CHAPTER 1

Brainstorming

Alternate names: Brainstorming, creative thinking, group brainstorming, group ideation, interactive brainstorming.

Related methods: Affinity diagramming, braindrawing, brainwriting, buzz group, Delphi technique, individual brainstorming, KJ method, metaphor brainstorming, nominal group technique, remote brainstorming, unstructured brainstorming, and visual brainstorming.

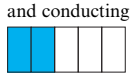
1.1 OVERVIEW OF BRAINSTORMING

Brainstorming is an individual or group method for generating ideas, increasing creative efficacy, or finding solutions to problems. This chapter focuses on group brainstorming where participants generate ideas on a particular topic or problem in a nonjudgmental environment following a set of ground rules about appropriate behaviors. Table 1.1 is a method scorecard that highlights the relative investment needed to conduct a group brainstorming session and when brainstorming is most useful.

The basic procedure for group brainstorming involves:

1. Selecting a group of three to ten participants with different backgrounds.
2. Posing a clear problem, question, or topic to the group.

Table 1.1 Method Scorecard for Brainstorming

Overall effort required	Time for planning and conducting	Skill and experience	Supplies and equipment	Time for data analysis
				
Most useful during these project phases:				
✓ Problem definition	✓ Requirements	✓ Conceptual design	Detailed design	Implementation

3. Asking the group to generate solutions or ideas with no criticism or attempts to limit the type and number of ideas. This is the "divergent" phase in which you want as many ideas as possible without any censorship.
4. Discussing, critiquing, and possibly prioritizing the brainstorming results for later action. This last step is often called the "convergent" phase where there is a winnowing of all the ideas into the ones that are judged as most applicable to a problem.

Variations on group brainstorming can be used to gather ideas from large groups, geographically-dispersed people, or participants who are inhibited by their shyness, the social environment, or cultural norms. These variations are described later in this chapter.

Alex Osborn, an advertising executive, is generally credited with developing modern organizational brainstorming procedures in the 1940s and 1950s (Osborn, 1963). Osborn described brainstorming (originally he called it "thinking up") in his classic book, *Applied Imagination: Principles and Procedures of Creative Problem-Solving*.

"Brainstorms" as Mental Disease and Fortunate Thoughts

In the early part of the twentieth century, "brainstorm" referred to violent bouts of temper or bouts of lethargy and depression. Toward the middle of the twentieth century, the usage of "brainstorm" changed to mean "sudden and fortunate thoughts" (Oxford English Dictionary, 2012). Alex Osborn, the "father of brainstorming" used the term "brainstorm session" in the mid-1950s to describe his method of generating solutions to problems (Osborn, 1963).

There are three fundamental principles for group brainstorming:

1. **Aim for sheer quantity.** Quantity, not quality, is the goal of brainstorming. The primary criterion for the success of brainstorming is the sheer number of ideas that are generated.

   Anything that limits the number of ideas is contrary to the intent of brainstorming. For example, brainstorming participants should not be taking their own notes because that keeps them (and those around them) from generating ideas. Participants should not be monitoring e-mail (so easy now with wireless connections, smartphones, and tablets!) or checking out Facebook during

brainstorming. After the brainstorming session, you can criticize, rate, rank, or vote on what makes a good idea, but during brainstorming the focus should be on getting as many ideas as possible.

2. **Defer judgment about the quality of ideas.** Do not criticize the ideas of others either implicitly (e.g., through facial expressions or other nonverbal behaviors) or explicitly (saying "Wow! That is a crazy idea!").
3. **Encourage new and wild ideas.** New ideas can be generated by synthesizing ideas, stretching ideas (bigger, faster, smaller), applying metaphors, or improving on existing ideas. Wild ideas that may not be directly applicable to a brainstorming topic can serve as triggers for ideas that are potentially useful. Ideas from science fiction stories or movies, for example, might seem odd, but many existing products are filled with concepts like teleportation, invisibility, and the ability to travel back in time (Freeman & Gelernter, 1996).

The apparent simplicity of these three principles leads many people to assume that successful brainstorming is easy and can be done by anyone. However, this assumption is not always warranted. Good brainstorming is rare, and in many cases what people consider "good brainstorming" is often seriously deficient. More on that later.

Tip

During a brainstorming session, should you praise people for ideas? The answer would generally be "No!".

While the rule to avoid criticism during brainstorming is well known, another more subtle rule is to avoid praise. Praising an idea is attaching a judgment to that idea which means that the lack of praise for other ideas could be construed as tacit criticism. So, avoid both praise and criticism during brainstorming.

Osborn's "structured brainstorming" approach, with clear ground rules and procedures, contrasts with "unstructured brainstorming," where a group gets together to generate ideas without a facilitator or clear ground rules (Osborn, 1963). Ideas that emerge from unstructured brainstorming are often criticized as they are generated, and loud or dominant individuals can exert inordinate influence on the quiet participants, thus limiting the number and type of ideas that participants are willing to express. This chapter will focus on structured brainstorming where there is generally a facilitator and a set of explicit rules for participants.

Don't Believe All That You Read on the Web: Group Brainstorming Isn't Simple!

While group brainstorming seems simple, there are many social issues like status differences, shyness, informal relationships, ego, and cultural factors that can affect the quantity of ideas. Camacho and Paulus (1995, p. 1078) found, for example, that social anxiety had a significant effect on brainstorming productivity and suggested that "... interactive [group] brainstorming may be best suited for people who are low in social anxiety".

A trained facilitator can mitigate some of these problems, but even a good facilitator won't have total insight into all the social forces and group dynamics that can influence productivity. Sandberg (2006), writing in *The Wall Street Journal*, summarizes some key requirements for successful group brainstorming:

"In fact, great brainstorming sessions are possible, but they require the planning of a state dinner, plenty of rules, and the suspension of ego, ingratiation and political railroading."

1.2 WHEN SHOULD YOU USE BRAINSTORMING?

Use brainstorming to:

- generate ideas or requirements;
- find solutions to specific problems;
- support conceptual design by generating metaphors, ideas for user interface (UI) architectures, and new ways to do old things;
- explore new design spaces;
- generate social cohesion within product teams.

Brainstorming is often used in the early to middle stages of product development; however, this method is applicable any time that new ideas or solutions to problems are required. If you have an unexpected and difficult problem just before you release a product, brainstorming would be an appropriate method for generating potential solutions.

1.2.1 Strengths

- Brainstorming has name recognition. Most people have some sense of what a group brainstorming session is like and you don't have to convince teams to use the method (which you might if you decide to try a lesser known approach like brainwriting).

- Provides ideas that may not surface any other way.
- Provides many ideas quickly.
- Requires few material resources. Paper, pens, sticky notes, and tape are about all you need unless you are doing remote brainstorming.
- Is a useful way to get over design blocks that are holding up a project.
- Is a democratic way of generating ideas (assuming that particular people don't dominate and you have a good facilitator).
- Provides social interaction—people like to work together in groups to solve problems.

1.2.2 Weaknesses

- Is sometimes less effective than having the same number of participants generating ideas individually. The quantity of ideas can suffer when one person in the brainstorming group blocks the production of ideas by other participants by telling "war stories" or whispering to a colleague. Brainwriting, covered in Chapter 2, can yield a trove of ideas using a silent method where participants write ideas on slips and hand them in or pass them to someone else who adds additional new ideas or modifies previous ones.
- There is often no good way to match ideas that come up in brainstorming with an insight that occurs outside the brainstorming room that might just be the missing ingredient to a brilliant concept. Johnson (2010), in his book, *Where Good Ideas Come From*, suggests that groups build information networks that allow ideas from different times and places to mix and provide brilliant insights.
- Requires an experienced facilitator who is sensitive to group dynamics and social pressures and not afraid to note violations of the ground rules.
- The focus on the quantity of ideas can be derailed easily by criticism or poor facilitation.
- Can be chaotic and intimidating to the quiet or shy person.
- Can reduce individual recognition for good ideas (although you can compensate for this by being known as a "good brainstormer" and creative contributor).
- May be difficult in some corporations, countries, or cultures where "wild ideas" could be viewed as inappropriate because those ideas are contrary to corporate initiatives or cultural norms.

