

# Using Improvisation to Enhance the Effectiveness of Brainstorming

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## ABSTRACT

Group brainstorming is a popular ideation method for design teams, yet brainstorming outcomes vary greatly. The method depends on individuals working collectively to generate ideas, and so group dynamics determine whether the method succeeds or fails. This paper explores how interaction designers used techniques from theatrical improvisation, or improv, to adhere to the rules of brainstorming thereby enhancing group interactions while collaborating. The usefulness of improvisation for brainstorming stems from the similarity of the goals of improvisation and brainstorming, the similarity of the recurrent problems that actors and designers encounter when collaborating, and the distinctness of the ways each have devised to resolve the problems that block the group's performance. This paper reflects on the individual- and group-level outcomes for design students and practitioners while brainstorming.

## Author Keywords

Design Methods, Creativity Support Tools, Collaboration, Brainstorming, Improvisation

## ACM Classification Keywords

A.1 General Literature

## INTRODUCTION

Group brainstorming is a popular method used by design teams to generate new ideas. When brainstorming face-to-face, individuals gather together for a discrete amount of time to generate ideas on a proposed topic. Before a brainstorm begins, participants often agree to follow a set of rules initially identified by Osborn as essential to effective brainstorming in his 1953 book, *Applied Imagination* [15]. Osborn's rules for effective brainstorming encourage people

to withhold judgment, build on the ideas of others, generate a large quantity of ideas, free-wheel, and identify a leader. The rules are intended to govern participant behavior and enhance the productivity of the brainstorm. Although this short set of rules are often difficult for groups to adhere to, they are easily remembered and are espoused by high-status design organizations such as IDEO as supporting effective brainstorming among cross-functional design teams [2]. The rules have shaped the way that brainstorming is practiced and have arguably contributed to the broad diffusion of brainstorming as a group idea generation technique. Brainstorming, especially the variety codified and popularized by the likes of IDEO, is considered particularly relevant when tackling complex technological problems which require interdisciplinary collaboration to design an effective solution.

With its growing popularity, researchers have sought to understand the conditions that support brainstorming as an ideation method, that is, why and when Osborn's rules work. When brainstorming is effective, participants generate new and unexpected ideas by drawing on each others' preexisting knowledge to create new combinations of ideas not previously considered [8].

When participants are able to break free from cognitive, emotional, and behavioral bounds of socially shared conceptions of what is possible, they generate novel and valuable solutions. For this to occur, participants must feel safe sharing their knowledge, building on the ideas of others, and expressing their ideas fluidly to their group [21]. But brainstorming can fail in at least as many ways as it can succeed. When participants are unable to express their ideas fluidly, the brainstorm is less productive. Researchers theorize that when a group member shares an idea, others are unable to present their ideas and may forget to share their ideas later in the brainstorm when time permits. Further, participants may become distracted by others' ideas and unable to develop their own ideas [5].

Based on this research, designers have created tools to support the fluid expression of ideas. Electronic brainstorming software facilitates parallel entry and sharing of ideas among group members so each member can see the

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ideas generated by their group members, avoiding redundancy of ideas and waiting on others to express their ideas [4]. While electronic brainstorming software seems to facilitate synchronous ideation and idea sharing, brainstorm participants using such software often become interested in viewing others' ideas at the expense of entering new ideas themselves lest they miss an idea generated while they are entering their own idea on the keyboard [17]. Such computer supported brainstorming tools support some brainstorming imperatives, namely fluid idea expression and the generation of a large quantity of ideas, but they do not directly support other directives, such as building on each other ideas and taking turns speaking as outlined by Osborn. Neglecting one rule or another may not make a particular brainstorming session ineffective, but the persistent and systematic neglect of some rules rather than others may channel groups away from effective brainstorming outcomes they might otherwise achieve. Tools that make it easier for a group to access the benefits that each rule can provide may also enhance the effectiveness and reliability of brainstorming as a group ideation practice.

