SOUNDSTORM

COLLABRATIVE IDEATION FOR SOUND-DRIVEN DESIGN

AUTHOR
Rob Moleman

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Faculty of Industrial Design Engineering

GRADUATION COMMITEE
Chair - Elif Özcan Vieira
Mentor - Stefano Delle Monache

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SUMMARY

Product sounds are important in our interactions with them. The temporal and context-dependent nature of sound makes it difficult to design them. There is a semantic gap between how we talk about sound and how it is embodied. Sound-driven design aims to improve this in two ways. It proposes a human-centered design approach, focusing on designing for the listening experience instead of purely the sound. Secondly, it proposes a collaborative approach, iteratively designing the listening experience with all stakeholders throughout the project.

The four stakeholders of sound-driven design work and design with sounds in different ways. Sound designers are brought in late into a project and work on sound solitarily. They are experts at bridging semantic gaps. Acoustic engineers are solution-oriented and think of sound in terms of noise elimination. Design researchers are experts in guiding design processes and incorporating user needs but are ill-equipped for sound. Expert users are well attuned to the sounds of their context, which is vital information for sound-driven design.

During group ideation, participants use generative session methods to generate solutions to a design problem. If this collaboration is managed effectively, a group outperforms its members. Generated ideas are larger in quantity, quality, variety, and originality. During idea generation, participants use their creative cognition to generate ideas. The dual pathways model of creativity states that creative cognition is the result of persistence and flexibility in thought. These two cognitive processes can be primed to enhance creativity.

Based on this theory I designed Soundstorm, a quick and collaborative card game. Players take turns making product sounds based on randomized prompts. It should be played before starting a generative session, and positively influences its outcomes. Soundstorm is meant to improve creative cognition by priming the persistence and flexible cognitive process. Soundstorm allows players to practice vocal expressions. Playing a collaborative game increases social cohesion. Soundstorm was validated using a protocol study (n=18), in which 3 groups played a game before a brainstorm, and 3 did not. There was no increase in the number of ideas generated. There is an increase in iteration for the Soundstorm group, but the effect was not significant.

Future research into sound-driven design ideation should explore the fundamentals of sonic and verbal generative methods. Furthermore, sound-driven design should be applied in a collaborative project where problem and solution are allowed to coevolve over multiple iterations.

SOUNDSTORM

CONTENT:

20 Product Cards

60 Sound Cards

1 Timer

OBJECTIVE

Work as a team to get the highest score by successfully completing as many cards as possible.

SETUP

...le the 20 product cards, ... the top card. This will be the ... for this round.

... 60 sound cards, and ... in the middle. ... person draws the first ...

...AY

... sound ... tasks ... he ...

SCORING

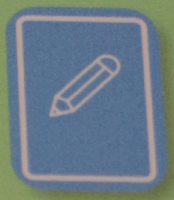
Count the cards in the discard pile, this is the score of your team.

CARDS

MAKE

Produce a product sound based on the card.

"Yada lada dadada"
- a happy stroller sound

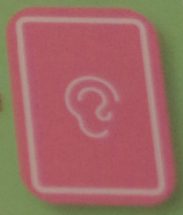


DESCRIBE

Use words to describe a product sound based on the card.

"Like dragging your finger through sand"
- a sleepy pencil sound

FIND



Identify a scenario where the product would make the sound on the card.

"When you land after taking a big leap"
- a trainhorn sneakers sound

REPEAT

Repeat the answer given by the previous player

REPLAY

Replay the challenge played by the previous player


MAKE A SOUND
WORRIED
FIND A
MOOIN

PREFACE

This report is the documentation for my graduation project for the master Design for Interaction. It was done at the faculty Industrial Design Engineering, at the Delft University of Technology. For the project brief that kicked of this project, see appendix D. This master thesis was done at the Critical Alarms Lab, a research lab at Industrial Design Engineering. Critical Alarms Lab collaborates with industry and medical partners to research complex sound issues in design.

In this thesis, I explore the concept of sound-driven ideation, and what the various sound and design experts need during this. I will first introduce the context of sound-driven design, and the four stakeholders involved in its process. These are Sound Designers, Acoustic Engineers, Design Researchers, and Expert Users. Then I dive into the field of ideation research, and what that would mean for sound-driven ideation. I introduce a collaborative board game, Soundstorm, meant to prepare players for a sound-driven generative session. Finally, this report concludes with a validation study, researching whether the board game has a positive impact on sound-driven brainstorms.

Thank you Elif and Stefano, for the opportunities and guidance. Not just for this graduation project, but also for the prior projects leading up to this. Your warm and clear feedback styles allowed me to explore and complete a solitary project of a size I have not done before. I would not have been able to navigate my pitfall without this.

Thank you to the numerous sound professionals, who took time out of their busy schedules to let me interview them. Thank you for providing an open and honest look into your workflows and introducing me to a world I knew nothing about. Thank you to the game design agencies, for kickstarting the design of my board game. Thank you for lending me your playtest methodology, and playtest groups.

Thank you to my parents and my dog Kobus, for providing a warm place to come home to. Thank you to my friends for tirelessly reading and reviewing my report drafts and participating in my playtests. Thank you to Steijn and Maarten for being there throughout my studies. A very special thank you to Ylva, and Merel, who went the extra mile in supporting me during the graduation process and helping me put my thoughts to paper.

Lastly, a thank you to the inhabitants of Thesistown, for the shared lunches and motivational talks. Especially, Kenneth, I hope my feedback on bikes was as useful as your feedback on sound.

Good luck with the Read.
Rob.

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01
GLOSSARY

In this chapter, I will explain the terms used in this report. First, I explain the concept of a Sonic Idea and its aspects based on the modes of listening. Then I will explain what the Means of Expression are. Finally, there is a clavis with other terms.

SONIC IDEA

In this thesis, the term Sonic idea refers to an idea that has been shared with others, often during group ideation, that relates to the product sound in some way. This sharing is done through a Means of Expression.

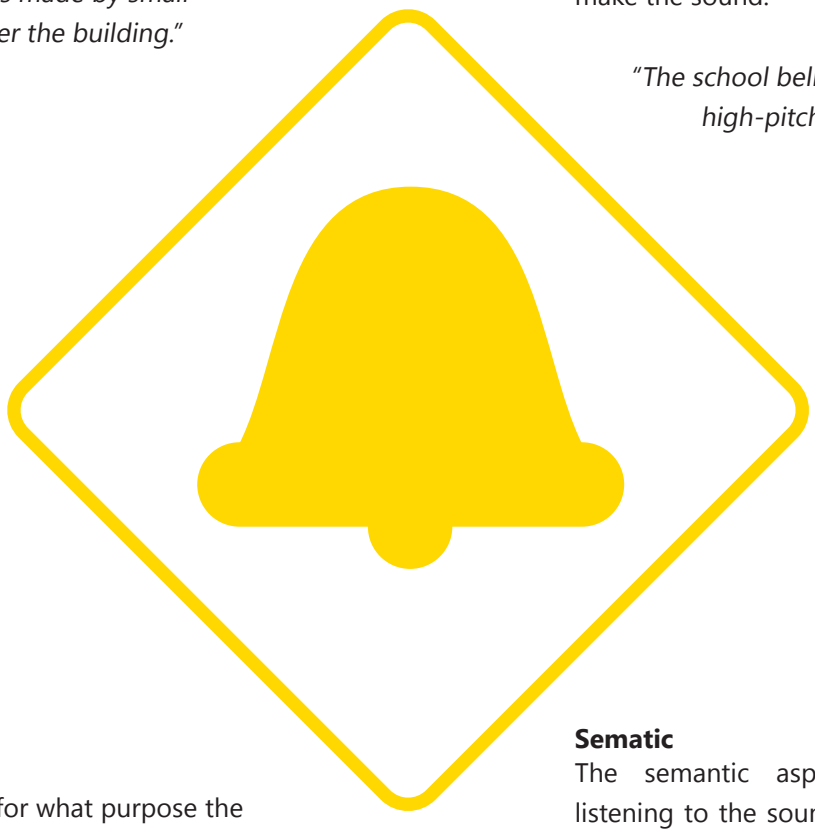
A Sonic idea might focus on a specific aspect of listening. These aspects are based on the nine modes of listening (Tuuri, 2012), of which the four denotative modes are relevant to sound-driven design (Delle Monache, 2022). These aspects are explained in figure 1, with examples of sonic ideas for a school bell. Any sonic idea reflects through all four aspects, though this might be implicit. When discussing differences through the empathetic aspects of sonic ideas, the semantic aspects will also differ. The aspects are different perspectives on sound that need to be considered in designing sound.

Casual
The causal aspect is the source of the sound. It would be how the sound is made from a technical perspective. A sonic idea focusing on this aspect would express how the sound is made.

"What if the sound is made by small speakers spread over the building."

Empathetic
The empathetic aspect is what the sound sounds like. It is a sound-focused perspective. A sonic idea focusing on this aspect would express existing sounds that the design should be similar to. With the school bell example, it would be the speakers used to make the sound.

"The school bell should sound like a high-pitched clock bell."



Functional
The functional aspect is for what purpose the sound is made. What is the function of the sound for the users. A sonic idea focusing on this aspect would express why or when the sound should be made.

"The school bell should play when there is only 5 minutes of lunch left."

Sematic
The semantic aspect focuses on what listening to the sound means to the listener. For a physically identical sound, the semantic aspect can still change depending on other context factors.

"When the school bell starts the lunch, it will feel great, whereas when it ends the break, it will feel bad."

Figure 1

MEANS OF EXPRESSION

Means of Expression is the communication method through which a sonic idea is shared with other people. There are multiple Means of Expression, which are commonly used for sharing ideas. The Brainstorm method uses verbalization as the Means of Expression (Osborn, 1963), Brainwriting uses pen and paper as the Means of Expression (VanGundy, 1984).

There are always limits to the sonic idea output through a Means of Expression. When there is only one pen, the Means of Expression is limited to one person at a time. When that one person is writing, they are occupying the Means of Expression, preventing others from expressing their sonic ideas. When you increase the number of pens, the limit then becomes the writing speed of the group members.

Similarly, with verbal Means of Expression, the limit is imposed by the talking speed of the group. In normal conversation, a verbal Means of Expression can be occupied by one person at a time, and occupying this Means of Expression takes effort (Sacks, 1978). However, this is not necessarily true for generative sessions, where people might be encouraged to talk over each other. For example, the brainstorm method does not prohibit talking over each other.

In this thesis, I focus on two Means of Expression, verbal descriptions of sound, and vocal scribbling. These are especially relevant for sound-driven design because they use sound in their expression, and are easily accessible (Ekman, 2010).

CLAVIS

Vocal scribble
Using your voice to express a sound (Delle Monache, 2019).

Problem space
The definitions that inform the problem for which a solution is designed, this in turn influences the solution space (Dorst, 2001).

Solution space
The potential areas where solutions to the problem are explored, this in turn influences the problem space (Dorst, 2001).

Generative session methodology
The set of rules and tools employed during group ideation.

Generative session
The time-constrained moment where group ideation is done.

Idea exposure
The synergistic effect that occurs during group ideation. Exposure to other ideas increases your idea output.

Ideation
Term for all diverging activities focused on solutions during a design process.

Problem space
The definitions that inform the problem for which a solution is designed, in turn, influences the solution space (Dorst, 2001).

Production blocking
Interference effect that occurs during group ideation. Production blocking is the inability to express an idea to the group.

Psychoacoustics
How people sense and perceive sound. Human sound perception is context-dependent (Ingold, 2000).

Sematic gap
The difference between how we discuss sound, and how it is embodied (Delle Monache, 2018).

Solution space
The potential areas where solutions to the problem are explored, in turn, influence the problem space (Dorst, 2001).

Sound designer
Sound professional, trained in making sound effects. Often for film.

Sound-driven design
Design method that emphasizes the listening experience of the product (Delle Monache, 2021).

Vocal scribble
Using your voice to express a sound (Delle Monache, 2019).

02
SOUND-DRIVEN DESIGN

In this chapter, I introduce the field of product sound design and why product sounds are important for the product experience. Then I explain the concept of Sound-driven design, how it can improve product sounds, and what the challenges are for sound-driven design. Then I give an overview of the four stakeholder types participating in sound-driven design, and their current design methodology. I conclude this chapter by focusing on ideation for sound-driven design.

PRODUCT SOUNDS

Product sounds are the sounds made by a product. This includes both Intentional sounds (van Egmond, 2008), made with a purpose, but also consequential sounds (van Egmond, 2008), the results of the mechanical functioning of a product. The sounds of a product play a big part in how we interact with them (Rocchesso, 2008).