- Status or experience differences among participants can reduce brainstorming effectiveness. Mixing senior and junior colleagues may cause junior people to defer to their more senior colleagues.
- Sorting through hundreds of ideas and choosing the best ones can be difficult.

1.3 PROCEDURES AND PRACTICAL ADVICE ON BRAINSTORMING

1.3.1 Planning the Brainstorming Session

1. **Decide if group brainstorming is going to be the best method for generating ideas or solutions for your particular question.** Other ways to generate ideas, like spirited debate, brainwriting, braindrawing, free listing, scanning ideas from previous activities, or idea networks where colleagues share and rate ideas of others, might be more appropriate for some contexts. For example, if you have some quiet people who might feel intimidated because their managers want to be part of the brainstorming session, you might try a less public method like brainwriting (Chapter 2).

Tip

Brainstorming homework can focus the creative energies of your participants, but asking people to do homework creates some obligations for the participants AND facilitator.

1. Assign homework that is reasonable given the roles and schedules of your participants.
2. Make sure that you give people enough time to complete the homework.
3. Make the homework fun!
4. Give your participants clear instructions about what they should do with the results of the homework—for example, jot down answers to a brainstorming question based on the homework. You might ask people to bring examples to the session for inspiration.
5. Make it clear that the participants are expected to come to the meeting, homework-in-hand.

2. **Develop the question or topic that will be the focus of the brainstorming session.** The topic should be neither overly broad ("What can

we do to make consumer products better?") nor so narrow ("What color should we use for the background of the horizontal navigation bar in our web site?") that creativity is stifled (Wellner, 2003). The topic could be focused on a specific customer problem or need like "What can we do to reduce the time it takes to become proficient with our product?"

3. **Decide if there is some "homework" for the brainstorming session that will prime the participants and encourage more ideas.** You might expose your colleagues to stimuli related to your brainstorming topic. Kelley (2001, p. 60), for example, describes a warm-up "experiment" for a brainstorming session at IDEO on toy design that involved different types of homework. One group of designers did no preparation for the session; a second group read books related to the design of toys and listened to a lecture; the third group took a field trip to a toy store. Each group conducted a brainstorming exercise. According to Kelley, the group that actually went to the toy store generated more and better ideas than the other two groups. This was not a definitive study, but asking a group to step outside their current experience provides an opening for more ideas. Nowadays, research is relatively easy since you can use Google to collect information, examine images, and read scholarly articles on nearly everything.
4. **Choose a facilitator who has experience conducting brainstorming sessions or similar activities like focus groups or design reviews.** If you have a contentious group with some overpowering participants, consider a facilitator with formal training. Brainstorming sessions are enhanced by experienced facilitators who can focus on eliciting as many ideas as possible and reminding participants of the ground rules.
5. **Draft an agenda for the brainstorming session that describes how much time is allocated to introductions, discussion of the topic and procedure, warm-up exercises, the brainstorming itself, and any post-brainstorming activities.** A common question about brainstorming is "how long should the actual brainstorming session last?" The answers in the literature range from 15 minutes to several hours per topic with frequent short breaks when there are sessions longer than 30 minutes. Short breaks may help overcome mental blocks or fixations on particular approaches or solutions. Some brainstorming researchers advocate giving participants cards to write ideas on during the breaks from active brainstorming.

6. **Decide on the size and composition of the group.** A group of three to ten participants is recommended, although if you have a large group, you might consider a variation called the "buzz group" or "buzz session" (described later in this chapter) where you split a large group into smaller groups of three to six participants. These buzz groups each conduct their own brainstorming sessions, report the results to everyone (Brahm & Kleiner, 1996), and then all the ideas from different sessions are combined into a single list. If there is a mix of managers and employees, the managers can brainstorm in their own group so they don't intimidate those who work for them.

   It is advantageous to have a somewhat diverse group to explore ideas from different perspectives, but be careful about the mix of participants. Try to invite participants who are about the same rank in the organization to avoid status anxiety. If you invite outsiders—people who are not known to the main group—introduce them with a bit of background and do some warm-up exercises before you get started with the official brainstorming topic.

Diversity Can Be Good or Bad

Diversity is important, but group comfort and cohesion are also important for successful brainstorming (Milliken & Martins, 1996). Brainstorming guidelines often call for diverse participants on the assumption that greater diversity will yield more diverse ideas. This is true to a point, but diversity can also create problems for brainstorming.

The relationship between diversity and creativity is complex; sometimes diversity in groups can lead to discomfort (Milliken, Bartel, & Kurtzberg, 2003). For example, having several senior managers and strangers from other parts of a company join you for a brainstorming session might increase diversity, but also make the junior participants feel awkward or anxious about voicing "bad" or "wild" or "politically incorrect" ideas in front of other managers or strangers.

Some 10–15 minutes warm-up exercises you might consider to reduce anxiety are:

a. A practice brainstorming session on a topic that is not at all associated with the job or the topic of the session. You might invite people to brainstorm about "new kitchen gadgets" or "new applications for smartphones." The practice topic should be fun,

something that everyone can relate to, and stimulating enough for a brisk 10 minutes or so of idea generation.

b. An exercise where you hold up an item like a brick or paper clip, or show a photo of a common object and ask people to brainstorm as many ways to use the object as possible. A brick, for example, could be used as a paperweight, prototype, weapon, chicken-flattener, door stop, exercise device, or hammer.
c. A word association exercise where you give people a word like "apple" or "strong" and ask the group to list as many associations with the word as possible e.g., with "apple" you might get: gravity, Fuji, computer company, pie, doctor, health, crisp, record, Beatles, California, juice, fritter, and jack.

Tip

To make it easier for a person in a brainstorming session, you might post your ground rules and on the wall and after reviewing them together, clearly state: "I (the facilitator) will point out any violation of the ground rules and gently remind the group. If any of you feel that someone is not abiding by the rules, you can point that out at any time." This author was conducting a brainstorming session once and made a subtle ground rule transgression and a colleague very gently reminded me of my rule violation. Even good facilitators need an occasional reminder about the ground rules.

7. **Choose a location that is comfortable and has flipcharts and space on the walls for posting ideas.** Try to get a room other than the room where you meet everyday to talk about boring topics like the daily bug reports or changes to the project plan (Berkun, 2004). If this is a crucial session, you might want to get your participants out of their building and away from possible interruptions (any interruptions will reduce the quantity of ideas).

   In larger cities, there are often companies that will rent out rooms for half days. Convince your participants not to bring their laptops and to put their mobile phones in silent mode. You do not want participants answering calls, checking e-mails, whispering to each other, or doing other work during brainstorming. Each interruption takes time away from idea generation and blocks the production of new ideas for both the individual and group.

8. **Develop a short introduction (several minutes is often enough) that describes brainstorming and your goals for the session.** A checklist of items for the introduction would include:
   - Introducing yourself and your role as facilitator.
   - Describing the goal of the session.
   - Laying out the timeline for the session.
   - Describing the process.
   - Describing the ground rules and how they will be enforced (this is very important).
   - Describing what you will do with the data.
   - Conducting a brief warm-up.
9. **Develop an explicit set of rules for the brainstorming session and go over them during your introduction.** Paulus and Brown (2003, p. 130) and other experts have proposed rules for productive brainstorming sessions. Here is a set of ground rules based on both research and personal experience that this author has used with success.