But few tools, computer supported or otherwise, have been identified as supporting the skilled use of all of Osborn's rules of brainstorming. Improvisation is useful for brainstorming because it shares similar goals, challenges, and ways to resolve the problems that block group effectiveness. Like improvisation, brainstorming is a creative collaboration between people with a common goal of developing engaging ideas in a discrete amount of time. Both practices rely on the uniqueness of individual participants working in concert with others. Improvisational theory is based on the belief that creative action can be taken without prior thought by assuming a specific cognitive stance towards others' and one's own ideas [10, 18]. When brainstorming and improvising, action is stifled when the group dynamic is disregarded. This paper aims to explore specific ways in which improvisation may serve to reinforce the rules of brainstorming, creating a group dynamic required for interdisciplinary idea generation.

Increasingly, user centered interaction designers concerned with improving interactions between users and complex technological systems are integrating improvisational techniques into their design practice [2, 3, 7, 14, 19]. Thus far, researchers have considered how interaction designers use improvisational performance to increase user empathy by re-enacting their experience in a staged environment [3, 19]. Designers create small scale low fidelity environments and design within this context to better understand the constraints and opportunities of the user's context. This practice of improvising everyday user performances is referred to as bodystorming and relies on interaction designers translating observational data to a simulated environment [3]. Concerned that staged environments may not capture the richness of the users' actual environments, researchers have considered how bodystorming may be

performed "in the field." While performing in the context in which users enact their daily routines, designers are able to integrate context rich feedback while designing [14].

Related work considers how interaction designers engage users in improvisational performances through participatory design, a process in which designers interactively create artifacts with users [2]. Designers simulate an experience such as traveling on a plane and ask users to hold props as substitutes for future tools while spontaneously navigating the travel experience. Users communicate their needs and possible uses for the props as they act [13]. Designers rely on participants to perform in staged environments that can easily be manipulated to better understand their needs and their experience interacting with complex systems [22]. While this research illustrates ways in which interaction designers use improvisation to gain empathy for users and to generate ideas, it primarily focuses on the performance aspects of improvisation and how performance improves usability and experience.

This performance focus is expected as improvisation was initially popularized as a tool for dramatic performance by theatre director and instructor Keith Johnstone. He developed principles of improvisation to encourage actors to interact spontaneously on stage. Recognizing that actors often become fear driven and self-focused while on stage, he designed exercises to relieve the fear and encourage collaboration. These exercises prepare actors to follow his directives such as "Dare to be Dull," "Make Others Look Good," and "Accept All Offers" [10]. While improvisation is commonly used to generate new drama, dance, and musical performances, Johnstone's principles of improvisation may be usefully imported by interaction designers as a toolkit to support Osborn's rules and to improve group dynamics for effective brainstorming. Designers may rely on improvisation beyond the performance aspect and use the practice as a way of fostering group dynamics that underlie group collaboration.

### **Principles of Improvisation and Brainstorming**

In this paper, I explore how improvisation can support group brainstorming among interaction designers. To do so, I describe how improvisation activities serve to reinforce the rules of brainstorming. For each application to a rule, I illustrate the use of improvisation activities. I conclude the paper with a discussion of the implications for brainstorming at the individual and group level.

The ideas and examples presented in the paper were developed throughout a five year period (2003-2008) while teaching improvisation to approximately sixty practitioners and 110 undergraduate and graduate students. The practitioners worked on product development teams at two large high tech firms in the Silicon Valley and the design students were engaged in team based design coursework at Stanford University's Joint Program in Product Design and Hasso Plattner Institute of Design (See Figure 1). The paper compiles reflections from teaching and observing the ways

in which participants integrated improvisation into their design work.

The length of improvisation training varied from two to sixty hours over the course of one day to ten weeks. For the practitioners, the improvisation training typically occurred during the launch of a product development effort. Their work demanded collaboration and coordination throughout the project's six month to one year long duration. For the students, their improvisation training occurred at various stages of industry sponsored design projects. Student teams worked together for the duration of the project which ranged from one to ten weeks. In most cases, the students had limited to no experience working together prior to the course. This situation is typical for many student design teams and requires students to quickly negotiate ways of working effectively together.

Both the practitioners and students were engaged in interaction design related projects. Examples of projects included interfaces for enterprise, financial, and knowledge management software, search engines, consumer websites, and mobile devices. To complete this work, practitioners and students worked in teams of four to six members. The teams typically included members with backgrounds in design, engineering, and business. Because the student teams were working on industry sponsored projects, like the practitioners, their projects had the potential to be introduced to market if proved viable during user testing.