Why is it important

Product sounds play an important role in how we appraise them (Özcan, 2006). When done properly it can improve the functioning of the product (Hildebrandt, 2016), or enhance its brand perception (Toppano, 2014). Similarly, when done poorly, or ignored, it leads to negative experiences. For example, the abundance of hospital alarms leads to a decrease in the performance of nurses (Kristensen, 2016).

SOUND-DRIVEN DESIGN

One methodology for dealing with the complexities of designing product sounds is using sound-driven design (Delle Monache, 2021, June). Sound-driven design combines three things, Human-centred design, Collaborative design, and Sound design.

Applying human-centred design to the design of product sounds means that you design for the listening experience, instead of designing the sound itself (Susini, 2014). With this paradigm shift, there come different ways of thinking and discussing sounds. Sound is a physical phenomenon, that upon sensing instigates a response from the listener (Truax, 2001; Gibson, 1966). Such a response can be minimal of course, the constant whirring sound of a refrigerator instigates little action from the user. When designing sound through a listening approach, the seven modes of listening are a useful framework (Tuuri, 2012). For sound-driven design, four of these are especially important (Delle Monache, 2022). These are the same as the aspects of a sonic idea as discussed in Chapter 2. They are divided into two categories, the sound category is about the sensing qualities of the sound, whilst the Human category is about the situated responses to the sound.

Navigating this design for the listening experience requires a more complete integration of all involved stakeholders during the sound-driven design process (Delle Monache, 2021, June). This collaborative design process is required to create an empathetic and context-aware shared cognition (Arias, 2000). Listening is inherently context-dependent (Ingold, 2000). One of the benefits of collaborative design is how it involves users from this context (Sanders, 2014). Collaborative design is vital for sound-driven design.

The final hurdle for sound-driven design is the semantic gap (Delle Monache, 2022). This semantic gap is the difference between describing sound and embodying sound (Delle Monache, 2018). This gap is not unique to the sound domain but shows up across design domains (Hu, 2013; Wang, 2020). In most domains, designers work by dividing the problem into smaller parts and iteratively working towards a solution (Roozenburg, 1991). In essence, they zoom in and out of a problem context whilst converging towards a solution. Because of the temporal-dependent and context-dependent nature of sound, this division strategy is not applicable (Delle Monache, 2018). When you work on part of a sound, and then introduce it into its full context, the listening experience changes (Ingold, 2000). Similarly, a sonic sketch is not as well equipped to model an embodied sound when compared to a visual sketch of a product's aesthetics (Delle Monache, 2018). This is the semantic gap that makes designing for product sound difficult.

Sound designers are professionals at bridging this gap (Hug, 2020). There also exist tools that help bridge the gap, such as sonic lexicons (Carron, 2017) or accessible sound concept tools (Vardanyan, 2023).

STAKEHOLDER FRAMEWORK

The core tenet of sound-driven design is to include all parties relevant to the sound throughout the design process (Delle Monache, 2021, June). For this project, these parties are separated into four stakeholder categories (Delle Monache, 2021, June). These are Sound Designer, Acoustic Engineer, Design Researcher, and Expert User. During this project I have surveyed literature and conducted interviews with professionals from these fields, to gain an understanding of how these stakeholders relate to sound and design for sound and listening. This is a summary of these findings.

Conclusion

Sound desginer

Overall, the working methodology of a sound designer bears many similarities to interaction design. The difference lay in the solitary nature of the sound embodiment, and the linear creative process employed. As far as skillsets go, sound designers are very good at shaping sounds to get desired experiences. Indeed, part of the challenges for sound-driven design is incorporating them earlier in the process (Delle Monache, 2021)

Acoustic engineer

The acoustic engineer is focused on eliminating or reducing sound. They do this in a systematic approach, using the source path receiver framework. The acoustic engineer is trained as a mechanical engineer. They are solution-oriented, focussing on solving the task at hand.

Design researcher

The design research is experienced in doing design, and in guiding other stakeholders through this design process as well. They are well-equipped to integrate the various needs of stakeholders during a design, focussing extra on user needs. The tools design researchers use are visual. They are also inexperienced in the sound domain. This makes them currently ill-equipped to manage the complexity of sound-driven design.

Expert user

Expert Users are well attuned to the context for which is to be designed. This is always relevant when designing, but especially important for sound. They have no standardized method of designing, and they need to be guided and involved in the design process.

Sound desginer

The Sound Designer is an artisan. They are responsible for the experiential qualities of the sound. Often this is done for movies or television. To get a better understanding of how sound designers work I conducted three semi-structured interviews, see appendix F for the topic list. With an independent sound designer, specializing in film and television, a sound design studio, specializing in games and interactive exhibitions, and a sound mixer, specializing in film and educating sound professionals.

Relation to sound and listening

Sound designers make and embody the sound. In doing this, they want to ensure the experience of listening to the sound matches the vision of the experience (Zattra, 2021). Sound is a tool to achieve a certain goal, often a feeling during an interaction.

Design methodology

Sound designers employ a linear method of working (Hug, 2020; Zattra, 2018), this is especially true for projects smaller in scope. They work from a desired vision from their client. The terms used for this sonic varied per interview, some called it sonic colour instead of vision. The sonic vision has much in common with the interaction vision method (Pasman, 2011). The sound designers are not involved in what this sonic vision is, though they do start projects by exploring what the sonic vision of the client entails. Sound designers are brought on late into most projects and have little say in the sonic vision, or the sonic experience of the result.

The sound designer then translates the sonic vision into sound effects, they bridge the semantic gap between sonic vision and embodied sound. Sound designers employ a variety of sound editing tools, sample libraries, and purpose-made recordings to generate sound effect concepts. This is a mostly solitary creative process, though in larger productions there is intermingling between other sound experts. Even in the sound design studio, sound concepts were generated solitary, though iteration on these concepts was done collaboratively. The process of translating a sonic vision into sound concepts is a learned skill of sound designers, that is trained by years of experience. It becomes second nature to them.

The sound designer then presents a selection of the sonic concepts to their client, who provides feedback. This feedback is then incorporated by the sound designer, and the finalized sound effects are handed off.

Conclusion

Overall, the working methodology of a sound designer bears many similarities to interaction design. The difference lay in the solitary nature of the sound embodiment, and the linear creative process employed. As far as skillsets go, sound designers are very good at shaping sounds to get desired experiences. Indeed, part of the challenges for sound-driven design is incorporating them earlier in the process (Delle Monache, 2021).

Acoustic engineer

The Acoustic Engineer is responsible for the technical execution of the designed sound. To get a better understanding of how acoustic engineers work during a design process, I interviewed (n=2) an acoustic engineer at a consultancy and an acoustic engineer at a shipbuilding company. These were semi-structured interviews, see appendix F for the topic list.

Relation to sound and listening

The acoustic engineer thinks in terms of noise, instead of sound (Delle Monache, 2022). Noise is treated as total vibrations of a system that are in the audible range (Cowan, 1993). The acoustic engineers I interviewed aim to keep the noise of a system within predefined ranges, either because of legislation or design demands. Psychoacoustics are not currently considered, but this is the focus of their new developments.

Design methodology employed

Sound and noise are treated as the dissipation of energy, that causes vibrations (Cowan, 1993). Acoustic engineers use a set methodology, the Source Path Receiver framework, to manage and control this dissipation (Cowan, 1993).

Source: the origin of the energy in the system
Path: the path the energy takes through the system as it dissipates
Receiver: the place where the energy exits the system, and becomes audible

This framework serves as a hierarchy for mitigating noise. The higher in the framework the mitigation the better the result. Removing the source of noise is more effective than damping the receiver (Cowan, 1993).

Acoustic engineers use a variety of tools and models to evaluate this. For example, the acoustic engineering consultancy I interviewed uses proprietary microphones and software, to analyse the source and paths that sounds take through physical products. They are often employed after a product has been launched, to try and locate noise issues. The acoustic engineers from the shipbuilder use digital models to simulate the noise behaviour of their ships, these models are then validated using audio sensors installed in their fleet. This allows them to predict the noise behaviour during the early stages of ship design.

Acoustic engineers are trained as mechanical engineers. This means they are more solution-oriented than the typical design researcher (Agogue, 2015; Vasconcelos, 2016). During ideation, they are typically more concerned with the technical feasibility of ideas.

Conclusion

The acoustic engineer is focused on eliminating or reducing sound. They do this in a systematic approach, using the source path receiver framework. The acoustic engineer is trained as a mechanical engineer. They are solution-oriented, focussing on solving the task at hand.

Designer researcher

The Design researcher is focused on all parts of the design process (Koskinen, 2013). It is a multidisciplinary role, combining the fields of technology, business, and psychology. The design researcher's main role is to incorporate the needs of the users into the design. When talking about the skillset and knowledge of design researchers, I am assuming those of one who graduated from the IDE faculty at TU Delft.

Relation to sound and listening

Design researchers are visual thinkers (Rowe, 1991; Eris, 2014). They are great at using visual media to communicate and structure complex contexts (Schon, 1992; Ware, 2010). This is also their pitfall in product sounds. Product sounds are often not considered during the design process, leading to noisy experiences (Langeveld, 2013). Sound is temporal, which translates poorly to visual representation (Gibson, 1966; Gaver, 1993). Design researchers currently do not know what they are doing when dealing with sound.

Design methodology employed

Design researchers use an iterative approach to tackle design problems (Roozenburg, 1991). There are many ways to divide this cyclical approach into steps. The returning principle in these ways can be summarized into four steps (Cross, 1992), Analysing the problem, Designing a solution, Testing the solution, and finally Evaluating. After which the process starts again, until a sufficient solution is designed. Each of these steps is first diverging, exploring the possibilities, which is then followed by a converging refinement. This diverging and converging of design activities is also captured in the double diamond model of design (Tschimmel, 2012).

Conclusion

The design research is experienced in doing design, and in guiding other stakeholders through this design process as well. They are well-equipped to integrate the various needs of stakeholders during a design, focussing extra on user needs.

The tools that design researchers use are visual. They are also inexperienced in the sound domain. This makes them currently ill-equipped to manage the complexity of sound-driven design.

Expert users

Expert users are those who will use or encounter the product/service that is being designed for. As such this is an extremely broad category, with the specifics dependent on the product/service. Some generalizations exist, which are based on literature from the participatory design and sound-driven design fields. During a sound-driven design process, the specifics of their Expert Users should be explored in detail. These will vary wildly between contexts.

Relation to sound and listening

It is the Expert user who experiences the sounds of their context. Both before and after the designed artifact is introduced. The Expert Users' attitude towards listening is mostly on the functional aspects (Delle Monache, 2022). The Expert User is the expert of their context (Ostroff, 1997). Since listening is inherently context-dependent (Ingold, 2000), it is vital to include the expert user throughout the sound-driven design process. Experts Users could better imagine what the impact of certain ideas would be on their context. During these sessions, the focus of their ideas was also more on the functional and semantic aspects of sonic ideas.

Design methodology

Expert users are great at knowing their context (Ostrof, 1997), but are usually inexperienced in the field of design (Sanders, 2008). Because of this, they do not have a fixed methodology of designing (Sanders, 2008). During cocreation it is the job of the design researcher to assist and guide the users through the design process (Sanders, 2008).

Conclusion

Expert Users are well attuned to the context for which is to be designed. This is always relevant when designing, but especially important for sound. They have no standardized method of designing, and they need to be guided and involved in the design process.

SOUND-DRIVEN DESIGN METHODOLOGY

There is a need for a collection of design tools and methods that are usable for sound-driven design (Delle Monache, 2021, June). Not all methods and tools are useful when designing product sounds (Özcan, 2006). The granular approach that is often used in engineering design (Cross, 2021) is ill-equipped to deal with the temporal nature of sound (Özcan, 2006).

This does not mean that there needs to be a collection of completely new tools and methods. The basic design cycle of iteratively working towards a solution also applies to sound-driven design (Nykänen, 2014). Similarly, collaborative design approaches have been used successfully for sound-driven design (Özcan, 2018). Similarly, designer-focused tools for prototyping sounds are developed, from high-tech solutions (Vardanyan, 2023) to ubiquitous tools such as vocal cords (Falkenberg, 2020). This thesis focuses on the latter type of tools, investigating how these can be used for group ideation.

03
IDEATION THEORY

In this chapter, I introduce the theoretical background behind group ideation. First, I will explain what group ideation is. Then I discuss what creativity is, and what the dual pathways model to creativity is. Then I discuss ideation research and the effects that occur during group ideation. Then I highlight the effect of Idea Exposure and Production Blocking, and outline how they happen during a session. These highlights are part of the intervention demands that wrap up this chapter.

