratic voting increases commitment and pooled individuals' judgements usually provide more accurate prediction.)

leadership suppresses the number of ideas evaluated and, more pertinently to the present point, drastically reduces acceptance of the solution. In the directive-leader groups, 21 out of 26 groups adopted the leader's solution but, in post-session debriefing, many individuals privately disagreed with the leader's solution. In the participative-leader groups, only four of the 26 groups chose the leader's solution, and virtually all individuals agreed with the group's chosen solution.

Another advantage of pooled individual votes is that it usually produces a more accurate prediction than when individuals in groups interact to arrive at a forecast (Armstrong 1987). The pooled individual voting procedure allows positive and negatives to cancel out and is therefore more likely to *correctly predict* a successful idea.

Individuals are the keys to the beginning and the end of the I-G-I brainstorming procedure, while acting as a group in the middle. The Individual-Group-Individual method would appear to best capitalise on the respective strengths of individual processes as well as group processes in the search for high-quality creative ideas.

7. Principle Six: The Time Required Should be Kept Remarkably Short

Conventional wisdom has it that creative idea generation cannot be rushed because a rest or "incubation" period is necessary. The incubation notion has been around at least since Wallas' (1926) well-known, four-stage model of creative thinking (preparation, incubation, illumination, verification). Just about everyone believes in incubation and can cite personal anecdotes of its value. But from a scientific standpoint, it is a myth. Extremely, systematic investigations by Read and Bruce (1982) and Olton (1979) have failed to find convincing evidence for incubation as an "autonomous unconscious processing" phenomenon nor as a necessary step in creativity. The notion that brainstorming needs an incubation period for best results must be rejected.

A consistent observation about the brainstorming experiments reviewed for this article—even where the brainstorming task was for a complex, real-world problem—is that the time required for initial idea generation is remarkably short, of the order of fifteen minutes. Moreover, the overall I-G-I procedure, of which individual ideation is the first part, rarely requires more than a couple of hours from start to completion.

A total duration of two hours compares very favourably with the typical, rambling, unstructured group "ideas meeting" where half a day's deliberation is not uncommon and the lack of structure and systematic procedure often requires a follow-up meeting. The I-G-I procedure is extremely efficient in terms of man-hours and produces superior results.

8. Conclusion

The production of high-quality creative ideas can be regarded as essential to the survival of most companies and organisations. Creative idea production is fundamental to planning and management and is vital to the generation of concepts for new products and for the advertising of new and established products. Nowadays, there is a premium on the identification of "winning" ideas. In this article, we have presented a distillation of the large body of research on creative idea production since the origination of "brainstorming" by Alex Osborn in 1953. Emerging from the research literature are six principles or guidelines which should

enable any company or organisation to maximise the likelihood of finding high-quality creative ideas with a minimum of time invested. Recapitulated, these are:

1. Brainstorming instructions are essential to maximise creative idea output. Osborn's dictum that "quantity breeds quality" has proven correct in numerous brainstorming experiments and this central instruction has the effect of deferring evaluation of initial ideas, which is the key to successful brainstorming.

2. A specific, difficult target for the number of creative ideas per person should be set. A specific and difficult target translates to the number of ideas, in the time allowed, that could be attained by only 20% of participants if no target were set. Specific, difficult targets consistently produce more high-quality ideas than unmotivated brainstorming.

3. Individuals, not groups, should generate the initial ideas. Group interaction detrimentally results in "production blocking" as people forget some of their ideas and can rehearse only a few while waiting for others in the group to express their ideas. Individuals have uniformly been found superior to groups in generating more, high-quality, initial creative ideas.

4. Group interaction should then be used to amalgamate and refine the individuals' initial ideas. Groups of five or seven work best. Ideas, and participants, should be given equal time by the group leader. The emphasis should be on discussion of reasons pro and con each idea rather than final evaluation.

5. Individuals, voting privately, should make the final selection of ideas. [Overall, the Individual-Group-Individual (I-G-I) procedure combines the advantages of individual ideation with the advantage of group assessment of ideas prior to final selection by individual voting.] Individual voting for final idea selection is better for predicting successful ideas and is especially beneficial for increasing commitment to the chosen idea or ideas.

6. The remarkable practical fact to emerge from the review of creative idea production literature is that the time required should be kept short: to the order of fifteen minutes for initial idea generation, and totaling two hours with refined idea production and selection. "Incubation" over longer periods is not necessary. Short brainstorming sessions mean that this powerful technique is more likely to be used.

We are confident in recommending these principles to managers. However, there are some additional areas relevant to brainstorming that are in need of further research. One obviously important but unresearched topic is problem definition or "problem framing" (Csikzentmihalyi and Getzels 1988; Russo and Schoemaker 1989). We have assumed that the problem to be brainstormed is clearly defined, as presented by the chairperson, but this is not always the case. Poor definition could lead the ideas in an unproductive direction and alternative framings could produce

very different results.

A second topic in need of research is the selection of brainstormers based on ability. Most of the experimental studies we have reviewed selected brainstorming participants at random, whereas managers have the opportunity to select those who may be more fluent idea generators. In-coming ability of individuals has been shown by Yetton and Bottger (1982; Bottger and Yetton 1987) to greatly increase performance in problem solving (convergent thinking). But ability has rarely been investigated in creative idea generation (divergent thinking) other than for fairly simple tasks. What does seem sensible for manager-selected brainstorming tasks is to select individuals from different knowledge areas (Fern 1982). This should increase the range of ideas produced and should be especially helpful for hard-to-define brainstorming problems.

Another open question is whether assistance or training helps brainstorming performance. Although there are now a number of fascinating computer-aided brainstorming programs available, such as *IdeaFisher*, *Brainstormer*, and *PRODIGI*, the several studies that have compared their performance with regular unaided brainstorming have shown unimpressive results (discussed in Kabanoff and Rossiter 1994). Similarly, whereas a number of creativity training courses have emerged since Osborn's book, such as the Osborn-Parnes Creative Problem Solving course and in-company courses offered by such luminaries as Basadur, de Bono and Rickards, evidence of their long-term influence is mostly anecdotal (again, see Kabanoff and Rossiter 1994). Based on the research evidence to date, we cannot recommend computer aids or training programs.

It appears that short-term task instructions and procedure—the subject of this article—offer the most significant aid to successful brainstorming. Careful and typically well-replicated research studies on brainstorming conducted since the publication of Osborn's pioneering book have shown that new principles of brainstorming have now emerged. By following these principles, companies can employ brainstorming to greatest effect in the generation of new ideas for strategy, management, products, services and advertising.

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