I began teaching improvisation to design practitioners and students because I was broadly interested in the relationship between the practice of improvisation and design work. I was interested in understanding how the work practices of design teams were affected by training in improvisation. I use this paper as an opportunity to reflect specifically on how practitioner and student design teams integrated improvisation into their group brainstorming practice and by doing improved their ability to collaborate.

Designers who had been exposed to the principles and practices of theatrical improvisation reported regularly drawing on improvisation to skillfully use the rules of brainstorming popularized by Osborn. Osborn's rules advise brainstorm participants to 1) withhold judgment 2) build on the ideas of others 3) generate a large quantity of ideas 4) free-wheel and 5) identify a leader [15].

#### *Withhold Judgment*

Designers are advised to withhold judgment of their own and others' ideas generated during brainstorming [15]. The belief is that when evaluating an idea, cognitive capacity is diverted from generating new ideas oneself. Judgment reinforces socially shared conceptions of what is possible, making it difficult to conceive of novel solutions. When designers judge their ideas before sharing them with their group, they preclude the possibility that others will be inspired and see a possibility in their idea.



**Figure 1. Design students brainstorming after doing an improvisation activity.**

Osborn fully recognized the importance of evaluation for decision making, only he argued that premature evaluation keeps groups from effective brainstorming; he advised organizing a later session for evaluating ideas generated during a brainstorm [1]. Similarly, improvisers recognize the importance of evaluation, but again only once a performance is complete so as not to stifle spontaneity and interfere with the performance. Improvisers schedule time after a performance to discuss the highlights and challenges of their improvised performance on stage. Scheduling a future session to review and evaluate group performance reassures improvisers and brainstormers that their judgment is valued and has a place, but that place properly comes after the generative processes of improvisation and brainstorming.

In their work, while designers are required to be both harsh critics and open minded creators, transitioning between one mind set and another can be challenging. Designers used improvisation activities to transition to the non-judgmental frame of mind needed when brainstorming. To practice withholding judgment of their own ideas, before a brainstorm, designers played an activity called "Malapropism." This activity involves individuals walking around a room, pointing to familiar objects, and calling the object by another name out loud. For example, a player points to a lamp and calls it a "garage." The goal of the activity is to misname as many objects in the room as possible. Although participants are interacting directly, they hear others misnaming, thereby normalizing failure and breaking free from the normative scripts that constrain them to see the world as they are accustomed to seeing it [10, 18]. Through this activity, designers report that it is difficult to generate new names for familiar objects if they focus on critiquing their behavior or focusing on what the "correct" word should be. This activity supports the goal of brainstorming which is to orient participants towards generating novel ideas and fluidly expressing them rather than slowing down generation through critique.

Improvisers, like designers, not only have to be aware of withholding judgment of their own ideas but also of others'

ideas. By withholding judgment, they are more readily able to respond and build on each other's ideas. Like a sport, brainstorming requires focus and quick reactions to others' ideas. Just as a player learns to react quickly to a ball being passed to him, so does an improviser learn to react quickly to an idea being "passed" to him by another improviser. If either player pauses to judge the quality of the pass, the reception of the pass is hindered. Similarly, by withholding judgment of others' ideas, designers are better able to receive ideas, to see the strength instead of the weakness of the ideas, and to build on the ideas.

To practice this skill of receiving ideas without judgment, designers use an improvisation activity called Metaphor ball. Metaphor ball is an activity that involves players standing in a circle facing each other. The activity begins when one player "throws" an imaginary ball to another player in the circle. When "throwing" the ball, the player says the first part of a metaphor. For example, she might say, "Love is like a..." The other player extends his arms as if he is catching the imaginary ball and repeats the line, in this case, "Love is like a..." and completes the metaphor as quickly as he is able. The goal is to say the first thing that comes to the player's mind and then to explain the metaphor. For example, the player might respond, "Love is like a glass of water for they are both transparent and nourishing." Once this metaphor is completed, the player quickly "throws" another ball to another player in the circle saying, "Work is like..." The recipient completes the metaphor and the activity continues. The goal of the activity is to say what comes to mind as quickly as possible in reaction to what the other player has said. If a participant pauses to think about a clever response, s/he is encouraged to say the most obvious response to keep the activity moving quickly. Improvisers do not allow time for criticizing the idea that has been given to them by the other player or critiquing their own response. Designers find that by doing this activity, they not only withhold judgment of their ideas and others ideas, they also recognize the creativity that results from saying what first comes to mind. This is consistent with research that finds that when individuals, who are open minded to new ideas and who receive support for idea generation, benefit from a certain amount of time pressure [1].