WHAT IS GROUP IDEATION

Within the double diamond model, group ideation is done during the Develop and Explore steps (van Boeijen, 2014). It is one of the tools for diverging during a design process. It is most associated with generating solutions to a problem definition. It is then one of the first activities when going from Defining to Developing. In practice, these definitions are not as clear cut, and ideation is used throughout a design process whenever divergent thinking is needed. For this report, I will use the context of using group ideation to generate potential solutions to a design problem, but most of the findings should translate to all applications of group ideation.

Group Ideation is done during a generative session. This is a time-constrained activity, focussed purely on using the creative thinking of a group to get divergent results (Roozenburg, 1998). This is done based on a written problem definition, called a problem statement. The ideation is done through a generative session method. The outcomes of a generative session are then used in the next steps of the design process. They are refined, combined, and tested; the design process converges. Since designing is an iterative process, group ideation, and generative sessions are a repeated activity.

Generative session methods

A generative session method is the set of rules a group uses during the generative session to do the ideation (Roozenburg, 1998). These methods aim to provide structure during the session, and agreement on behaviour during the session. This in turn leads to more productive sessions. There exists a wide range of generative session methods, table 1 shows the three most relevant methods. Over time the Brainstorm method has remained the most used (Geschka, 1996; Williams, 2016), despite its known shortcomings (Diehl, 1987). This is in large part due to low-time investments in applying the Brainstorm method (Furnham, 2000).

GENERATIVE SESSION METHOD	Nominal groups	Brainstorm	Brainwriting
RULES	Participants generate ideas in isolation, without crossover from others, for a limited amount of time. Usually using pen and paper. Nominal groups are the common benchmark to compare other methods.	Participants sit in a common room and generate ideas verbally on a time limit. The facilitator is responsible for idea documentation. To encourage creativity there are four rules: • Focus on the quantity of ideas. • Suspend feedback during the generative session. • Build upon ideas. • Wild and crazy ideas are encouraged. Brainstorming gets outperformed by most other generative methods but is well-known and easy to execute.	Participants sit at a shared table. They generate ideas solitarily on a piece of paper within a time limit. Preferably, ideas include a sketch. Once the time is up, the piece of paper is passed clockwise, and the timer starts again. This repeats until all papers have been passed around. This is a common method used in design processes. It circumvents most social and logistical issues that brainstorming has.
TOOLS	• Pen and paper • Timer	• Whiteboard • Timer • Facilitator	• Pen and paper • Timer
UPSIDES	• No group think • High idea count	• High idea integration • Easy to execute • Collaborative iteration on ideas	• Equal Participation • Collaborative iteration on ideas • High idea count
DOWNSIDES	• Time-Consuming • No collaborative itera-tion	• Low idea count • Group think • Social pressure • Production blocking	• Limited Real-Time Discussion • Visual media only
SOURCES	Gallagher, 1993; McMillan, 2014; Sosa, 2020	Osborn, 1963; Rietzschel, 2006; Diehl, 1987	VanGundy, 1984; Litcanu, 2015

Table 1

Problem statements

The start of a generative session is usually reading the problem statement (van Boeijen, 2014), and the cumulation of the analysis phase (Roozenburg, 1998). In a sound-driven design process, all stakeholders would be involved in shaping the problem statement (Delle Monache, 2021), though that is not possible in my project.

A problem statement directly influences the outcomes of an ideation session (Maher, 1996). Whilst this influence is not exactly surprising, the ways a problem statement influences the outcome are varied. During ideation, a problem is transformed into a solution space, which is then explored by generating ideas within this solution space (Dorst, 2001). In a full design process, this transformation is a recurring event that slowly refines both the problem definition and the solutions (Dorst, 2001). However, in a single ideation session, there is little time for this effect to kick in.

A participant's initial perspective on a problem statement directly influences the solutions space they generate in their mind (Payne, 1992). This perspective is also fixed for people inexperienced in design (Björklund, 2013). This means that once a participant has generated their solution space, they cannot change it in the span of a single ideation session. If this generated solution space is small or misses the mark, the ideas explored will also be narrow (Daly, 2016). Preconceived cultural notions of participants greatly influence their perspective on the problem statement (Kirton, 1986).

Amongst the factors that influence this shaping of a solution space are the structure and the specificity of a problem statement (Silk, 2021). If you view the problem statement as an information funnel (see figure 2), then the structure is the width and order of the funnel. A highly structured problem statement has a defined funnel of information, with little fluff. Keeping with the same analogy, the specificity refers to how deep and small the funnel goes. Depending on what the desired outcome of an ideation session is, different variations in structure and specificity are optimal (Kirton, 1986). When searching for far-out ideas it is better to have less structure (Kirton, 1986), whereas if you are searching for ideas that fit the existing context it is better to provide a structured and focused problem statement. Something similar applies to the specificity, though this is more of a balancing act (Kirton, 1986). If you make a problem statement too specific, the participants will generate a small solution space. If you make the statement too global the generated solution space will become too vague for participants to meaningfully explore (Kirton, 1986).

Because of the short nature of the generative sessions, I conducted for this project; the problem statement has a large impact on the process of idea generation. I have one opportunity (per session) to get a serviceable solution space out of the participants. To best mitigate this, I use problem statements tailored to the world experience of participants.

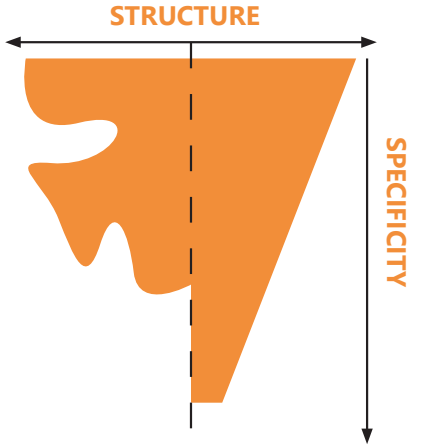


Figure 2

CREATIVITY

Creativity is a universal trait of humans (Koestler, 1964), not limited to certain disciplines or special individuals (Sawyer, 2011). Creativity is closely linked to problem-solving (Sawyer, 2011), and is therefore used during ideation. Creativity is not limited to the artistic or genius but is a skill all humans possess. Here, I discuss the basics of creativity and different types of creativity. I explain the dual pathway model of creativity. Finally, I discuss the emergence of collective creativity in groups.

Differences between creative skills are not the result of innate differences. Creative individuals simply practice and hone their skills more (Sternberg and Lubart, 1995). Their capacity for mental imagery is better developed (Boden, 2004), and they are more practiced in using this to generate various representations of ideas (Boden, 2004). Furthermore, they are used to ambiguity (Zenasni, 2008) and are less pressured to conform (Sternberg and Lubart, 1995). Luckily these skills and mindset can be trained (Sawyer, 2011). Focussing on open-mindedness and encouraging exploration and divert enhances creativity (Sawyer, 2011). Group ideation techniques need to help individuals with this mindset.

Creativity types

Different definitions of various types of creativity exist, I use a definition that recognizes three types of creativity (Boden, 2004), see figure 3,4,5. This definition is based on using creativity for the creation of new ideas, making it well-suited for framing ideation. Koestler(1964) differentiates between two types of creativity, Generative and Combinatorial. Boden(2004) recognises a third, transformative creativity. People have different preferences for what type of creativity they use (Kirton, 1986). Creative thinking methods use these three frameworks to help structure idea generation. For example, the SCAMPER method (Eberle, 1972) forces you to use combinatorial and transformative creativity on a design problem, whereas the Crazy Eight method (Jones, 2021) focuses on generative creativity.

Generate

involves generating entirely new ideas or elements from scratch. It's like starting with a blank canvas and painting a unique masterpiece. This type of creativity is focused on creating something novel, often by imagining possibilities that have never been explored before.

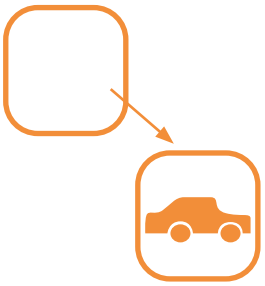


Figure 3

Combine

rearranging existing ideas or elements in new and interesting ways. It's like taking pieces from different puzzles and putting them together to create something unique. This type of creativity is all about finding connections between things that might not seem related at first.

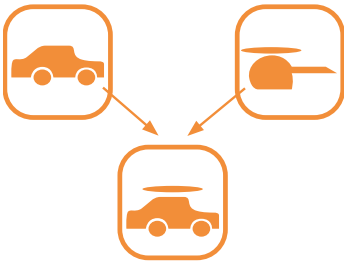


Figure 4

Transform

involves reshaping and fundamentally changing existing ideas or elements in innovative and profound ways. It's like taking a familiar object and completely reinventing its purpose or form. This type of creativity is about changing existing ideas into new uses or better versions.

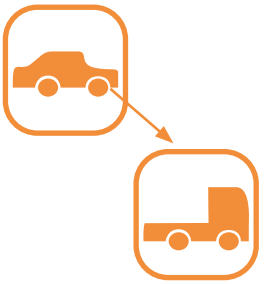


Figure 5

Cognitive model of creativity

Creative cognition is not linear and behaves in unexpected ways (Schön, 1963). Creativity occurs during a complex interplay of internal and external factors (De Dreu, 2011), making it difficult to observe. Creative cognition is a contentious research field. There are different models for how creative cognition works. Most of these models focus on spontaneous or unstructured creativity. These models treat creative insight as an AHA erlebnis (Koestler, 1964; Sawyer, 2011), making them incapable of modelling structured generative sessions. I use the dual pathways to creativity model (De Dreu, 2008). This model can explain creative cognition as it occurs during ideation activities (Nijstad, 2010).

The dual pathways to creative model states that creative output is dependent on two cognitive processes (De Dreu, 2008). These are Persistence and Flexibility.

Persistence is forcing your cognition to explore ideas. By continuously producing ideas, you increase the quantity of the output, and therefore also increase the creative exploration. This can also be seen as putting in hard work, to be creative. Flexibility, on the other hand, is allowing loose associations to form in your cognition. By doing this you create more unique connections in your cognitions, making it easier to create ideas.

These two cognitive processes are somewhat linked (Nijstad, 2010). When putting effort into persistence, your flexibility lowers and vice-versa. But this relationship is not continuous, and overall, your creative output does increase when activating a process. Most importantly, it is possible to activate and practice both cognitive processes (Nijstad, 2010), thereby increasing your creative output.

Most generative methods activate both the persistence and the flexibility process. By putting a time constraint on a generative activity, you force the participants to generate ideas. This engages the persistence process. The flexibility process is usually engaged via the sharing of ideas during the session. This introduces new associations into your cognitive process. It is possible to prime both the persistence and flexibility process before idea generation (Nijstad, 2010).

Collective creativity

Collective creativity is the collaboration of individuals on a creative task (Sawyer and DeZutter, 2009). During this collaboration, creativity emerges from the interplay of individual cognition and social interactions (Sawyer and DeZutter, 2009). Whilst all these individuals already provide valuable input through their expertise and knowledge (Sanders, 2005), the potential outcomes of collective creativity are greater than the sum of their parts (Spencer, 2008).

Collaboration between individuals with diverse backgrounds skills and perspectives can lead to the generation of more novel and innovative ideas (Spencer, 2008). innovative solutions and ideas emerge through the exchange and synthesis of individual contributions (Sawyer 2010). The diversity in views enhances the creative process, creating a form of shared cognition (Paulus, 2007). The social interactions, both verbal and nonverbal, in these groups are important in fostering these novel ideas (Sawyer, 2010).

It is not the case that groups automatically always outperform their individual potentials. Effects such as groupthink, conflicts, and coordination difficulties can undermine collective creativity (Spencer, 2008). Group composition also affects collective creativity (DeDreu, 2011). High group cohesion improves information sharing but can lead to increased conformity (DeDreu, 2011). This then leads to design fixation. You need to put effort and attention into creating collaborative environments that foster information sharing and idea sharing amongst the group (Sanders, 2005).

Collective creativity means groups can perform better than the sum of their parts, but only if this collaboration is managed effectively. Generative session methods do this by providing groups with a structure during ideation.