Ground Rules for Brainstorming
Quantity, not quality, is the goal of the session
No criticism and no praise
Wild and different ideas are welcome
Don't worry about duplicates
You can modify the ideas of others
No long stories (that takes time away from ideas)
You can ask for brief clarification if you don't understand an idea, abbreviation, or term.
Ground rules will be posted and enforced
Anyone can note a violation of ground rules
Cell phones on vibrate and no computers or tablets except for the notetaker
Only one person speaks at a time
If you have an idea while someone else is speaking, write the idea down on a sticky note

10. **Ensure that all the ideas generated during brainstorming are visible to everyone.** The facilitator or a designated notetaker should be writing the ideas down on large sheets of paper or large sticky notes so everyone can see all the ideas. Write the ideas large enough and legibly enough for the person furthest away in the room to read them easily. Avoid typing ideas into a computer and displaying them to the participants unless you are doing sessions

with colleagues at different sites. Even with high-resolution displays, only a few dozen ideas will generally be visible which reduces the likelihood of early ideas triggering later ideas.

11. **Develop some techniques for encouraging new ideas and expanding existing ones.** Osborn (1963) provided a checklist of techniques for changing and expanding ideas during a brainstorming session. This venerable, but still relevant, checklist includes the following techniques:
    - **Adapt.** Is there something like this idea that might be worth emulating? Could you adapt a concept from physics or psychology or cooking to expand on an idea?
    - **Modify.** Can you change something about the idea? What would happen if you changed color, materials, shape, motion, visual style, orientation, texture, or who the users are?
    - **Magnify.** What happens if you add things to your idea or change some properties? What could you do to make it larger, faster, heavier, taller, wider, or sexier? What if you accentuated various properties like saturation or brightness? What if two or more people could use something that is currently a single person system?
    - **Minify.** Can you subtract things from an idea? Can you make it smaller, shorter, lighter, or more condensed? Can you subtract features? Can you reduce complexity? Can you eliminate features? Can you shrink something in a single dimension?
    - **Put to other uses.** Can you put your idea to some other use? What else could you do with the idea beyond the immediate use? For example, what nonstandard uses could you come up with for a set of features in a graphics program?
    - **Substitute.** Can you interchange components, methods, techniques, ingredients, people, language, perspective, or something else? For example, you might take the perspective of someone who was 80 years old with arthritis, poor vision from macular degeneration, and hearing problems.
    - **Rearrange.** Can you use a different organization, layout, sequence, or arrangement? Can you move things around? Can you invert or reverse the order of controls in a user interface? Berkun (2004) proposes several other "tricks" for stimulating new ideas during brainstorming sessions.

- **Use random theme generators.** Here you might have a list of random words, attributes, colors, shapes, or other stimuli that you use for design brainstorming. You would pull out random sets of words and ask how you would design something with these attributes.
- **Eliminate constraints.** Explicitly remove common barriers like cost, current technology, schedule, safety features, and expertise, and see what ideas emerge when people are not operating with assumptions about everyday constraints. What could you do if you removed some of the things that the development team said "the development kit doesn't support"?
- **Add constraints.** Here you might impose constraints and generate ideas that fall within those constraints. For example, you might add a constraint that the product must work "under water," "in bright desert sun," or "in a hurricane." If you add the constraint that the product (and user) will sometimes be subject to intense vibration, you might come up with ideas for using a product in vehicles or while riding a bicycle.
- **"Rotate."** Berkun (2004) suggests adding a bit of physicality to brainstorming by asking people to get up and move one chair to the right or left. The rationale for rotating seating position is that a surprise physical action might loosen the participants up and inject a bit of levity and energy into the session. Rotating is potentially risky if your colleagues lack a sense of play in the workplace. Before trying actions that are clearly unusual like rotating seats, consider your audience carefully.

If you will be called on to facilitate brainstorming sessions or focus groups, keep a list of these methods with brief instructions on how to apply them if a brainstorming session starts to lose energy. These creativity stimulation techniques take practice, so try some of them out on a small and friendly group first. You can find other techniques for idea generation in books on creativity and design.

Where to Find Some Creativity Techniques and Tips for Facilitators

There are many books out with techniques for stimulating the creativity of your colleagues including:

Epstein, R. (1996). *Creativity games for trainers: A handbook of group activities for jumpstarting workplace creativity*. New York, NY: McGraw-Hill.

The Forensic Technician. *100 online brainstorming tools to help you think outside the box*. <http://www.forensicsciencetechnician.org/100-online-brainstorming-tools-to-help-you-think-outside-the-box/> Accessed 28.10.12.

Gray, Brown and Macanufo (2010). *Gamestorming: A playbook for innovators, rulebreakers, and changemakers*. Sebastopol, CA: O'Reilly.

Higgins (2005). *101 Creative problem solving techniques: The handbook of new ideas for business (revised edition)*. Winter Park, FL: New Management Publishing Company.

Michalko, M. (2006). *Thinkpak: A brainstorming card deck (revised edition)*. Berkeley, CA: Ten Speed Press.

12. **Plan how you will record, track, and decide which brainstorming items to pursue further.** In most cases, you will probably enter the ideas into a spreadsheet or database for later use. A common complaint from brainstorming participants is that they often don't know how the ideas were eventually used. Keep in mind that ideas from one session might be useful a year or more later. You might consider keeping an online catalog of ideas that are searchable or an "idea book" where you organize ideas that might be reusable.

1.3.2 Conducting a Brainstorming Session

1. **Schedule time before the brainstorming session to prepare the room.**
   a. Arrive early to assess the brainstorming facilities. Check whether you have enough tables and chairs and that they can be moved around.
   b. Make sure you have paper, tape, sticky notes, markers, and other materials ready during the session. If you have to fumble with materials during the session, then you are wasting time and blocking the production of ideas by others. A subtle quality of good brainstorming is that of "smooth flow" where disruptive actions (like taking a few minutes to tape more papers on the wall) are minimized.
   c. Tape paper to the wall and have extra sheets ready for the ideas.
   d. Set up remote connections if you have distant participants. Remote brainstorming requires somewhat different rules as it is harder to know when remote participants want to contribute an idea.

e. Arrange the seats so everyone can see the ideas that are generated. If you are going to an unfamiliar location for brainstorming, it is worthwhile asking for a diagram of the room early so you can plan the best layout for the session.
f. Spread snacks around the room to increase the energy level and show that you care for your participants. One snack tip—consider bringing some healthy snacks like carrots, grapes, and celery. A minor, but common gripe at ideation sessions is the lack of low calorie, healthy food.

Ideas for Getting Input from Remote Participants

Many companies are using Internet collaboration tools to conduct business and exchange ideas with geographically dispersed teams. Remote brainstorming using these tools is difficult because it is hard to know when someone at a different site has an idea to contribute. Several possibilities for engaging remote participants include:

- Using electronic brainstorming tools with the remote meeting tool so your distant colleagues can see all the ideas.
- Asking remote participants to type their ideas into chat windows where they can be read off to everyone and added to a physical or electronic list of ideas. You could have someone assigned to type the local ideas into chat so the remote colleagues can have the benefit of seeing as well as hearing all the items.
- Instituting a rule for switching to a remote site and getting their input periodically. For example, you could explicitly ask your remote colleagues to list ideas on paper and then about every 3 minutes or so ask for their ideas to ensure that they aren't forgotten. The problem with explicit switching between the local and remote sites is that you will lose some time (and thus ideas) because of the lag between asking for remote input and getting feedback.

2. **Introduce the facilitator and ask the participants to introduce themselves if they do not know each other.** Introductions are important and you might want to do something creative for the introductions, but don't let them drag on too long or allow people to talk past your general guideline—say 1 minute per person. You could make the introductions into a warm-up exercise as noted earlier in this chapter.