Designers who practiced collaborative rapid fire idea generation generated ideas quickly with peers when brainstorming by focusing on idea generation rather than idea critique. The improvisation activity served as a low stakes warm up for the actual brainstorm. To generate novel ideas in a brainstorm, designers, like improvisers, react to new ideas and integrate them in their current thought.

#### *Build on the Ideas of Others*

Withholding judgment and building on the ideas of others are inextricably linked. To build on others' ideas, the ideas must first be heard. To hear ideas, designers must be paying attention to others. During a brainstorm, designers aim to build on each others ideas to develop novel and valuable

ideas. Similarly, during a performance, improvisers aim to build on each other's ideas to develop a novel and interesting narrative.

The practice of brainstorming in a group is built around the central premise that designers generate new and unexpected ideas by drawing on each others' preexisting knowledge to create new combinations of ideas not previously considered [2]. When designing solutions to complex problems, the ability to weave intelligence leads to superior performance. Similarly, improvisation is based on the premise that combining two people's ideas will create a performance that neither one of the actors could have created individually. By reacting in real time to each other's ideas, improvisers create narratives that engage audience members [10].

Designers practice the skill of building on the other's ideas, by playing a popular improvisation activity called "Yes, let's." This activity involves picking an imaginary activity in which the group will participate such as planning a party or going on a trip. Participants generate ideas and offer them to each other, beginning each offer with the phrase, "Let's" and the group responds to the suggestion with the phrase, "Yes, let's." The first player makes a suggestion such as "Let's travel in Paris" and then gestures in a way that supports her suggestion. Withholding any criticism that might spontaneously arise in a group member's mind—"What a stupid idea!" or "Ugh, I'd rather be in Japan instead"—the group responds, "Yes, let's!" A second player adds a suggestion, "And let's climb the Eiffel Tower" and gestures accordingly. The group responds, "Yes, let's." A third person adds, "And yes, let's return home and teach our friends how to speak French," and so on until the energy of the group begins to falter.

In the cases I observed, designers modified the "Yes, let's" activity to be product focused. For example, one group decided to design a product and company to support their product. The first designer began by saying "Let's design enterprise software that is easy to use." Withholding criticism, the group members smiled and said, "Yes, let's." A second designer made a second suggestion building on the first suggestion. She offered, "And let's make software that people look forward to using every day at work." The group responded in agreement saying, "Yes, let's." The designers continued until the company and product had been defined. The designers reported generating an idea that while seemed crazy at first led to a discussion of a market viable idea. By withholding judgment of each other's ideas and generating ideas in the spirit of collaboration were they able to generate such an idea. Designers and improvisers enhance their collaborative partnerships by building on the ideas of others and being open to unexpected possibilities to create new combinations of ideas not previously considered [7].

Osborn noted that for brainstorms to work effectively, "all minds must work together" [15]. He identifies little groups working separately in a group brainstorm as hazardous to the brainstorming process because everyone is not able to hear

all ideas generated. For this reason, designers aim to have one person speak at a time while brainstorming. If a designer generates an idea while another is talking, s/he is encouraged to briefly note the idea on a piece of paper and communicate the idea when s/he is able, thereby reducing the likelihood that s/he will forget his idea and increasing the likelihood that s/he will focus on the ideas being generated in real time. Similarly, improvisers aim to focus intently on the actions and words of their fellow performers so they may react accordingly. Without rehearsing, improvisers are able to perform together on stage in such a way that audience members are convinced their performance has been scripted because they respond to each others actions in expected ways, creating interesting narratives with interesting characters. Improvisers are able to perform in such a way because they are trained to listen to each other carefully and react in such a way that is natural. Because their attention is focused on each other, improvisers speak one at a time because they are aware if another is going to speak. They look at each other in the eye and by doing so are able to anticipate what and if another player is going to speak.