IDEATION RESEARCH

There are two categories for measuring the effectiveness of generative sessions, Outcome-based and process-based (Nelson, 2009; Cash, 2015). Outcome-based ideation research only looks at the ideas produced during a generative session (Nelson, 2009. Process-based ideation research tries to make sense of processes occurring during the generative session (Santanen, 2004; Nelson, 2009). Since interfering with the session ultimately also influences the session (Nelson, 2009), process-based research is more difficult to execute. But because it can expose more complex effects It can be valuable to execute (Santanen, 2004). It is possible to use a mix of both categories (Chan, 2017). When comparing two or more generative session methodologies, it is more common to use outcome-based metrics (Shah, 2003).

Outcome-based metrics

Outcome-based metrics only look at the results produced after an ideation session. Four common outcome metrics are measured in ideation research (Shah, 2003). All four view the generated ideas from a session and derive the metric from that. Of these four Idea Quantity and Idea Variety are the most used, and in short generative sessions are also indicative of quality (Reinig, 2008).

Novelty

The novelty metric in ideation research quantifies how unique or originally generated ideas are compared to existing solutions or other ideas. It assesses how innovative a session was by measuring the distinctiveness and whether they introduce new or novel ideas. Novelty is measured by having other participants rank the generated ideas from a session on their novelty.

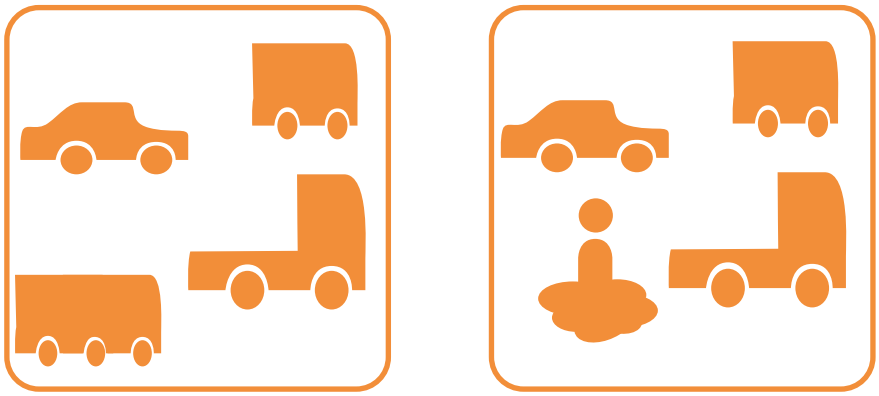


Figure 6

Variety

The variety metric in ideation research quantifies the diversity of ideas generated during the ideation process. It assesses how distinct and dissimilar ideas are from one another in terms of their concepts, approaches, or solutions. This metric emphasizes the importance of exploring a wide range of possibilities and avoiding redundancy in idea generation. By quantifying variety, researchers and practitioners can evaluate the richness and breadth of idea-generation sessions, helping identify ideation processes that promote a broad spectrum of creative concepts. Variety is measured by comparing how different generated ideas are from each other, either through ranking or by using a semantic distance rating based on ontology coding.

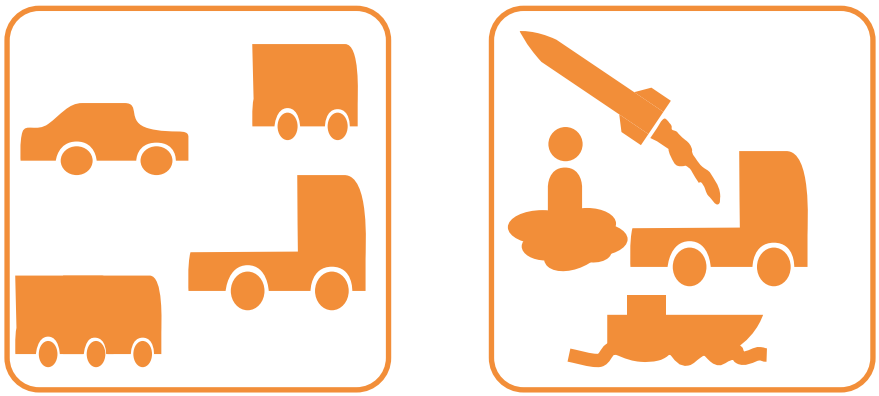


Figure 7

Quality

The quality metric in ideation research assesses the excellence and effectiveness of generated ideas. It focuses on evaluating the depth, feasibility, and potential impact of ideas. This metric helps differentiate between ideas that are merely novel and those that possess substantial value in addressing a problem or challenge. Quality is quantified by ranking the generated ideas.

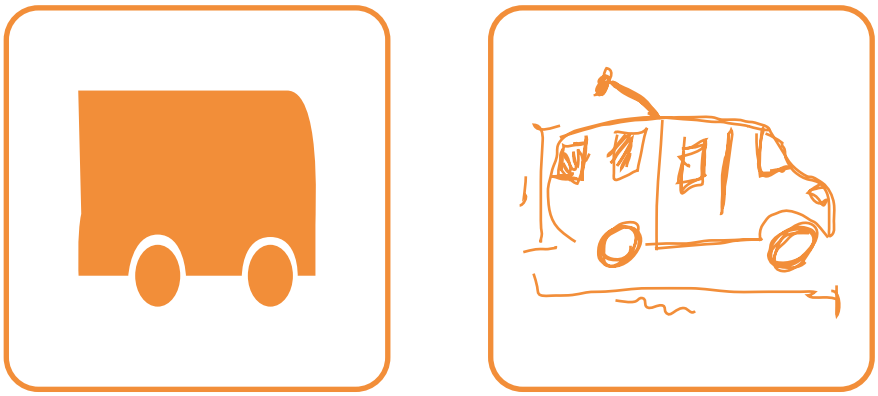


Figure 8

Quantity

The quantity metric in ideation research quantifies the sheer number of ideas generated during an ideation session. It provides a basic measure of ideation output, focusing on idea volume. This metric is a straightforward way to assess how prolific an ideation process is in terms of idea generation. It is valuable for comparing the productivity of different ideation sessions or methods. Sometimes duplicate ideas are not counted in this metric.

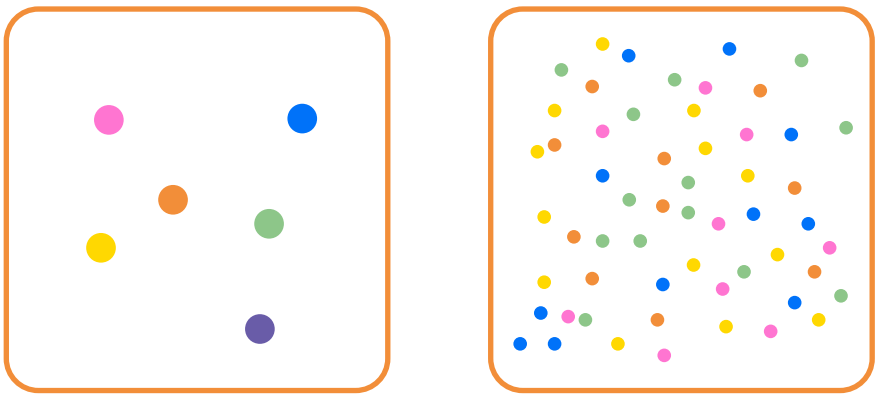


Figure 9

Ideation effects

The beneficial and detrimental aspects of group ideation can be clustered into respectively Synergistic and Interference effects (Derosa, 2007). There is a wide variety of effects that occur during group ideation, what is listed here is an incomplete summary. Most of the effects play into each other as well, improving one effect. For example, group homogeneity improves information sharing, but reduces the conflicting views during a session. Managing these effects, by improving the impact of synergistic effects, while mitigating the downsides of interference effect, is the goal of generative session methodology.

PERCEIVED EXPERTISE

Interference

Group interaction

Perceived expertise of participants by others causes them to follow along with their ideas. Thereby not exploring other options and instead staying on the part of the perceived expert. The perceived expert does not have to be more experienced; it is simply attributed by the others. Either because they are more outgoing in idea generation or have experience in the field of the problem statement. This is doubly interferent as a perceived expert might have pre-existing biases that limit their generated solution space.

Collaros, 1969

SOCIAL LOAFING

Interference

Group interaction

A participant not generating ideas, or fewer ideas, because others are generating large quantities. The participant thereby does not feel the need to contribute to the group effort.

Karau, 1993

TIME PRESSURE

Synergistic

Logistic

Time pressure increases the quantity of ideas generated by participants.

Liikkanen, 2009

SOCIAL ANXIOUSNESS

Interference

Group interaction

Social anxiety caused by group dynamics limits the number of ideas expressed. Essentially cognitive power is used to monitor the social goings between the participants and others, outside of generating ideas. This is also closely related to other group interaction effects.

Camacho, 1995

EVALUTATION APPREHENSIONS

Interference

Group interaction

The fear of expected judgment by the other participants limits the ideas expressed by the participants. Essentially ideas are rejected based on internal criticism from the participant that they also expect from the others. Generative session methods often try to forbid criticism, but here the criticisms are internal, thereby impossible to forbid.

Diehl, 1987

IDEA EXPOSURE

Synergistic

Exposure

Exposure to other ideas stimulates the making of new connections per participants. This increases the number of ideas generated during a session. It is also possible to over-expose the participants during a session (see overexposure).

DeRosa, 2007

OVER EXPOSURE

Interference

Exposure

Over exposure of ideas can lead to a reduction in newly generated ideas. Either because too much time and cognitive effort is used on taking these ideas in, or because idea's are too far out for the participant, leading to a disconnect from their solution space. Idea Exposure in moderate amounts is a strong synergistic effect.

Chan, 2017

HOMOGENUAL KNOWLEDGE FOCUS

Interference

Group interaction

When participants focus on information and knowledge that they all have in common, instead of the differences. Thereby the participants limit the solution space they explore and neglect the value of the diverse information present in a group.

Paulus, 2000

NOVEL ASSOCIATIONS

Synergistic

Exposure

New links and combinations of ideas and knowledge foster the creation of more ideas.

Paulus, 2000

CONFLICTING VIEWS

Synergistic

Group interaction

Conflicting views between participants can lead to new insights. But it can also cause the owners of the views to generate more ideas that support their existing views. Both effects stimulate the outcome of the session.

Paulus, 2000

IDEA INTEGRATION

Synergistic

Post session

Idea integration is the usage of ideas or session outcomes in the organization after the session. The integration of session results is higher when they are produced using group ideation techniques.

Okhuysen, 2002

PRODUCTION BLOCKING

Interference

Expression

When a participant is unable to express an idea, it is considered blocked. This often happens during verbal techniques, where participants must wait or claim their turn to talk. It also happens because a participant is unable to transfer their idea to the means of expression used, such as an inability to draw conceptual ideas.

Diehl, 1991

KNOWLEDGE EXCHANGE

Synergistic

Group interaction

Knowledge in a group is greater than in an individual, because of the interplay during group interaction the sum of this is greater than when kept individually.

Brown, 1998

PRIMING

Synergistic

Exposure

Prior exposure to a stimulus, i.e. a word or image, influences the response of participants to consequent stimuli. This increases the speed of idea generation.

Paulus, 2000

IDEA EXPOSURE AND PRODUCTION BLOCKING

From these synergistic effects on ideation, the most promising to focus on is Idea Exposure. Idea Exposure is at the root of most of the synergistic effects. For instance, increasing the Exposure to new ideas also increases the number of novel associations the group can make. For this project, I will focus on improving the Idea Exposure during generative sessions. Production Blocking, an interference effect, is in many ways the inverse of Idea Exposure, see also figure 11. When Production Blocking is high, the number of expressed ideas decreases. This leads to a reduction in the Idea Exposure. This was based on my ability to directly observe these effects during small pilot sessions (4) (see appendix B), and the impact I expect these effects to have on sound-driven design. The exposure to ideas and the blocking of idea expressions are particularly relevant to sound-driven design. In most generative session methods these effects are controlled through non-verbal means, but this is not desirable for sound-driven design. As sound-driven design relies on designing for listening, the focus should be on auditory expressed ideas.

I mapped the different forms in which Idea Exposure and Production blocking occur, see table 4,5. These occurrences are divided into three categories each. For Idea Exposure, the categories are, Non-Exposure, Desired Exposure, and Over Exposure. Over-exposure is the potential interference effect when Idea Exposure is too high (Chan, 2017). This is taken as out of scope for this project, first, the Idea Exposure needs to be increased before worrying about eventual overshoot.

For Production Blocking the categories are Individual Skill, Group Conduct, and Social Dynamics. All three categories are important when trying to increase the Idea Exposure. However, the effect of Social Dynamics on collaborative ideation is very complex (Diehl, 1987), and not solvable in one single master project. The impact of social interaction will be considered but will not be a focus point.