3. **Describe the topic of interest and how long the session will last.** Display the topic or question for the session prominently by writing it in large clear text on a board or poster (or computer projection) so that it is visible to all participants. This is important for keeping the meeting focused. Focus on one major topic or one aspect of a problem at a time. Nijstad, Diehl, and Stroebe (2003) recommend breaking large problems or topics into several pieces to keep the level of productivity high throughout the session. The introduction of new pieces of a problem or a new topic will lead to increased motivation and idea generation, and will postpone the feeling that ideas have run out.
4. **Include short breaks (5–10 minutes) during a brainstorming session to stimulate different approaches to a problem or to overcome mental blocks.** Schedule short breaks every 20–30 minutes if you have a long brainstorming session or multiple topics to cover. Brainstorming is intense activity and short breaks will keep the ideas flowing. Give the participants cards or sticky notes to write down any thoughts they have during the breaks.
5. **Describe brainstorming to the group and explain the key principles and ground rules of your brainstorming session.** Write these principles and other ground rules on the board or create a playful poster or handout as a constant reminder about what will make the session successful. One of your rules could be that you will explicitly note when someone breaks a rule ("John, you are telling a war story"). Some specific principles that you need to point out every time you conduct a brainstorming session include:
   a. **No criticism, praise, or discussion of any ideas (other than to explain something like an acronym or unfamiliar idea or phrase).** This can include verbal disparagement ("what a dumb idea!") or nonverbal behaviors (facial expressions or body language that indicate disapproval). While most organizers of brainstorming sessions stress the cardinal rule of "no criticism," it is important that the facilitator be aware of subtle verbal and nonverbal behaviors as well as blatant attempts to criticize participants. Keep in mind that "praising" one idea is subtle criticism of "un-praised" ideas.
   b. **Quantity is the sole measure of brainstorming effectiveness.** Stress that the only metric for brainstorming is the sheer number of ideas that the group can generate and anything that gets in the way of quantity is bad.

c. **Ideas can be totally new, modifications of existing ideas, or ideas that come from combining other ideas.** Explain that there is no shame in expressing an idea that is an extension or modification of another idea or combinations of several ideas. If you were brainstorming breakfast foods your participants might come up with "pancakes" and "eggs" which could be combined into a "pankegg"—an egg cooked inside a pancake (which, by the way, is quite a tasty breakfast item).

6. **Describe what you will do with the brainstorming items that the group decides to examine further.** Failure to inform people about how the ideas will be used may lead to skepticism about the value of brainstorming.
7. **Designate one or more notetakers for the brainstorming session.** For many sessions, the facilitator can write the ideas on the work surface. For longer (and larger) sessions, you might consider several notetakers who alternate recording the ideas so writing delays don't interfere with the brainstorming. If you have two notetakers, one person could write the items on a board or easel while the other writes them on sticky notes for later grouping and prioritization. If you use several notetakers, work out the basic rules for who writes what, when. For example, one rule could be to divide the room or table where people are sitting into two areas and have each notetaker write down the ideas on sticky notes from one side of the table.

   The act of recording ideas during brainstorming is essential, but must be done in a way that does not disrupt the flow of ideas. If ideas are flowing quickly, a person who is a sluggish writer will slow the brainstorming down and reduce the quantity of ideas. So, in your planning, consider how to you can capture ideas efficiently and accurately.

   Here are some suggestions about how to make the capture of ideas efficient:

   - Choose someone with domain knowledge so he or she is familiar with the terminology that the group will use and won't have to ask clarification questions too often.
   - Choose a notetaker who is a fast typist or writer.
   - Consider using two notetakers with simple rules for who takes what notes.
   - Have enough materials at hand for writing and recording. For example, if your notetaker is writing on sticky notes, then have an ample supply of notes and extra markers nearby (How many

of us have been in a meeting where there are brilliant ideas flowing and suddenly the facilitator's marker dries up and there is silence while everyone looks for a good marker).

8. **Describe what you will do with the brainstorming items that the group decides to examine further.** Failure to inform people about how the ideas will be used may lead to skepticism about the value of brainstorming.
9. **Consider a warm-up for your brainstorming.** This warm-up could be a short practice run on a fun topic that you do just before your planned brainstorming session. This warm-up should take only a few minutes but can help loosen inhibitions and put participants in a positive mood. Positive moods have been linked to increases in individual creativity (Grawitch, Munz, Elliott, & Mathis, 2003; Isen, 2000) so taking some time to set up the brainstorming session as a positive, fun, and creative activity is a worthwhile investment. Spreading small plates of candy, grapes, or nuts on the table could be part of your mood enhancement plan.
10. **Review the topic, problem, or question that is the focus of the brainstorming session and remind participants of the brainstorming rules.** Let the participants know that if they violate the rules the facilitator will provide gentle reminders. Ask if there are any questions and if not, begin the brainstorming.

Competitive Brainstorming Can Increase the Quantity of Ideas

Paulus and Dzindolet (1993) conducted a study where participants were given goals that were about twice those of a "typical performance." The groups given high goals increased their performance by about 40%. In addition to setting specific goals, you can urge people to get to the next level by exhorting participants with statements like "we have 90 ideas, let's try for 100 or more!" If you are doing electronic brainstorming you could indicate the average number of ideas being generated per person (although never identify anyone by name). As a general rule, the expectations for group performance should be set reasonably high (Paulus & Brown, 2003).

11. **Invite participants to shout their ideas so that everyone can hear, one idea at a time, as quickly as possible.** Do not let participants:
    - Interrupt one another.

- Start elaborating on ideas beyond what is needed to understand the ideas.
- Engage in distracting side conversations, phone calls, texting, or other activities.
- Worry about quality.

What Do You Do When the Rate of Idea Generation Slows Down?

During a brainstorming session, the rate at which ideas are generated will vary from fast and furious to slow and awkward. If there is a lull, take a short break or try a different approach. For example, the facilitator might focus on one idea and ask for variations on it rather than press for completely new ideas. Facilitators can also try using analogies, random words, or other creativity techniques to stimulate some additional ideas (Higgins, 1994; Infinite Innovations, Ltd., n.d.).

12. **Ensure that each idea is understood and adequately captured before accepting the next idea.** Allow for brief questions to clarify ideas, terminology, abbreviations, or anything that might not be understood by every participant.
13. **Review the items with the group.** At the end of a session, clarify any unclear or ambiguous items so you will know what each item means even days or weeks later.
14. **Combine duplicate items into a single item.** As noted earlier in this chapter, having duplicate ideas is not a problem—simply combine them into a single item.

1.3.3 After the Brainstorming Session

1. **Designate a specific person or team to handle all the data after the session.**

   Capture all the ideas and record which ones will be considered further. Catalog the ideas, preferably in a database that is easily accessible. Ideas that were not considered important at first may become important later. Your ideas could be useful 2 years from now or help another group who had a similar problem with a different product.

Information Networks to Keep Ideas Alive

Ideas and hunches come from brainstorming and many other sources. Johnson (2010), in his brilliant book, *Where Good Ideas Come From: The Natural History of Innovation*, advocates an open information network that keeps good ideas around and visible to anyone in an organization. Johnson believes that the key to innovation is to keep ideas visible and "liquid" so they can easily be combined, expanded, and modified by everyone. So think about ways to capture your ideas from brainstorming, hallway conversations, meetings, and other activities and make them visible to others. Perhaps ideas could be posted on large monitors in hallways and pulled up from old meetings from the idea database. You might find that the next big idea comes from an idea from an old brainstorming session and a hunch that you had at lunch. You could use tablets as "idea catchers" and "idea labs" that keep ideas alive and banging together until something special emerges.

Tip

If you have a lot of ideas, use a quick method to eliminate the weakest ideas before you use voting, rankings, or ratings. You might, for example, ask the team to sort items into a pile that merits further consideration and a pile that doesn't merit further action. Then you can take the ideas in the "further consideration" pile and reduce those to the best ideas through a rating or ranking process.