To cultivate this awareness of each other and the intention to speak, improvisers will warm up for a performance by attempting to say the letters of the alphabet one by one without interrupting each other. If two people say a letter at the same time, the players return to the beginning of the alphabet. The objective is to focus on each other's intention to speak rather than to derive a short cut for getting through the alphabet such as coughing as a signal before a player offers a letter. Interested in developing awareness of each other's intentions to contribute, one designer adopted this game for use before a brainstorm. She found that doing this activity before a brainstorm helped participants to transition from their previous activity at work and focus their attention on the participants of the brainstorm and their intention as a group. She observed the participants were holding one conversation at a time and building off each others' ideas.

When designers withhold judgment and actively listen to one another, they focus on what is happening rather than thinking about their own ideas - hearing and responding to what the participants are saying rather than contributing to the group dialogue independently of what is being said.

#### *Generate a Large Quantity of Ideas*

During a brainstorm, designers are encouraged to generate a large quantity of ideas. The belief is that when many ideas are generated, the likelihood of useful ideas increases. For a successful improvisation performance, improvisers must have many ideas and be able to react to the situation at hand. Designers practice being prolific idea generators using a modified improvisation activity called "New Choice." For this activity, two people stand side by side. A third player stands to the side. The two players begin to have a conversation about building a new product. When the player to the side doesn't like what has been said, s/he asks the player who last spoke to offer a new choice. If s/he is still not

pleased with that response, s/he asks the player to offer another new choice. The goal of the activity is not to critique but to have the players generate ideas as quickly as possible. For example, one player may say to another, "Let's create a product for the elderly." The other player may say, "Yes, let's build a safer walking cane." The third player coaches the second player to come up with a new choice by saying "New choice." The second player responds, "Yes, let's build a wheelchair for ice." The third player coaches the second player for a new choice again by saying "New choice." The second player says, "Yes, let's build a new limb for the elderly." The coach requests new choices until s/he is satisfied with the new direction. This activity reminds designers that ideas are not precious and that when prompted by others, they may generate ideas in areas in which they have not previously considered.

Osborn's directive to generate a large quantity of ideas is consistent with a popular design mantra which is to "Fail early, fail often" [11]. By failing early and often, designers learn what works and what doesn't work before designs go into production and failures are more difficult to fix. The thrust of the imperative is a designer's bias towards action and hands on learning rather than theoretical contemplation out of context. Improvisers similarly celebrate regular action [10, 18] because they believe that taking action leads to more opportunities to learn. When people act, they experience more successes and more failures. Successes breed confidence and failures provide learning experiences to inform future performances. Johnstone advises improvisers to "Fail cheerfully" [10]. By failing cheerfully, improvisers look to their failures with an eye towards improvement rather than with an eye towards criticism which may lead to paralysis rather than production on stage. While both designers and improvisers benefit from thoughtful contemplation of ideas and trends, both are inclined towards active hands on learning, creating multiple opportunities for successes and failures.

#### *Free-wheel*

When brainstorming, designers are encouraged to free-wheel, or generate ideas free of constraints [15]. Osborn argued that "it is easier to tame down than to think up." By this, he meant that it is easier to put constraints on an idea that it is to alleviate constraints on an idea. Similarly, improvisers generate ideas free of constraints when performing a unique show for their audience. Paradoxically, improvisation teaches that improvisers can more easily free-wheel when they are not trying to be clever or unique, but when they are "being obvious" with their fellow players [10]. Designers innovate not when they are trying to be clever but when they are attentively reacting to the needs and opportunities they observe. As they attend to their environment, they are inspired to take what may be an "obvious" solution in one domain and apply it to another [9].

Designers practice free-wheeling by playing a modified version of an improv activity called "Presents." During this

activity, designers pair up and pass a familiar object back and forth, generating alternative uses for a familiar object. When the object is received, the designer names the object and then describes an alternative use for the object. The goal of the game is to pass the object back and forth as quickly as possible while generating as many alternative uses as possible until the original use of the object becomes just one of many possible uses of the object. For example, while doing this activity, a pair of designers passed a small trash can back and forth developing multiple uses for the can such as a stool and a door stop. The first several ideas generated were ideas that more or less assumed the constraints and typical uses of the object. However, the designers realized that to generate more alternate uses, they had to relinquish their preconceptions of what a trash can or could be. As they continued the activity, the trash became a cup for giants and a boat for a mouse.