FOCUSING ON GENERATIVE SESSION PREPARATION

Improving Idea Exposure and Production Blocking can be done either by focusing on developing a new generative session methodology, or by preparing participants for an existing generative session methodology.

Improving the preparation of participants for a generative session has more potential for impact on ideation than focusing on developing a new generative methodology. One of the benefits of existing generative session methodologies is that they are easily accessible and applicable by organizations of all sizes (Bjork, 2010; Basadur, 1982). The only tools required are pen and paper. Introducing new generative session methodologies is a slow process, as evidenced by the prevalence of the brainstorm method (Williams, 2016). Furthermore, doing sound-related activities often involves specialized technology (see Chapter 3), which is not accessible to all organizations. The potential of using an intervention as preparation is higher. While improving preparation for existing generative sessions, organizations can continue using their preferred generative methodology. Implementing a preparatory activity can also be cheaper and easier to implement and allow for multiple generative methods to be used during the design process.

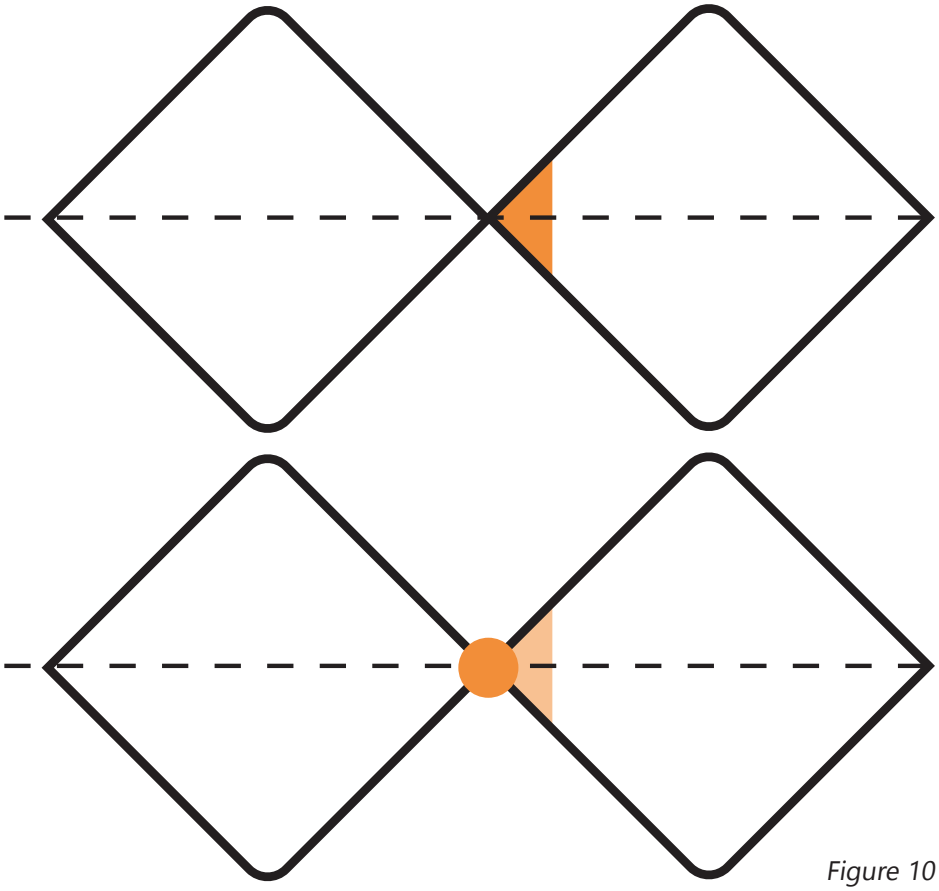


Figure 10

Intervention Demands

To improve Idea Exposure, and reduce Production Blocking, the interventions must practice participants in their sonic idea expression and exposure. The focus should still be on the generative session itself, not on a specific preparation for a single design activity. Ease and cost of implementation is one of the more important considerations whether a generative session method is used (Williams, 2016). This should also apply to the preparation for a generative session.

The stakeholder categories have enough work without introducing an extensive preparation workload. The interventions should therefore not take up much of the stakeholder's time and require little effort to complete.

In tables 2 and 3 the intervention demands and wishes are outlined. Improving idea exposure and reducing production blocking is done my mitigating the occurrence as described in tables 4 and 5. These serve as the requirements for the intervention.

LIST OF DEMANDS
The intervention must improve idea exposure
The intervention must reduce production blocking
The intervention must tractice participants in expressing Sonic Ideas
The intervention must practice participants in sensing Sonic Ideas
The intervention must prepare participants to iterate during a session

Table 2

LIST OF WISHES
The intervention should be relatively cheap
The intervention should be quick to complete
The intervention should be intrinsically fun to complete

Table 3

Idea exposure

Non exposure

I.E.1.1	• Blue is Production Blocked • Blue does not express • Orange is not Exposed	See also P.B.1, but from a different perspective
I.E.1.2	• Blue and Green express simultaneously • Orange does not follow (sensing issue) • Orange missed Exposure	See also P.B.2
I.E.1.3	• Blue expresses sonic idea • Orange senses the expression of the sonic idea • Orange does not comprehend the sonic idea • Orange missed Exposure	

Desired Exposure

I.E.2	• Green expresses sonic idea • Orange senses the expression of the sonic idea • Orange comprehends the expression of the sonic idea • Orange is Exposed	Desired outcome. Note that Orange does not necessarily use the expressed idea for there to be Exposure.

Over Exposure

I.E.3	• Blue & Green express sonic ideas • Orange is Exposed • Orange is overwhelmed by the Sonic Ideas • Orange is Production Blocked	Over Exposure can cause numerous forms of Production Blocking to occur.

Table 4

Production blocking

Individual skill

P.B.1.1	• Orange has a Sonic Idea • Orange wants to share the Sonic Idea • Orange is unable to Express the Sonic Idea to the group. • Orange is Production Blocked.	Sharing the idea fails, because Orange cannot transfer the Sonic Idea from his cognition to the Means of Expression.
P.B.1.2	• Orange has a Sonic Idea • Orange wants to share the Sonic Idea • Orange Expresses the Sonic Idea to the group. • Orange is not Production Blocked.	Desired Outcome .

Group conduct

P.B.2.1	• Orange has a Sonic Idea • Indy wants to share the Sonic Idea • Green occupies the Means of Expression • Orange is unable to Express the Sonic Idea to the group • Orange is Production Blocked	Sharing the idea fails, because Orange cannot get the attention of the group. Orange now has to focus on finding an opportunity to occupy the Means of Expression, or give up on sharing.
P.B.2.2	• Orange has a Sonic Idea • Orange wants to share the Sonic Idea • Orange occupies the Means of Expression • Green interrupts Orange • Orange is Production Blocked	Sharing the idea fails, because Orange cannot finish the expression. Orange now has to focus on finding an opportunity to occupy the Means of Expression, or give up on sharing.

Group dynamics

P.B.3.1	• Orange has a Sonic Idea • Orange experiences thought/emotion relating to Blue • Orange does not want to Express the Sonic Idea • Orange is Production Blocked	Sharing fails because of fear of judgment from other group members.
P.B.3.2	• Orange has a Sonic Idea • Orange experiences thought/emotion relating to the Sonic Idea • Orange discards the Sonic Idea and does not want to Express the Sonic Idea • Orange is Production Blocked	Sharing fails because Orange judged the quality of the Sonic idea prior to expression.
P.B.3.3	• Orange has a Sonic Idea • Orange experiences thought/emotion relating to the Self image • Orange discards the Sonic Idea and does not want to Express the Sonic Idea • Orange is Production Blocked	Sharing fails because Orange judged the contents of the sonic Idea based on the fit to his own self-image.

Table 5

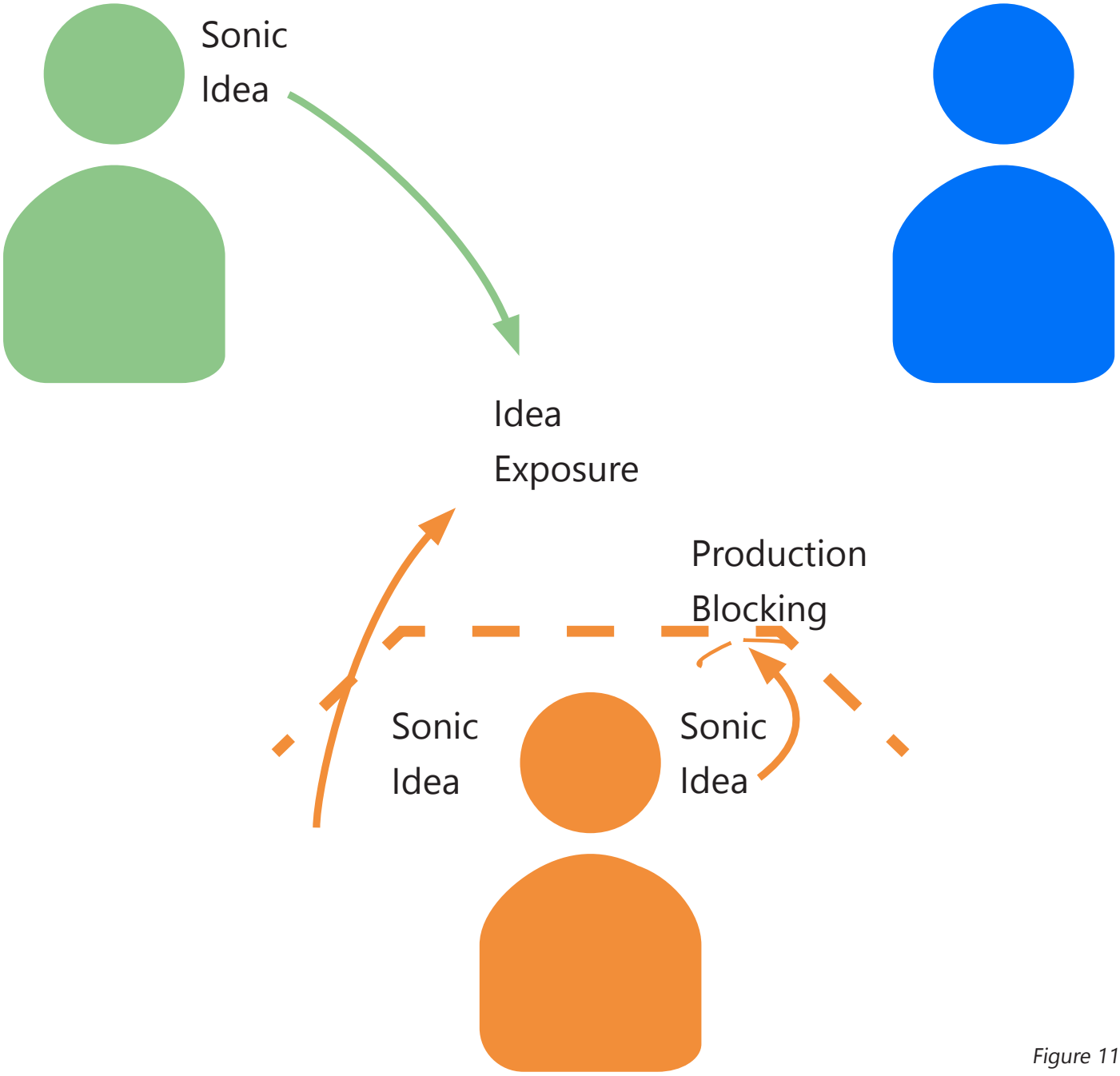

Sonic
Idea
Idea
Exposure
Production
Blocking
Sonic
Idea
Sonic
Idea

Figure 11

04
THE INTERVENTION

In this chapter, I discuss the design of a preparatory card game, that improves Idea Exposure and reduces Production Blocking during generative sessions. First, I discuss how I went about designing a board game, based on expert input. Then, I present the collaborative card game Soundstrom.

Here, I explain why I designed a collaborative card game, and how I did this. It first outlines the learning and team-building benefits of board games. Then I explain the design process I used, based on feedback sessions with two boardgame companies.

Why a board game?

Board games are an effective way of teaching, both behaviour (Nieh, 2018), knowledge (Taspinar, 2016), and skills (Poole, 2019). As a bonus, playing board games is an effective way to achieve a feeling of social cohesion amongst the players (Uz Bilgin, 2020), more so than with other education methods. This allows the game to also function as a social icebreaker.

Why a collaborative board game?