2. **Develop a plan for investigating the important items in more detail.** You might, for example, create a matrix of potential solutions, look at the costs and benefits of each, and then narrow the list of ideas to the ones that seem feasible under your current constraints. Some of the general approaches for making decisions about what ideas or solutions to consider further are (Borchers, 1999):
   - **Private rankings or ratings.** Participants in the brainstorming session privately rate the brainstorming items and the highest rated items are considered further. You might, for example, rate each idea on a simple 1 (low priority) to 3 (high priority) scale and then take the average value of the ratings for each idea. You could choose the top 10 for further consideration. Private ratings are at the core of the nominal group technique,

the Delphi method, and other brainstorming variations. Private rankings or ratings are useful for mitigating the influence of managers and loud, influential, domineering, or high-status colleagues.

- **Majority vote.** Participants vote on which ideas to consider and the majority rules. Majority voting can be unwieldy if you have many dozens or hundreds of items.
- **Consensus.** Consensus is an accord reached by a group as a whole. The brainstorming participants or the people designated to choose ideas must all agree on the best ideas through discussion and debate. Achieving true consensus on what ideas to consider can be difficult and requires time outside the actual brainstorming session.
- **Compromise.** Participants come to agreement about what ideas to consider further by giving up some of their individual demands.
- **Decision by a leader.** The final decision is made by a designated leader (who may or may not be the facilitator or one of the participants in the session). For example, the engineering manager who controls the development resources and has to make other trade-offs of time, features, and quality could make the final decision. At some companies, the product managers, who often define the requirements for products, might decide what ideas should be considered further.
- **Arbitration.** Another person or group makes a decision for the brainstorming participants. For example, a usability team might brainstorm solutions for a user interface problem surfaced by developers, but the development manager and product managers would be the final arbiters and make the final decision about which solutions to consider.
- **Criteria-based prioritization.** This is discussed in the data analysis section, but briefly, this approach would rate each idea against explicit criteria like feasibility, cost, and time. The highest rated items across the criteria are chosen for further consideration. Criteria-based prioritization can be hard if you have a large number of items so some way to reduce the number of ideas to a manageable size first is recommended.

3. **Consider a method for tracking which ideas are used during product development.** Assign ownership and due dates to the chosen ideas

and solutions so there is a clear assignment of responsibility for developing possible ideas and solutions.

4. **Collect feedback on the brainstorming.** You might ask participants to fill out a short survey or you might conduct a short "plus/delta" session where everyone is asked to discuss what worked well (the "plusses") and what could work better (the "deltas"). Apply good suggestions to future brainstorming sessions.

1.4 VARIATIONS AND EXTENSIONS TO BRAINSTORMING

1.4.1 Buzz Sessions (Also Known as the Philips 66 Technique)

The buzz session, or Philips 66 technique, is a way to generate ideas when you have groups that are too large for traditional brainstorming, like a college class or a group of colleagues at a professional conference. The buzz session divides a large group (say more than 12 people) into several smaller groups (4–6 people). The small groups are given a topic, a brief set of rules, and then asked to brainstorm for a period of time (6 people for 6 min in the Philips 66 technique). At the end of 6 minutes, the groups report on the results of their brainstorming (or other activity like prioritizing ideas). The idea here is that you might have a large group for a short period of time that could provide valuable input to a question or problem. The major benefit of this brainstorming variation is that it gives more people a chance to speak. A major disadvantage is that you have to coordinate multiple groups and decide how to report and combine the results (Brahm & Kleiner, 1996). You might also have some initial inertia to overcome if the people in the short-lived groups don't know each other.

1.4.2 Free Listing

Free listing is a fast way to get ideas on a topic or possible answers to a question. Free listing (Sinha, 2003) involves asking individual participants or a group to list as many ideas as possible on a specific topic in a short period of time, often just a few minutes.

Some examples of free listing questions for user-centered design are:

- List all the ideas you have for solving (description of a problem).
- List all the tasks that you perform in the course of a week.
- List all the tools that you use in your work.
- List all the forms and documents that you use in your work.

- List all the functions that you use in (put product name here).
- List all the things about (put product name here) that frustrate or irritate you.

Free listing is a research technique used by cognitive anthropologists to uncover how different cultural groups classify concepts (Bernard, 2006). For example, you might ask members of a particular cultural group to, "List all the foods they eat." Trotter (1981) first asked 378 Mexican Americans what home remedies for illnesses they knew and then what illness was treated by which remedy. From these two questions, he was able to compare response frequencies by gender, age, place of birth, and other factors. The results of free listing can be used to rank order the words or phrases by frequency or other dimensions (Bernard, 2006; Hines, 1993).

Free listing can be used to understand terminology, concepts, behaviors, and beliefs. In the domain of user-centered design, free listing can be used to gather ideas and complement brainstorming and other idea generation methods. However, you can also use free listing as cultural anthropologists do, to understand cultural and cognitive domains of users and other stakeholders. Sinha (2003) recommends free listing as a method for understanding a domain or mental model by examining the frequency and order of answers to the free listing question. If there is statistical consistency across participants in the frequency and position of many items in a list, the researcher would have a "coherent domain"; if there is little consistency in the set of free listing items, the domain may not be too coherent.

Tip

You can use free listing as a way to get ideas from a very large group in a short time or as a warm-up exercise for group brainstorming.

Free listing questions can be asked in questionnaires, during individual or group interviews, in focus groups, in e-mail, listservs, wikis, and other online techniques. If you are using this information to study a particular group, you may want to conduct face-to-face free listing

so you can use probes to increase recall (Bernard, 2006). Brewer, Garrett, and Rinaldi (2002) compared two types of probes for increasing the number of items in a list:

1. **Alphabetic probes** in which you ask participants after a free listing activity if they knew any more items starting with successive letters of the alphabet. So after a person does a free listing about usability methods, you might say "Think of all the usability or user-centered methods that begin with the letter 'A' and tell me any new ones that you haven't already said." This might prompt a person to remember "affinity diagramming" and "A/B Testing." You would do this for each letter in the alphabet.
2. **Semantic probes** in which you instruct the participant to go through the list generated earlier and use those items as cues for additional ones. Here you would ask something like "Try to remember usability or user-centered design methods that are similar to [the first item listed by the participants]." For example, if a person had listed "heuristic evaluation," you could ask "Are there any other methods that are like a heuristic evaluation?" to which the person might remember that she had once used a "structured heuristic walkthrough." You would do this for each item in the original list. Brewer and his colleagues found that semantic cues were somewhat more effective than alphabetic cues for generating new items.

The benefits of free listing are:

- It is simple, but powerful.
- You can administer the free listing method to large groups as well as individual participants.
- Free listing can be done face to face or remotely using the phone and a variety of electronic methods like chat or wikis.
- It is a quick way to gather information about a domain, product, or process.

The drawbacks of free listing are:

- Participants may forget items.
- Participants may not understand that they should generate an exhaustive list, though good instructions can help.

- Answers may require some interpretation. For example, if you asked participants to list all the attributes that they associated with user-friendly products, they might combine two separate attributes in a compound phrase ("quick and easy to learn"). You might also have people use idiosyncratic phrases that require interpretation like "a kernel that keeps on goin" or close synonyms like "credible" and "trustworthy" where you might have to decide if they were similar enough to be a single item.
- The basic data analysis is simple, but it can also get complex and involve cluster analysis, multidimensional scaling, and other sophisticated analyses.