During this activity, designers practiced free-wheeling and were able to use this skill while brainstorming. Designers modeled for each other the generation of novel ideas that occurs when they are able to break free from cognitive, emotional, and behavioral bounds of socially shared conceptions of what is possible – the desired state for an effective brainstorm [21]. By seeing their collaborators participate in this behavior, they felt safe and encouraged to develop their own wild ideas when brainstorming. Like designers, improvisers craft engaging narrative performances by making verbal and physical offers on stage that come to mind immediately rather than hesitating and adhering to their perceived notion about should happen. Best improvised performances happen without hesitation.

#### *Identify a Leader*

Since the fruits of effective brainstorming are personally satisfying and value-creating, it is not surprising that group brainstorms are often scheduled. But too often the processes that need to be in place for brainstorming to be effective are neglected. Brainstorming can be treated as a magical practice that generates wonderful things through an unknown process [6]. Because the processes underlying effective brainstorming are misunderstood, many brainstorm sessions are scheduled with little more than a problem to address; rarely do groups explicitly commit to a structure and to set of processes to enhance the effectiveness of the brainstorm. One strategy that can help a brainstorming group manage group dynamics to enhance brainstorming outcomes is to identify a leader for the brainstorm. To resolve similar issues faced in improvisational theatre, improvisers elect coaches who are able to take a step back and assess what they refer to as “shape of show.” They offer coaching to improvisers. For example, if an improviser is making offers, but not being heard by his fellow players, a coach may advise the player to speak up. Similarly, designers trained in improvisation use active coaching during brainstorms. During a brainstorm, a participant noticed that another designer was drawing interesting ideas on his notepad, but only occasionally sharing his ideas. The participant asked him to share his ideas

and upon sharing them, he received verbal praise from the rest of the team. From that point on, the designer verbalized more of his ideas to the group and informed the output of the brainstorm. This is consistent with research that finds that trained facilitators enhance face-to-face brainstorms by motivating participation and protecting individuals from personal attack [12].

Improvisers are trained to carefully note the enthusiasm of their fellow players while improvising. There is an agreement among improvisers that if either the performers or the audience are not enjoying themselves, they may stop the show mid-performance and begin a new improvised show. Permission to stop a performance comes from the belief that no singular performance is precious and there are many more performances to be created. Similarly, designers trained in improvisation, reported carefully assessing the groups members engagement in a brainstorm. If the number of ideas generated is small, the pace of generation is slow, or if people are not eagerly participating, the leader may stop the brainstorm and suggest a new direction. This being said, if improvisers find themselves in a challenging position, unable to see the next step clearly, they will not stop the particular performance to avoid the challenge. In improv, scenes are most often stopped if “they don’t go anywhere,” if there isn’t a narrative tension that excites the improvisers and draws them further into their characters and relationships in the scene. Skillful coaching helps groups navigate the balance between moving on to another idea and facing up to challenges that might result in surprising and useful ideas.

#### *Brainstorm Structure and Place*

Designers liken a brainstorm to a full body sport that requires warm-ups and breaks. In this way, group performance may be enhanced with effective preparation and breaks from the activity. Designers trained in improvisation reported taking breaks during a brainstorm to review the rules of brainstorming by using improvisation exercises. Not wanting to interrupt the flow of ideas during a brainstorm, designers reported using improvisation effectively before the brainstorm began. When on the field, on the stage, or in a brainstorm, the action is rapid and participants need to rely on the skills developed during practice. Before a game or performance, athletes and improvisers warm up with exercises to remind them of the skills necessary for optimal game performance. Similarly, designers used improvisation exercises as warm up and to remind them of the skills necessary during a brainstorm. Designers also used improvisation to reinvigorate a group when idea generation was slowing during a brainstorm. Like a coordinated sport activity, brainstorming is a demanding mental and physical activity requiring concentration and agility.

Designers trained in improvisation have also noted the importance of people over space. Improvisers are trained to practice and perform wherever they may be – on a stage, on a bus, or on a boat. Improvisers emphasize the group dynamic over the location in which the performance takes place. As

long as the improvisers are able to communicate effectively with each other, they are able to perform. Similarly, designers trained in improvisation prioritize the group dynamic over the location of the brainstorm, the type of candy offered, and the writing surface upon which their ideas are recorded.