A collaborative board game is not better at preparing players for collaborative activities than a traditional competitive board game (Eriksson, 2021). The benefits instead lie in higher player engagement during collaborative gameplay (Beznosyk, 2011; Baek, 2020). There is a type of player that is averse to direct competition in board games (Woods, 2012; Nakce, 2014), using a collaborative board game serves to get these players on board of playing the intervention (Lin, 2022). This does mean I would lose competition-driven players (Nakce, 2014), as was also noted by the experts. Competition was added by introducing a high score system, promoting a competitive drive between groups.

How do you design this?

For designing the board game, I started by getting expert opinions. I conducted interviews and feedback sessions at a serious game design agency and a board game design startup. Their advice informed me how I set about designing the board game. Their most important advice was to start with a simple play concept, and iteratively improve this by conducting lots of playtests. This is similar to the MVP design methodology (Moogk, 2012).

The simple play concept is using Randomness as the game input (Elias, 2012) for generating idea prompts, which players must complete while under some form of time pressure (Iiikkanen, 2009). Completing prompts results in points shared by all players. The goal of the game is to set the highest score. Personal impact on a high score-driven game is perceivable and controllable (Lee, 2016), making it a good motivator for simple games.

Initially, I used a set of dice for this, but I changed this to two card sets as it allowed for more options. According to the board game startup, this is also cheaper to produce in small quantities. There was a subject card type, and an idea prompt card type. The idea prompts were based on the modes of listening (Delle Monache, 2022) and product sound categories (Özcan Vieira, 2008).

I then explored this play concept. This was done by making changes, and then doing playtest(s) to evaluate the change(s). Over the course of doing this, I kept simplifying the game. Simplifying the taskwork of a team member helps improve the teamwork of the entire group (Salas, 2015). In the context of a collaborative board game, simplifying the taskwork means simplifying the turn of a player. Reducing the decisions that a player makes also puts more of their attention on the fulfillment of the prompt (Samson, 2015), therefore engaging

the player's mental persistence and flexibility more (Nijstad, 2010). Removing explicit individual goals and contributions in turn helps to reduce inter-player tension during the game (Johnson 1989).

Doing playtest

Throughout the iteration of the board game, I conducted lots of playtests. This was based on the advice given to me by the experts. These playtests were done very quick and dirty. Using scribbled slips of paper as cards, and whoever was available as players. Often these test players played multiple iterations in quick succession. I did use a consistent methodology during the playtests, based on that used by the serious game agency. For each playtest I had one focus aspect that I tested, and I consistently iterated over the idea prompts.

Method

1. Produce a quick prototype.
2. Write down the focus aspect of the playtest. (i.e. Duration of game)
3. Participants play a game(s).
4. During the game, focus observations on the focus aspect.
5. After the game, allow for open feedback from the participants. Be open and accepting feedback on all aspects of the prototype.
6. Ask questions specifically on the focus aspect.
7. Have players rate their two favorite cards and their least favorite.

SOUNDSTORM

Soundstorm is a short collaborative card game, played by 2-5 people. During the game players express sonic ideas for a given product, based on cards they draw. This practices their expression skills for sonic ideas (Delle Monache, 2019). Furthermore, it engages the player's persistence and flexibility in creative thinking (Nijstad, 2010), which should improve the player's creative cognition in the short term (Finke, 1996). For all the cards and the game rules see appendix E.

The game rules

- A game of Soundstorm lasts 3 minutes.
- First the Product cards are shuffled, and the top card is revealed. This product is the subject of this game of soundstorm.
- Then the Soundcards are shuffled, and the timer is flipped.
- Players take turns revealing the top soundcards and performing their tasks for three minutes.
- After three minutes all completed cards are counted, this is the final score.
- The final score is then added to the scorebook, complementary to the game.

THE CARDS

Soundstorm has Product cards, that are flipped at the start of the game. And Soundcards, which are used during the game. There are 5 types of Soundcards. The make and describe types are based on the Causal and Empathetic aspects of sonic ideas (Delle Monache, 2022). The find cards are based on the Functional and Semantic aspects (Delle Monache, 2022). The replay and repeat cards are there to encourage interaction between the players during a game of Soundstorm.

Sound card distribution

Not all soundcard types are equally important to encounter during a game of Soundstorm. The most important aspect is that new players encounter the Make, Describe, and Find card types during their first play session. These three have the most impact during play. The Make and Find cards have the biggest impact on the learning goals and play enjoyment of players, so they should be encountered more.

Intervention: Cards distribution

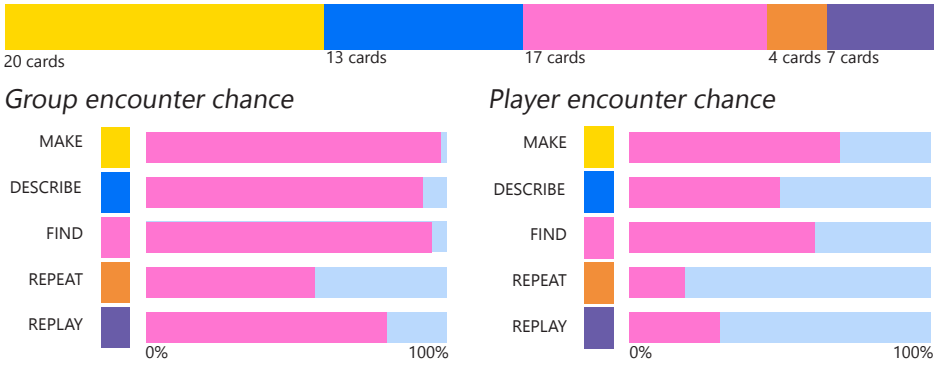


Figure 12

During playtesting, new playgroups seemed to consistently get a score between 12 and 14 points. This means that a new player will usually see 12 soundcards during their first play, for a margin of error I rounded this down to 10 cards during their first play.

During the first play session, new players must see the Describe and Find card at least once. Since the Make card type is important for game enjoyment, a player should encounter this card during one of their turns.

To calculate the odds of drawing a soundcard type during a game, I used a hypergeometric distribution probability calculator, accessed through Cardgame calculator(n.d.). I ensured the odds of not encountering a Make, Describe or Find sound card was lower than 5%. The odds of encountering a Make card on one of your turns is slightly above 70%.

Product cards - 20 cards

What
Product cards are the subject of a single game of Soundstorm. During a game players create sounds that the product on the product card will make. For all the product cards, see appendix E.

Why
The act of combining a sound description, with a product that does not normally make that sound is what makes Soundstorm work as a preparation game. Forcing the player to always answer their turn primes their persistence (Nijstad, 2010). Matching the product card to a Sound card primes their flexibility (Nijstad, 2010).

How
I tested a variety of products and services during the design. The product needed to be relatable to players. To achieve this, I settled on relatively common household items. Product cards played better if they had only product sounds, with a physical source. as opposed to also having synthesized sounds (Özcan Vieira, 2008).

The play difficulty was varied over the cards. This was done by including products that have varying levels of intentional sounds and consequential sounds (Van Egmond, 2008). A clock is known for its intentional sounds but also has consequential sounds. A bookcase on the other hand is not known for its sounds, though it can already produce consequential sounds. It is therefore more difficult. This is also usually reflected in the final scores; a difficult product card leads to a lower final score.

T O I L E T

T O I L E T

I R O N

I R O N

C L O C K

C L O C K

S O F A

S O F A


FIND A SOUND
MOOING COW
DESCRIBE A SOUND
PURPLE
REPEAT
THE LAST ANSWER

Sound cards - 60 cards

Sound-focused cards help players think creatively about the sound-focused domain. They also allow players to practice their verbal expressions and vocal scribbles of Sonic Ideas. For all the sound cards see appendix E.

Make cards - 17 cards

What
To complete a Make card, the player must make a sound that based on the word on the card, that is made by the product. They have then made a vocal scribble.

Why
Make cards serve two purposes. Most importantly Make cards have the players engage and practice vocal scribbling. Vocal scribbling is a useful tool in sound-driven design (Monache & Rochesso, 2019). Doing vocal scribbling before the session shows that it is a possibility for sonic idea expression. It also removes some of the awkwardness of doing vocal scribbling (Monache & Rochesso, 2019).

Secondly, the make cards show the relationship between sound interaction descriptions, and how these descriptions can then be sonically embodied (Özcan & Egmond, 2012, Rochesso, 2019). The intent of showing this relationship is to build some minimal expertise and trust in using verbal descriptions to express sonic ideas.

How
The make cards are at the heart of Soundstorm. They teach some of the more important aspects of sound-driven ideation. Over the course of refining Soundstorm through the playtests, make cards are also consistently the most fun card type. Make cards are also important as an icebreaker. The forced vocal scribbling pulls players over the initial awkwardness and lifts spirits. For this reason, the make cards are the most represented category in Soundstorm.

The words on the make cards were selected through iteratively refining them in playtests. As a starting point, there needs to be some difficulty in matching the word to a product card, to effectively stimulate the player in thinking creatively (Nijstad, 2010). This difficulty varies over the different words, with some being easier (e.g. a happy sound) and some being more difficult (e.g. A Blue Sound). After an initial selection made by me, I then used cards during playtests. After a playtest, players would rate which cards they liked, and which were too difficult.

MAKE A SOUND

DREAMY

DREAMY

MAKE A SOUND

MAKE A SOUND

ENERGETIC

ENERGETIC

MAKE A SOUND

MAKE A SOUND

ANGRY

ANGRY

MAKE A SOUND

MAKE A SOUND

BLUE

BLUE

MAKE A SOUND

DESCRIBE A SOUND

FLASHY

DESCRIBE A SOUND

FLASHY

DESCRIBE A SOUND

FLIRTY

DESCRIBE A SOUND

FLIRTY

DESCRIBE A SOUND

PURPLE

DESCRIBE A SOUND

PURPLE

DESCRIBE A SOUND

GENTLE

DESCRIBE A SOUND

GENTLE

Describe cards - 13 cards

What
To complete a Describe card, the player must use words to describe a sound based on the word on the card, that is made by the product. This practices verbal expressions for sonic ideas.

Why
Players practice verbal expressions for sonic ideas, more specifically the Causal and Empathetic aspects (Delle Monache, 2022). Based on small observations (see appendix B), players already use verbal expressions for sonic ideas. Describe cards are an opportunity to refine this skill, which is done by providing more difficult words on the cards. Removing Describe cards is not an option, as it should still be shown as a possibility for expressing sonic ideas.

How
Describe cards teach a means of expression that is already known. From the observations, I learned people already know how to use verbal expressions for sonic ideas. The Describe cards are therefore not as important as the Make cards. They do need to be included because those verbal expressions remain an option for sonic ideas. During playtests Describe cards were highlighted less as being a player's favourite card compared to the other categories. Their distribution is therefore smaller than make cards.

The words on the make cards were selected through iteratively refining them in playtests. As a starting point, there needs to be some difficulty in matching the word to a product card, to effectively stimulate the player in thinking creatively (Nijstad, 2010). This difficulty varies over the different words, with some being easier (e.g. a Brainy sound) and some being more difficult (e.g. a Clumsy Sound). After an initial selection made by me, I then used cards during playtests. After a playtest, players would rate which cards they liked, and which were too difficult. Because Describe cards are the simplest category to execute, I kept the words on these cards more difficult and abstract.

Find a function cards - 16 cards

What
Find a function cards contain a sound description, and the player must think up a reason why the product would make this specific sound.

Why
Find a function cards teach players to also consider the human aspect of sound-driven design. Specifically, the Functional and Semantic aspects of sonic ideas (Delle Monache, 2022), though it focuses primarily on Functional aspects. These are important aspects to teach, as they are not as consistently used by untrained stakeholders, as based on early observations (see appendix B). The Find a function cards teach players to consider the listening experience during sound-driven ideation.

How
Response to the Find a function cards was varied throughout the playtests. A subset of the players liked this category the most. A comparable group struggled with completing Find a function cards during play. Find a function cards introduce an important concept of sound-driven ideation but are not as important for the icebreaker and play engagement as Make cards. Their distribution lies between the Make and Describe cards.

The words on the Find a function cards do help set the tone for the other idea cards. Because the described sounds on the Find a function cards are silly, the tone of the entire game is communicated to be less serious.

I made the Find a function cards descriptions based on the perceptual categories of sound (Özcan & van Egmond, 2014). I then tested these initial versions on players. First testing whether players form a mental image of the described sound (Leaver, 2009). If this is the case the description is tested during playtests, similarly to the other cards.