1.4.3 The Nominal Group Technique

The nominal group technique (Delbecq, Van deVen, & Gustafson, 1975; Higgins, 1994; McGraw & Harbison, 1997; Stasser & Birchmeier, 2003; VanGundy, 1984) is designed to reduce the social anxiety associated with face-to-face group brainstorming. In the nominal group technique, participants are given a problem or topic and asked to write ideas privately for a specified period of time. Then all the ideas are listed on a board by having each participant read out one idea at a time. If a participant doesn't have an idea, he or she can pass for that round. No criticism is allowed when the ideas are read out. When all ideas are listed publicly, the facilitator reviews each idea to see if any further clarification is needed. If so, the person who proposed the idea has 10–30 seconds to explain (but not defend, refute, or sell) the idea.

After everyone understands all the ideas, the participants vote on the ideas using a secret ballot. If you are going to vote right after brainstorming, you can put numbers on each idea and hand people a "ballot" with corresponding numbers and ask them to vote for a number (say 10 or 20) of ideas that they think warrant consideration. The ballots are anonymous—no names are associated with the votes. The votes are tabulated during a break and the ideas with the most votes or highest average ranks are chosen for further consideration. If there are too many ideas after the first voting session, a second round of voting can be conducted.

Using Anonymous Idea Cards in the Nominal Group Technique

To reduce the anxiety of participants in the nominal group technique even further, you could present the topic or question and then ask everyone to spend a few minutes writing ideas on 3×5 cards or sticky notes—one idea per card or note (Teaching Effectiveness Program, n.d.). When time is up, you can collect the cards and then redistribute them randomly to the group. Then ask participants to read aloud what is on each card as they place them on a large table or stick them to a wall. Participants can ask for clarification on the items. Then you can conduct the secret ballot on the ideas. This approach separates people from ideas and is meant to reduce the anxiety associated with the creation of ideas and voting on the best ideas.

The benefits of the nominal group technique are:

- A reduction of the social inhibitions and anxieties that might occur in traditional brainstorming.
- A highly efficient method for generating ideas.
- A better chance for equal participation because quiet, shy, or fearful participants have a chance to state their ideas.
- A separation of ideas from personalities of the originators (especially if you use the anonymous card approach mentioned above).
- A reduction in the evaluation apprehension that group members may feel if there are status differences among the participants (e.g., your boss or vice president is in the group).
- A sense of closure since private voting is a specific step in the procedure (it may or may not be in traditional group brainstorming).

The drawbacks of the nominal group technique are:

- Limited interaction among the group members.
- The relative obscurity of the method. It is not a well-known variation on traditional group brainstorming.
- A lack of synergy because all ideas are generated privately.
- A possible lack of convergence on what the best ideas are during the prioritization or voting (e.g., many ideas each get a few votes with no clear "winner").

For details on how to conduct a nominal group session, see *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes* (Delbecq et al., 1975).

Table 1.2 Negative Items from Reverse Brainstorming and Their Positive Counterparts

Topic: What Can We Do to Make Our Customers Dissatisfied?	
Negative Statements	**Positive Statements**
• Keep people from returning items—it is real expensive • Hide the link for returns to the company	• Highlight the liberal return policy in a clear block above the fold • Put the link at the top of the page for returns
• Avoid telling customers how much shipping is for their orders	• Provide an estimator for shipping before customers have to fill out a lot of information • Provide rough estimates in a table that shows the various ways to ship
• Hide the phone number for calling our company directly • "Virtual" companies should not tell people where they are located or how to call	• Provide a customer support phone number in the contacts area and also during checkout
• Do not tell people that their passwords are case sensitive. • Do not make it easy to retrieve passwords • Do not warn people that their password is insecure	• Provide a short tip on password formats • Ignore case (but require at least one number) • Provide an easy way to retrieve lost passwords

1.4.4 Reverse (Negative) Brainstorming

This is a variation on brainstorming where you ask participants to first brainstorm negative aspects of a topic and then, with the list of negative aspects visible, brainstorm positive items for related clusters of comments. (CreatingMinds.org, n.d.; MindTools, n.d.; VanGundy, 1984).

The basic procedure for reverse brainstorming is to:

1. **Brainstorm on a negative topic.** For example, instead of asking "How can we improve customer satisfaction?" you might ask "What can we do to make customers dissatisfied?" or "How can we cause customers to be dissatisfied?" or "How can we make customers mad?" You could also ask "What is everyone else NOT doing?" rather than list what they are doing to improve product satisfaction.
2. **Group related comments.** Arrange related items in groups to simplify the next step.
3. **Generate positive statements for the negative groups of items.** In Table 1.2, negative statements about customer support for an e-commerce site are listed in the left column and positive statements on the right.

4. **Evaluate the positive statements for potential solutions.**

The philosophy behind reverse brainstorming is that it is easier to find fault first, then use the faults as input on how to improve some aspect of a product or service. You might also use this approach when:

- You have a very judgmental group and traditional group brainstorming is difficult.
- You are working on a product or service that is complex to implement (Mycoted, 2006).

1.4.5 Delphi Method

The Delphi method was developed at the RAND research institute in the 1960s (Brown, 1968) to study the opinions of experts without having face-to-face meetings where psychological factors such as dominant personalities, status, or approval could strongly influence the outcome of the meetings.

> **Weblink**
>
> To learn more about RAND and the original Delphi method, see www.rand.org.

The Delphi method involves a coordinator and a group of experts who are given a problem and a questionnaire that asks for ideas about how to solve the problem, and general questions related to the problem (Delbecq et al., 1975). The experts provide reasons for their opinions which are then critiqued by the rest of the experts. After they fill out the initial questionnaire, the results are collated and summarized by the coordinator and sent back to the panel of experts with no names attached to the ideas. A second questionnaire asks more specific questions (based on the earlier results) and once again the anonymous results are sent around to the experts who evaluate the ideas from the second round and add any new ideas.

The coordinator repeats the process of summarizing the results and sending out new questionnaires until there is convergence on the best ideas for solving the problem. The selection of the best ideas can emerge as a result of consensus of the experts, or the final set of ideas can be ranked or rated anonymously. The Delphi method is most often applied to complex problems with relatively large groups of experts.

Given the complexity of modern software development where requirements must be multinational and design is done by multiple groups across many time zones, the Delphi method has a place in the repertoire of user-centered professionals.

Delphi Studies by E-mail

Early Delphi studies relied on traditional paper mail. The exchange of questionnaires and responses between the coordinator and the team of experts could consume many weeks. The Delphi method is powerful, but coordinators can spend many hours creating the succession of questionnaires and feedback forms necessary for converging on the best ideas. With e-mail, chat, and wiki software, this delay can be reduced considerably.

For current examples of the use of Delphi method, see Harrison, Back, and Tatar (2006) who employed a version of the Delphi method for project planning of design projects and Francis, Firth, and Mellor (2005) who used the Delphi method to examine user-centered design of assistive technologies with autistic users.

1.4.6 Remote Brainstorming

Remote brainstorming can be accomplished with synchronous (e.g., chat) and asynchronous (e.g., blogs, wikis, and other social media) communication technologies. Here are some general approaches for remote brainstorming:

- **E-mail.** Participants can do individual brainstorming and send items to an e-mail address where they are combined and then listed on a web site or other type of archive.
- **Listserv software.** Remote participants can submit ideas that are circulated to everyone on the brainstorming team. The facilitator compiles the items and makes them available to the group for prioritization or further review.
- **Online chat and instant messaging.** You can assemble a distributed team to brainstorm topics using chat or instant messaging software. Members of the brainstorming team are sent instructions beforehand with the topic of interest and rules for the session. The session is recorded and the ideas that are generated can be prioritized later. One of the problems with using chat or instant messaging is that

ideas can scroll out of view so you lose the ability to see everything, which is important for encouraging variations on ideas that were listed earlier.

- **Electronic whiteboards.** Electronic whiteboards allow distributed teams to post ideas in during a brainstorming session. You can use whiteboards and conference calling systems to run remote brainstorming sessions.