### IMPLICATIONS FOR DESIGN

When writing this paper, I had two objectives. The first objective was to describe specific ways in which techniques developed for improvisational theater can support interaction design teams while brainstorming. Improvisers have devised a set of techniques to preempt and resolve personal and interpersonal dynamics that impede successful improvising. Many of these techniques are different from those that designers have considered while brainstorming in that they focus on group collaboration rather than using performance to enhance usability. Since brainstorming and improvising groups share similar goals and face similar socially created obstacles, brainstorming groups can improve the effectiveness of their brainstorms by integrating the principles and practices of improvisation. Such integration is difficult, however, and involves the joint expertise of improvisers and designers who are able to interpret the experiences in a group brainstorming context. Designers who have integrated techniques of improvisation into their set of interpersonal skills to be used when working collaboratively with others have an expanded and powerful set of techniques for potentially enhancing the effectiveness of brainstorming sessions in which they participate.

The second objective was to reconsider the expected outcomes of brainstorming for designers at the group and individual level. Beginning with the group level, the majority of research finds that when individuals brainstorm in a group, they generate fewer and lesser quality ideas than when brainstorming alone [5]. Researchers posit that groups are less effective because individual processes are hindered by group processes. This research has been critiqued for evaluating individual and group effectiveness out of context [16]. The research has been conducted in labs with individuals who are not familiar with each other rather than in organizational settings with individuals who are familiar with one another and have established a working group dynamic. Additionally, the research considers teams brainstorming ideas with no incentive for implementation. In the design teams I taught and observed, the teams were highly motivated to design successful interactive technologies for implementation. This paper suggests that if an individuals practice skills such as attentive listening, withholding judgment, building on others' ideas, and rapid idea generation, they will be better prepared for idea generation in a group context.

In addition to generating ideas, my reflections are consistent with research that finds that brainstorming may support the organization outside of the brainstorming session itself [20]. As the design of technology based products and services

become increasingly complex and dependent on a diverse set of skill sets, the ability to communicate and coordinate across disciplines in real-time is critical. Improvisation may support such design teams as they adopt this contemporary approach to design work. Brainstorming offers an opportunity to foster a design team. Using improvisation to support brainstorming reinforces skills necessary for cohesive teamwork in cross-functional teams which are increasingly prevalent when designing complex technological supported products and services.

Like group brainstorming, improvisation is a social activity that requires participants to feel safe sharing their ideas with each other [21]. Improvisers "make offers" to fellow actors on stage and designers offer their ideas and co-create during brainstorming sessions. Consequently, both improvisation and brainstorming rely on mutual trust. Improvisational techniques foster the psychological safety necessary for individual contribution [21]. At the individual level, designers use improvisation activities to foster idea generation by not passing judgment on their ideas and communicating them to others. Designers seek to break free from the cognitive, emotional, and behavioral bounds of socially shared conceptions of what is possible, to generate innovation solutions during brainstorms. Improvisers have developed several powerful techniques towards the same ends: these techniques can be usefully employed by designers, as I observed among participants whom I taught. With both improvisation and brainstorming, group performance depends on individual contributions and interpersonal relationships. This is to say that interactions among interaction designers are critical for successful design. The value of improvisation is in its potential to support group dynamics that support the collaborative design work practice of brainstorming.

### CONCLUSION

Designers use improvisation to foster a group dynamic necessary for effective brainstorming. Designers adopt improvisation inspired activities to practice the rules of brainstorming designed to create a supportive group dynamic.

This paper builds on the growing body of work examining how interaction designers use improvisation to develop more impactful designs. As interaction design becomes increasingly complex and competitive, the reliability of innovation processes has become a focal issue. Brainstorming remains an unreliable process, though one that shows great promise as an idea generation process [21]. Decades ago, Osborn offered a set of rules that support the reliability of brainstorming. Theatrical improvisation offers a set of practices and principles that support a group dynamic that might enhance the reliable effectiveness of brainstorming. Empirical research is needed to understand the direct relationship between improvisation techniques and brainstorming outcomes as measured by the quality and quantity of innovative ideas. Additionally, research is needed

to understand when and how improvisation may support group dynamics necessary for other commonly used group design practices such as prototyping and user testing [3,19]. Although much work remains to be done to understand the work practices of design, this paper explores a potentially powerful alignment between brainstorming, group dynamics, and improvisation that had previously been inadequately considered.

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