FIND A FUNTION

GRUMPY GORILLA

GRUMPY GORILLA

FIND A FUNTION

FIND A FUNTION

WET FART

WET FART

FIND A FUNTION

FIND A FUNTION

GONG

GONG

FIND A FUNTION

FIND A FUNTION

SQUEALING PIG

SQUEALING PIG

FIND A FUNTION

REPEAT

THE LAST ANSWER

REPEAT

THE LAST ANSWER

Repeat - 4 cards

What
The player must repeat the answer given by the prior player.

Why
Repeat cards ensure that players pay attention to each other during a game of Soundstorm. This teaches players to pay attention to each other's ideas during a generative session.

Without the Repeat card, players become focused on only their own turns. This then also loses the collaborative aspect of Soundstorm.

During playtests I experimented with repeating the last Make card. So the players need to pay attention to all turns and must engage their auditory memory during play. This task proved to be difficult (Özcan, 2007) to combine with the time limit during a game of sound storm.

How
It is not needed that players encounter a repeat card during a game of Soundstorm. If players know that there is a possibility that they must repeat another player, they will pay attention during their turn. The low distribution of the repeat cards reflects this.

Replay - 7 cards

What
The player must replay the previous card and give a different answer.

Why
Replay cards ensure that players pay attention to each other during a game of Soundstorm. This teaches players to pay attention to each other's ideas during a generative session. The replay card also simulates players iterating on each other's ideas (Chan, 2015).

How
Replay cards have more effect on a play session and have higher engagement during playtests than repeat cards. They do take longer to complete than other cards, as they require more steps for a player to complete. The player must first recall the previous cards, then the previous answer, and finally create a different answer. If this happens multiple times in a row it takes the speed out of the game. Their distribution is therefore slightly higher than repeat cards, but lower than the other three categories.

REPLAY

THE LAST CARD

REPLAY

THE LAST CARD

05
VALIDATION

In this chapter, I outline the validation study that investigates the differences between generative sessions using Soundstorm and not using Soundstorm.

In this part first I outline the goals and research objectives of the validation study. Then I outline the methodology used for validating. Herein I describe the study setup, using Protocol analysis to gain quantitative data, and using questionnaires to attain Production-blocking insights based on sound-driven brainstorming. Then I present the results of the validation study (n=18), which show that playing Soundstorm has little impact on generative session results. I then discuss the shortcomings and implications of these results. I then conclude this report with future recommendations for the field of sound-driven design.

GOALS OF VALIDATION

My goals with the validation study are twofold. First, I want to know what the impact of Soundstorm is on the Idea exposure and Production blocking during sound-driven brainstorm. Specifically, I want to determine if playing Soundstorm before a sound-driven ideation session improves the idea exposure and reduces the production blocking during the ideation session.

As a secondary goal, I am interested in applying ideation research methodology to the domain of sound-driven design. This means adapting and applying an established ideation research method to the sound-driven design process. Within ideation research, there is a focus on written generative session methods, as they outperform verbal methods (Diehl, 1987). There is therefore little research done on how to improve verbal generative sessions. For sound-driven design, verbal and vocal generative session methods are beneficial, and it is therefore interesting to reexamine verbal and vocal methods through the lens of sound-driven design.

Research questions

The primary research questions revolve around the group ideation effect Idea Exposure, and its antithesis, Production Blocking. As discussed in chapter 3, Idea exposure has a positive influence on ideation outcomes (DeRosa, 2007), whilst Production Blocking has a negative influence (Lamm, 1973). Soundstorm is designed to increase the idea exposure and reduce the production blocking that occurs during a generative session. This should be reflected in the ideation outcomes. This led to the following research questions for the validation study.

- Does playing Soundstrorm increase the number of ideas generated during a generative session?
- Does playing Soundstrorm influence the type of creativity used during a generative session?
- Does playing Soundstrorm increase the number of times participants use vocal scribbling to express their sonic ideas?

METHODOLOGY

Between participant study

This study uses a between-participant approach. Between-participants is not applicable, as doing two generative sessions after each other will train participants in doing generative sessions (Charness, 2012). There are then two categories, a Control group and a Soundstorm group. Participants were divided into groups of 3 each, evenly spread across the two categories.

18 Participants (M age = 29.7 years, SD = 9.5) were recruited from my network. Most participants knew each other before the study, which influenced the social conduct of the groups.

Generative session methodology: Brainstorming

The validation study uses Brainstorming (Osborn, 1963) as the generative session methodology. Brainstorming is one of the most used and studied generative session methodologies (Williams, 2016). Brainstorming is considered less effective than techniques like brainwriting (Diehl, 1978) because it relies on verbal expressions. However, in the context of sound-driven design, the verbal nature of brainstorming is seen as a significant advantage, facilitating the direct expression of sonic ideas.

The rules of brainstorming given to the participants: (Osborn, 1963; Van Boeijen, 2014):

Focus on the quantity of ideas.
Suspend feedback during the generative session.
Build upon ideas.
Wild and crazy ideas are encouraged.

Typically, the ideas expressed during a brainstorm session are written down, using for example a whiteboard, by a notetaker (Osborn, 1963; Rietzschel, 2006). After the generative session ideas are then scrutinized and filtered. However, for this project, the focus is on the divergence during the idea generation, not on the converging activities. Therefore, ideas are stored on a recording device, with no effort required from the participants.

Procedure

I conducted 6 workshops, with groups of 3 participants. Three groups served as control; the other three groups played Soundstorm. There were no differences between the two workshops, outside of playing Soundstorm.

Participants were seated at a table, and the sessions began with an explanation of the research, followed by obtaining informed consent (see appendix A). The Soundstorm groups then played one round of Soundstorm.

Following this, participants were presented with a problem statement (see appendix C) and allowed to read through it. No additional questions regarding the problem statement were answered to ensure consistency of information across all workshops. Once participants completed reading the statement, a verbal explanation of the brainstorming generative session method was provided. They were then given 5 minutes to brainstorm on the topic, with the audio being recorded. Upon the conclusion of the 5-minute brainstorming session, participants were thanked for their participation.

Problem statement(s)

The problem statement is based on the theory I described in chapter 4. It is important that participants can easily transform the problem statement into a problem space and solution space, as they are given limited time for this. The validation study is not about this transformation process. The problem statement needs to be easy to understand, and relatable to the participants.

To ensure the statement is relatable and understandable, I made several problem statements about common topics (see appendix C). These statements had the same structure and level of specificity. The problem statements are relatively open-ended, not specifying if they were looking for specific sounds or interactions. This was to ensure participants could generate ideas based on all aspects of sonic ideas.

These statements were then used in the pilot tests. Participants (n=6) ranked the statements on which were most relatable and understandable. The problem statement about a campus-wide clock tower sound was ranked best by the participants.

Data analysis

Transcription process

All recordings were transcribed, including speaker and timestamps. This was done using Microsoft Word transcribe tools, and then the produced transcription was manually corrected by me. During this manual correction, audible verbal interruptions and vocal scribbles were added to the transcript. If possible interrupted utterances that were later continued were combined to get complete sentences (Goldschmidt, 2014).

Transcription to utterances

The transcription was then split up into utterances, following a two-step segmentation process (Goldschmidt, 2014). In the initial split, utterances were divided based on speaker turns. In the second split, utterances were further divided based on the information chunks (Simon, 1974) they contained. See figure 13 for an example.

The second split separates all utterances based on information chunks (Simon, 1974), combined with the commonsense technique (Goldschmidt, 2014). An information chunk is a piece of knowledge, not yet learned by the shared cognition of the group (Bishop, 2018). This piece of knowledge can be new, or it can be a novel association of existing information chunks (Tononi, 2015). Once an information chunk has been expressed, it is treated as a constant in the shared group's cognition, which is not the same as being stored in memory (Simon, 1974). It does mean that once an information chunk has been made by combining previous concepts, the new information chunk is taken as one.

[What about seven] [gong sounds]	2 chunks
[What about a gear sound]	1 chunk
[It needs to be a technical sound]	1 chunk
[Definitly yes, good point] [gears are technical]	2 chunks
[Why not eight gong sounds]	1 chunk
[So, we have gong sounds and gear sounds]	1 chunk
[Do we have other ideas]	1 chunk

Figure 13

The utterances are then categorized into categories using a coding scheme (Goldschmidt, 2014), tailored to the research. For this coding often an ontology is used (Jiang, 2009). For example, Monache and Rochesso (2016) used the FBS ontology (Gero, 2014) when researching collaborative sound design. However, according to Cash and Storga (2015) FBS, and similar ontologies, are too abstract to apply to ideation research. They used the MOED ontology (Ahmed, 2009). This ontology is rooted in engineering design, and therefore relies heavily on physical properties in its definitions, making it unsuited for sound-driven design. This means I must construct my own coding scheme. This is not uncommon when using protocol analysis for ideation research (Hatcher, 2018). Often coding schemes are tailored to their specific research (Jiang, 2009).

Utterances can be one of four categories: Ideas, Analysis, Feedback, and empty, see table 6. This is based on the processes from the FBS framework (Gero, 2004). Since the focus of this study is on Ideas, this category is further expanded upon. The creativity types, as described in chapter 3, are used for this division. Ideas were split into 4 subcategories.

Ideas are all utterances that contain information chunks, that relate to the problem discussed during the session. Importantly, an idea is not confined solely to solutions for the problem statement; it includes any information chunk linked to the problem space, even explorations of the problem space itself. I am using the definitions of the three types of creativity and applying them to the chunk, as seen in figure 13.

Generative	New information chunks.
Combine	A combination of multiple already existing information chunks.
Transform	Previously existing information that has been changed.
Old	Chunks that have already been established, with no new additions or transformations.
Analysis	Utterances aimed at extracting more information from the generative session.
Feedback	Utterances that provide a judgment on a previous utterance
Empty	Utterances that have no relation to the problem statement at all

Table 6

Comparing scores

This analysis then leads to a total count of utterances, and a count of utterances per type. This can then be used to infer the occurrence of Idea Exposure and Production Blocking.

Comparing the total idea count

If the idea count is higher that means that more Idea Exposure occurred, and less harm was done by Production Blocking (Lamm, 1973; Javadi, 2011). However, because the brainstorming generative method was used, the idea count can also be limited by other factors (Rietzchel, 2006). Since the generative session is bounded by both time and turn-taking dynamics for speaking (Diehl, 1987), the idea limit can be reached even if the Idea exposure is low and Production Blocking is high. I expect this to be the case for both the Soundstorm and Control groups.

Comparing idea composition

When looking at Idea Exposure, this effect not only improves the quantity of ideas but also the iteration of ideas into each other (Okhuysen, 2002). Therefore, when looking at the composition of the idea types, if Idea Exposure is higher, I expect to find more codes of the Combine and Transform type, relative to Generative and Old ideas. Similarly, an increase in Analysis is also indicative that more attention is paid to idea expression. If Soundstorm positively influences the Idea Exposure, then this difference should be reflected in the results.

Production blocking

Looking at interruption is a direct way of measuring P.B.2.2.. The other versions of production blocking are not measurable using this approach. Soundstorm does not explicitly focus on mitigating P.B.2.2., though the turn-taking nature of the game does do so implicitly. I do not expect a decrease in this type of production blocking when using Soundstorm. Instead, I expect an increase in interruptions when using Soundstorm, as all participants should be better at expressing their ideas (P.B.1) and feel less inhibited when doing so (P.B.3).

Idea count

There is no significant difference between the idea count (p=1.0) of the control group and the intervention group, see figure 14. There is a small, insignificant difference between the total utterance count (p=0.8). This is also what I expected, as the brainstorm method is gated by the verbal Means of Expression (Diehl, 1987). Interestingly, interruptions had little effect on the idea output. From observations, participants would just talk over each other, so I expected interruptions to increase the idea count. There was also no difference in interruptions between the groups (p=0.8), see figure 15.