Tip

The first time you use a remote approach for brainstorming, conduct a pilot test with a small group of remote participants to work out technical issues, ground rules, and best practices.

- **Blogs and wikis.** Remote participants can add comments on a specific topic or question to a blog or wiki for a designated period of time.
- **Google spreadsheet.** Google spreadsheet is an efficient tool for conducting remote brainstorming sessions. You can assign individuals or teams at remote sites to a column in a Google spreadsheet and then have each person or group enter items into the column. As the items are entered, they appear in everyone's spreadsheet.
- **Specialized online brainstorming software.** A search of the Web using search phrases like "online brainstorming" or "brainstorming software" will reveal commercial online brainstorming tools and services with specialized features like threaded idea generation, features for organizing ideas, facilitator prompts, polls for rating ideas, and decision matrices where each idea is rated against a set of criteria.
- **Visual diagramming and mind mapping software.** Some visual diagramming and mind mapping software can be used for brainstorming. Examples are Inspiration, MindMeister, and Mindjet MindManager.

Dennis and Williams (2003) compared electronic brainstorming to verbal (face-to-face) brainstorming and nominal brainstorming where people worked in the presence of each other but did not share ideas verbally or in writing. Their research revealed that electronic brainstorming can be an efficient complement to verbal or nominal group brainstorming especially for large groups.

1.5 MAJOR ISSUES IN THE USE OF BRAINSTORMING

1.5.1 What Is "Quality" in Brainstorming?

A mantra of brainstorming is that quantity begets quality, but just what is this "quality"? Quality in brainstorming research is generally measured by considering the novelty or originality of an idea and the feasibility or appropriateness of the idea to the problem at hand. So a quality idea might be considered as something that others haven't thought of before that can be reasonably implemented with the resources available. One way to examine the quality of ideas from brainstorming sessions is to have several experts rate ideas for their novelty and appropriateness. Other criteria used in research to evaluate the outcomes of brainstorming sessions include (Isaksen, 1998):

- Satisfaction with the ideas generated
- Flexibility of the ideas
- Generality of the ideas.

The often-repeated statement that quality comes from quantity is generally supported in the research literature. Diehl and Stroebe (1987), for example, found a high correlation ($r = 0.82$) between the quantity of ideas generated and the number of "quality" ideas.

One open issue with regard to the value of brainstorming is the overall impact of good brainstorming ideas on product success. What is the return on investment (ROI) associated with brainstorming and the ideas that are applied from the brainstorming? There doesn't seem to be a good answer for that yet.

1.5.2 How Many Participants Should I Have in Brainstorming Sessions?

Earlier in this chapter, the recommended number of participants for effective group brainstorming ranged from three to ten people with some diversity in background. The optimal size of a group is determined, in part, by factors that influence production gains (larger groups may have more synergy and more persistence) and production losses (social anxiety, evaluation apprehension, production blocking, and cognitive interference where old ideas start popping up and people have to think if the idea is new or old). Diversity, for example, can result in idea production gains, but also result in losses if the diverse participants use a different language or have a different perspective

that results in communication problems (Nijstad, Diehl, & Stroebe, 2003).

There are many variables to consider when assessing what size brainstorming groups should be in a particular context, but there is a general trend in the research literature favoring relatively small groups of three to six participants. Heller and Hollabaugh (1992), for example, recommend small groups that do not exceed three people. In the real world, there is also a larger organizational issue that brainstorming with a small group may be seen as relegating the nonparticipants to an "outgroup" and engender some hostility in those who were not invited. So, for practical use, somewhere between three and ten people is reasonable and you can always run two medium-sized groups.

1.5.3 Social Issues that could Affect Idea Generation in Group Brainstorming

Brainstorming involves a number of social issues that can impair creativity (Paulus & Nijstad, 2003). These social issues include:

- **Fear of evaluation by other members of the group.** Evaluation apprehension, the fear or being evaluated or tested, is a serious issue for group brainstorming (Camacho & Paulus, 1995; Rosenberg, 1969). Participants may not want to put forth wild ideas if they are afraid of losing credibility, having their idea rejected, or being humiliated. Facilitators can reduce evaluation apprehension by:
  - Not inviting someone that the group fears. Avoid inviting managers who are tyrannical or several levels above most of the other participants. This is not the time to invite the CEO to drop by.
  - Stressing that the quantity of ideas is the sole criterion for brainstorming success.
  - Reminding participants that all ideas are welcome.
  - Pointing out that the participants will not be judged on the quality of ideas. The worst thing that any facilitator or manager can do to stifle brainstorming would be to hint (or publically state) that the results of brainstorming will be used as input to employees' performance reviews.
- **Competition for speaking time.** Facilitators should encourage participants to:
  - Respond crisply.
  - Not belabor an idea once it is understood.

  - Avoid criticism.
  - Watch for cues that someone is struggling to get his or her ideas out. While everyone should have a chance to speak, forcing people to speak or "going around the table" for input from everyone is generally not recommended. Putting people on the spot can be terrifying.
- **Listening to others.** A common (and often ignored) rule in brainstorming is that only one person speaks at a time. Some brainstorming researchers and practitioners even recommend that participants raise their hands if they have an idea to avoid interrupting a person who is currently expressing an idea. However, requiring participants to raise their hands may seem too juvenile for many professional offices.
- **No side conversations.** A primary responsibility of the facilitator is to suppress side conversations because they will distract the group and block the production of new ideas.
- **Avoid "filler conversations".** Filler conversations occur when a participant states an idea and then goes on to explain or elaborate excessively on the idea or "tells a war story." Filler wastes time that could be used to generate new ideas and can block the production of ideas by others who have to listen. Group brainstorming is more effective when filler material is kept to a minimum (Dugosh, Paulus, Roland, & Yang, 2000).

1.6 DATA ANALYSIS

1.6.1 Types of Data

Types of data that can be collected during brainstorming include:

- A list of ideas generated by the participants.
- Groupings of ideas into categories at the end of brainstorming sessions using the affinity diagramming method.
- Elaborations and explanations of ideas during review.
- A list of prioritized ideas.
- Ratings of the ideas on one or more criteria.
- Feedback about the brainstorming process itself.

1.6.2 Analysis Techniques

1.6.2.1 Listing Ideas

All the ideas from a brainstorming session can be listed in a spreadsheet, database, word processor, or specialized tools like PathMaker®

or Inspiration. If you have numbered the items sequentially as they were generated, your list would be chronological. To facilitate recall days, weeks, or even months later when you look through this list, you can annotate the list with clarifications and brief explanation of any unusual terms or abbreviations.

1.6.2.2 Affinity Diagramming—Grouping Ideas from Brainstorming

Affinity diagramming is a method for organizing qualitative data into related groups. For example, you could extract behavioral statements or other units of data from a series of field interviews, focus groups, or usability testing and then have your product team and other stakeholders organize the statements into related groups (Figure 1.1). These groups are then broken down into subgroups (and if you have large amounts of data, sub-subgroups). After creating a hierarchy of related information, the groups and their subgroups are given names. Affinity diagramming is often used to organize data from field studies, contextual inquiry, brainstorming, diary studies, usability testing, and other methods that generate qualitative data.

The affinity diagramming method originated with the software quality movement that began in Japan (Babbar, Behara, & White, 2002). The original intent of the affinity diagramming was to help

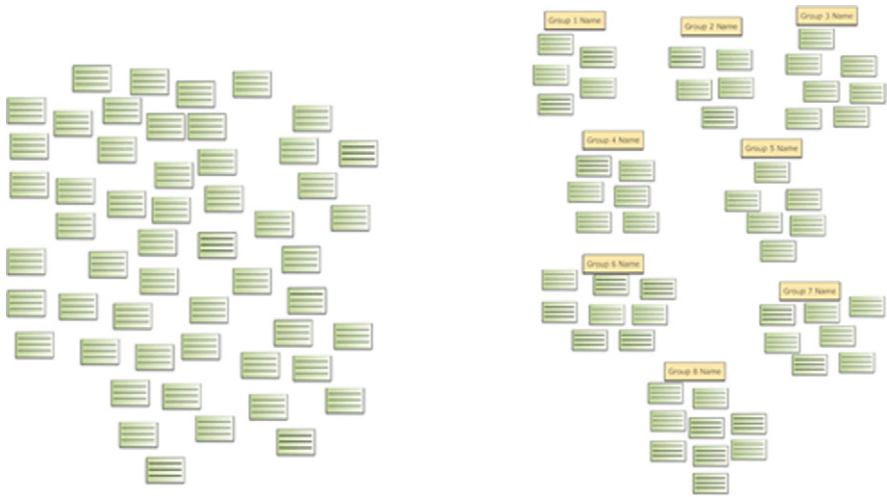


Figure 1.1 Ungrouped data before an affinity diagramming session and named groups after a session.

diagnose complex problems by organizing data from various sources to reveal themes related to the problem. The basic affinity diagramming method involves:

1. Gathering qualitative data from multiple stakeholders. This data can be text or images or work artifacts.
2. Writing units of data on "sticky notes," note cards, or even magnetic "paper".
3. Placing the items on a large surface.
4. Asking the participants to organize the items into "affinity groups"—groups of items that "go together" or that are related in some way (Figure 1.1).
5. Breaking large groups of notes into smaller subgroups.
6. Asking the participants to generate names (often called "labels") for the affinity groups and subgroups.
7. "Walking the diagram" as a group to ensure that everyone is clear on the meaning of the items and names for the groups.
8. Drawing the diagram formed by the groups and subgroups. The part of the process is used to clearly show the relationships between groups.
9. Prioritizing the items for further consideration in the design of products or processes.

1.6.2.3 Voting on Brainstorming Ideas

A group can vote on which brainstorming items should be considered further by placing adhesive dots or ink marks on items, by removing items from the master list, or voting online using tools like Excel, Google Spreadsheet, or SurveyMonkey.

1.6.2.4 Criteria-Based Evaluation

Criteria-based evaluation uses a decision matrix to choose the top ideas from brainstorming. The people charged with choosing which ideas will be considered further rate or rank each idea against a list of criteria like cost, ease of programming, novelty, and generality. The ratings or rankings for each idea are averaged, the ideas sorted by the average value, and the top rated or ranked ideas chosen for consideration. Criteria-based evaluation can be done with online survey tools if you want to expand the choice of top ideas beyond the original brainstorming participants (Table 1.3).

Table 1.3 A Decision Matrix for a Criterion-Based Approach to Choosing the Best Ideas from Brainstorming

	Criterion 1	Criterion 2	Criterion 3	…	Criterion *N*	Sum	Mean Rating/ Ranking	Top Ideas
Idea 1								
Idea 2								
Idea 3								
Idea 4								
Idea ….	…	…	…	…	…	…	…	
Idea N								

1.7 WHAT DO YOU NEED FOR BRAINSTORMING?

1.7.1 Personnel, Participants, and Training

You need a small, diverse group of three to ten people for a brainstorming session and a facilitator who will explain the process and keep the session going efficiently. An experienced facilitator is important for successful brainstorming. Key attributes of a good facilitator for brainstorming would include:

- An ability to keep participants from engaging in critical analysis of ideas too soon.
- Sufficient energy to keep ideas flowing.
- A focus on the quantity of ideas rather than the quality (quality assessment comes later).
- Acceptance of radical ideas.

Training requirements for the brainstorming facilitator are moderate. Research into methods for generating ideas (Paulus & Brown, 2003) highlights the need for experienced facilitators who are trained in procedures for effective group interaction (Paulus & Brown, 2003). Facilitators should be trained to:

- Apply the brainstorming rules consistently.
- Motivate participants using a variety of prompts.
- Ensure that no one dominates the session.
- Keep the focus on one issue, question, or topic, at a time.
- Notice when people are becoming fatigued.
- Be aware of best practices for ensuring effective group interaction.

- Deal with the occasional silent period. Sometimes participants will need to think a bit so the facilitator should not panic at momentary lulls in the conversation.

Training requirements for participants are relatively low. A short introduction to the brainstorming method and a clear statement of the rules are basic requirements. The most difficult training issues for participants are probably those of minimizing verbal and nonverbal criticism and keeping filler conversations and war stories to a minimum. Smith (1993) found that groups with just 5 minutes of training on the effects of criticism of ideas produced more ideas than groups with no training. Examples of verbal criticism and other behaviors that will result in production blocking and fewer ideas should be a standard part of training for brainstorming.

1.7.2 Hardware and Software

No special hardware of software is required for brainstorming. Brainstorming can be done by writing ideas on a board or using sticky notes that you can affix to a board, wall, or other large surface. If you plan to organize ideas, using sticky notes makes grouping simple but may slow down the brainstorming (you may want two notetakers to write down items). You could also have someone type in ideas on a computer and project them to the brainstorming group (this is useful for remote brainstorming with distributed groups).

You can use software like Word and Excel to capture ideas from brainstorming sessions, but these business applications make it somewhat hard to move items around quickly and easily. Software tools like Inspiration and MindManager can be used to capture ideas quickly and then move and categorize those ideas.

1.7.3 Documents and Materials

The key documents for group brainstorming include:

- A checklist with all the activities that you need to prepare and conduct the brainstorming session.
- A statement of the problem or topic for brainstorming. This statement should be given to all the participants or posted in the location that is visible during the brainstorming session.
- A set of brainstorming ground rules.
- A list of the ideas generated during the session.

- A list of the ideas that are chosen for further consideration (through ratings, rankings, or other forms of prioritization).
- An action statement or plan that describes who is responsible for following up on brainstorming ideas.

The only materials you need for face-to-face group brainstorming are sheets of paper, pens or markers, easels with poster paper, and some way to attach the pages of brainstorming to a wall or other surface that can serve as a temporary idea display.

RECOMMENDED READINGS

Higgins, J. M. (1994). *101 Creative problem solving techniques: The handbook of new ideas for business*. Winter, Park, FL: The New Management Publishing Company. Higgins' book is a compendium of problem-solving techniques. This book describes methods at a high level and provides practitioners who have used some traditional methods like face-to-face group brainstorming with variations for special cases (e.g., very large groups).

Osborn, A. (1963). *Applied imagination: Principles and procedures of creative problem-solving (third revised edition)*. New York, NY: Charles Scribner's Sons. This is considered a classic book on modern brainstorming. Alex Osborn, who began his writings on brainstorming in the 1940s, wanted a type of meeting that would reduce the inhibitions that block the generation of creative ideas. Many of the classic rules for modern brainstorming originated with Osborn. This book is out of print, but a worthwhile read if you can locate it. There are a number of versions of this book, each incorporating new ideas from Osborn. The 1963 version is the most-often cited. Used copies are generally available and reprints can be found at http://www.creativeeducationfoundation.org/press.shtml#imagination.

Paulus, P. B., & Nijstad, B. A. (Eds.). (2003). *Group creativity: Innovation through collaboration*. Oxford, UK: Oxford University Press. Paulus and Nijstad have edited a book that captures a wide range of research into group creativity. Much of the book deals with brainstorming and related methods for generating ideas and solutions to problems. While the book is loaded with research and theory, most chapters have a set of practical implications for group creativity methods like brainstorming and brainwriting. The book discusses both face-to-face and electronic methods and their respective strengths and weaknesses. The book highlights how social inhibitors can affect creative productivity and provides some research-based tips on how to overcome these inhibitors.

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