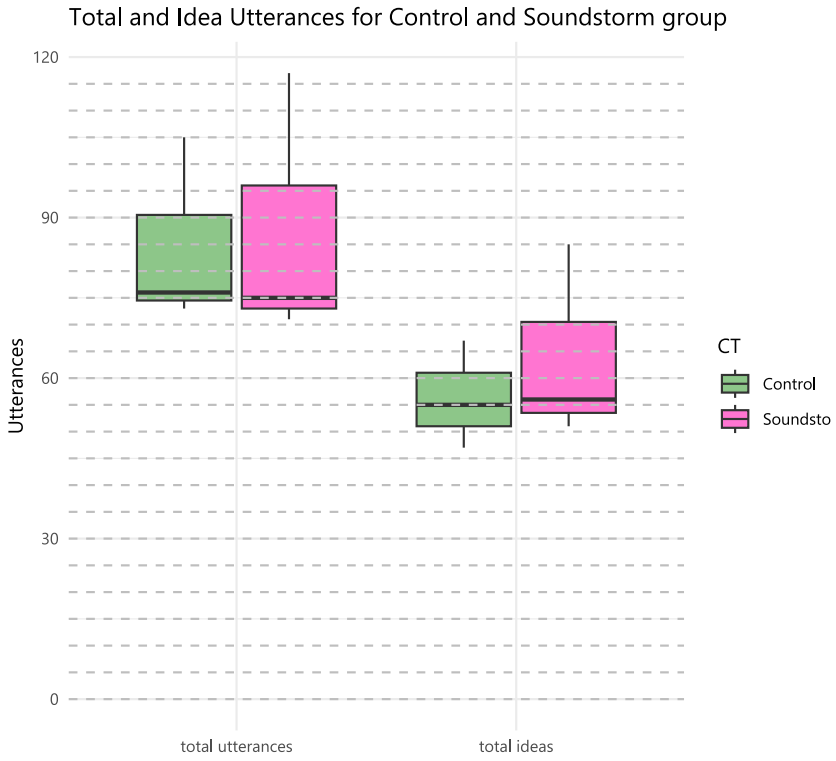


Figure 14

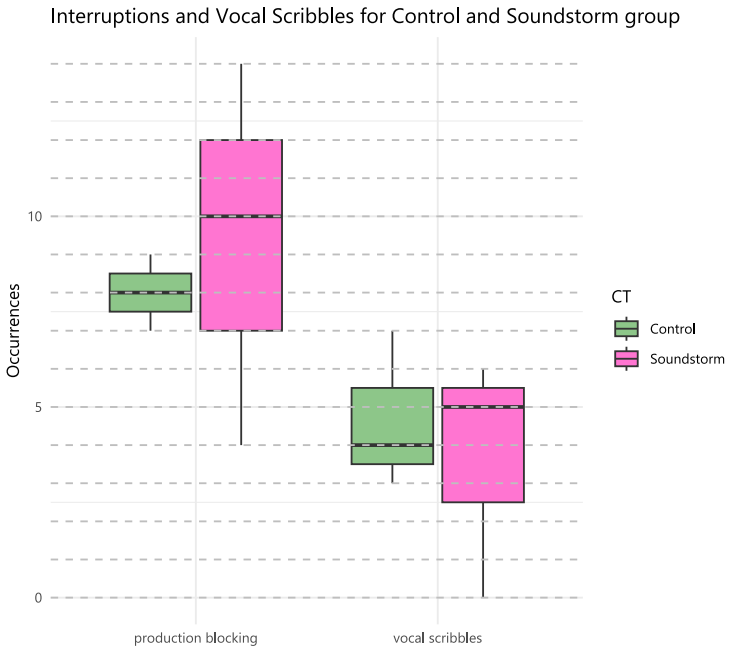


Figure 15

Analysis count

There is an increase in the number of Analysis utterances, and a decrease in the number of Feedback utterances for the Soundstorm group, see figure 16. Though this is not significant (p=0.1). This could mean Soundstorm makes the design dialogue during the generative session more focused on only generating ideas, and that Soundstorm groups paid more attention to each other

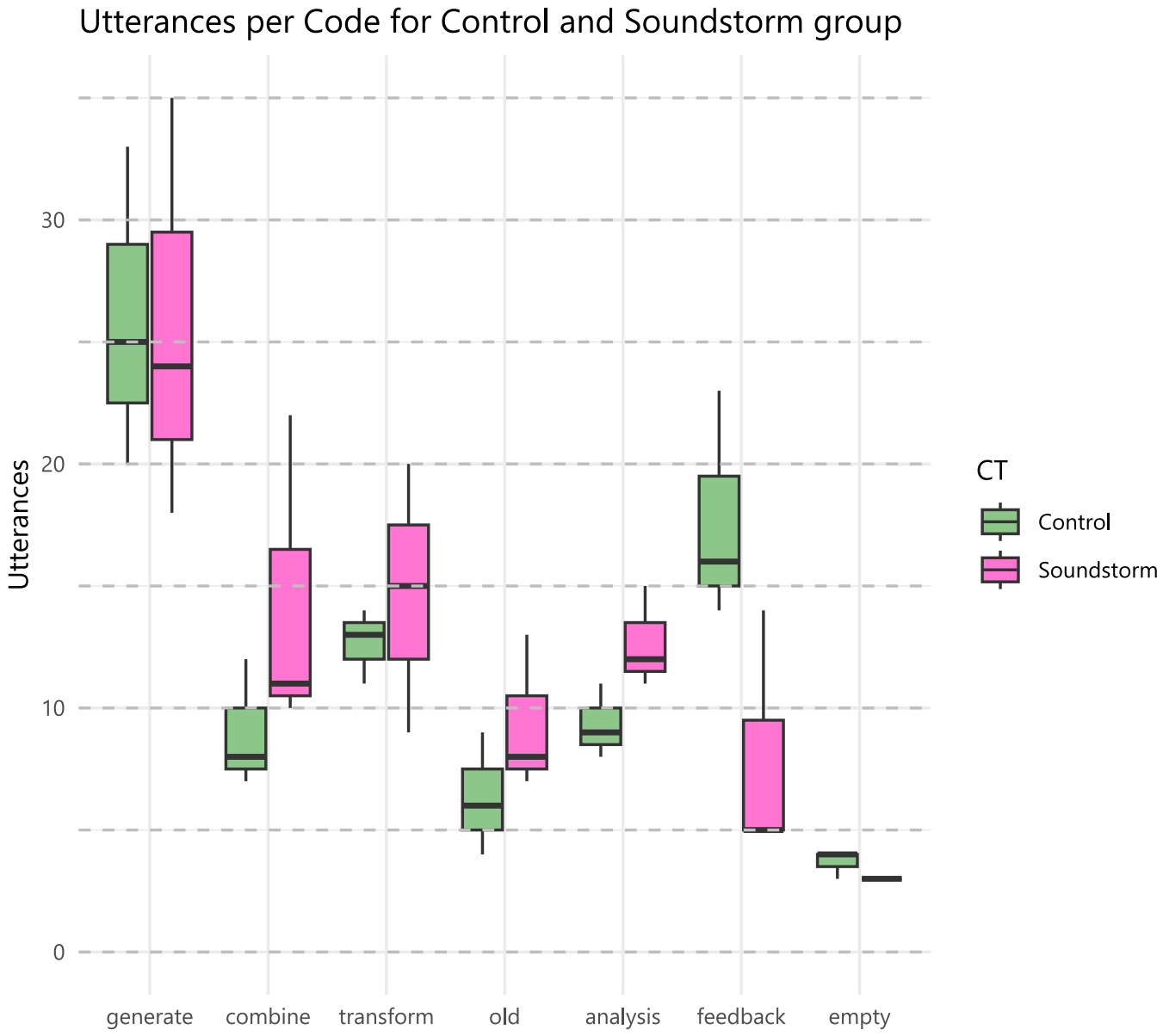


Figure 16

Idea composition

Idea composition is somewhat influenced by playing Soundstorm, see figure FIXME. There is an increase in Combine ideas (p=0.2), though it is not significant. This could mean that Soundstorm somewhat improves the iteration of ideas, though it is interesting that transformative ideas did not differ between the groups (p=1.0). That the Soundstorm group might pay more attention to eachother is also reflected in the increase in Old ideas(p=0.4), though this is also not significant. The method in which the data was prepared also did not take into account participants modifying and combining their own utterances.

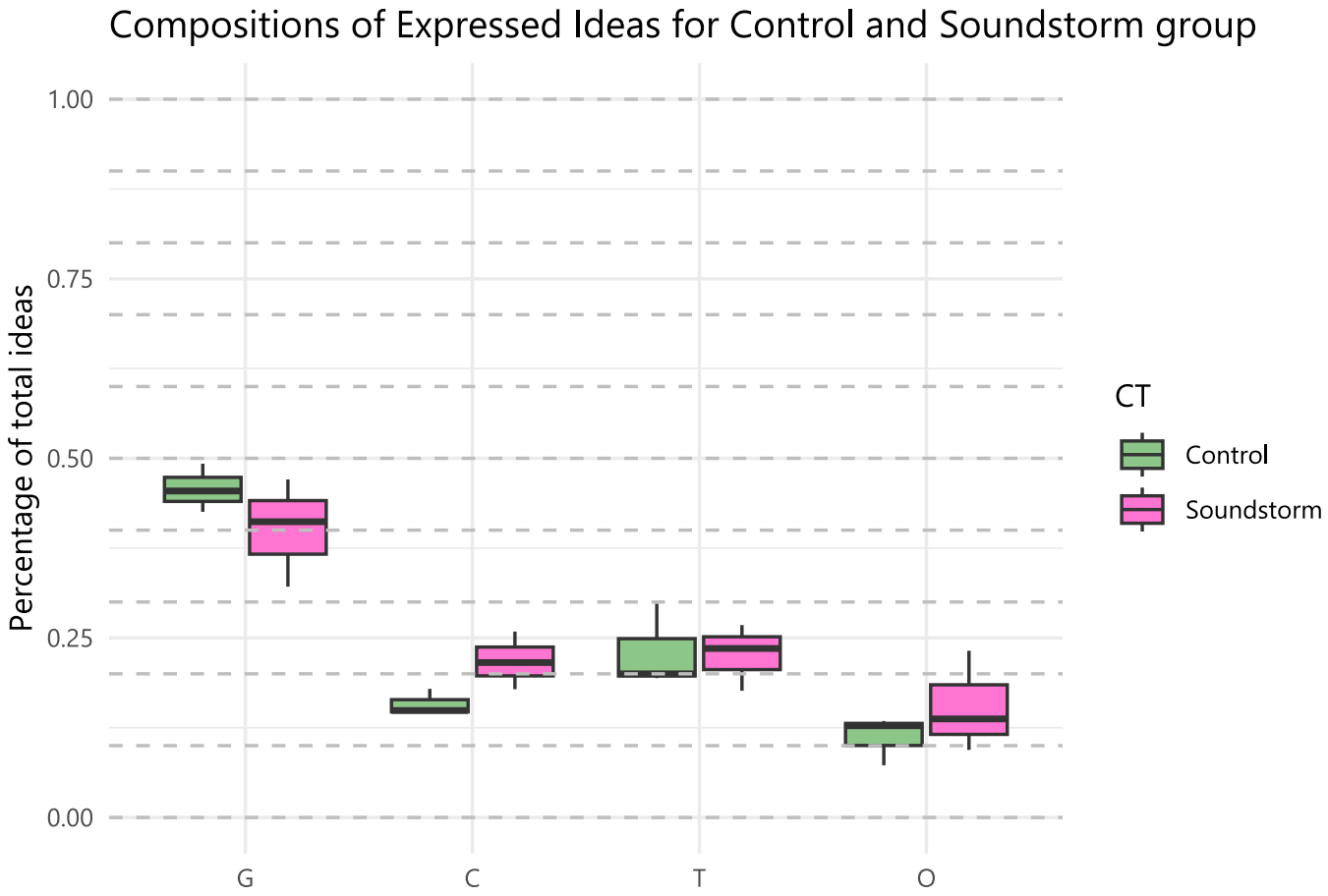


Figure 17

Conclusion

Soundstorm does not affect the Idea Exposure and Production Blocking. It does increase the occurrence of analysis during a generative session. It is difficult to say this definitively because of the low participant count, and the composition of the participants.

Test setip influence

Soundstorm is designed to engage the Persistence and Flexibility pathways, which should increase creative output (Nijstad, 2010). During testing, the Soundstorm group first played a game of Soundstorm, after which they were presented with the written problem statement. Reading the problem statement engages different cognitive processes (Kim, 2022), negating the effect of playing the game. Furthermore, the reading speeds within a group varied greatly. Though the problem statement was written to be readable within one minute (Dyson, 2000), some participants took upwards of 10 minutes. This then has a greater impact on participants' cognitive processes than playing the game. In a full sound-driven design process, the contents of the problem statement would not be new information to the participants of the generative session, so this effect should be less.

Particiants

Participant selection influenced the result in two ways. First, the number of participants (n=18) is low, as when divided into groups this leads to a comparison of 3 groups per category. This means results are easily influenced by outliers, and the significance of the results is low. In group ideation research participants can hit counts in the hundreds (Paulus, 2000). This could be circumvented by using linkography, to be able to better assess the differences between the formation of the sonic ideas of the two groups (Hatcher, 2018).

Secondly, the participants were recruited from my network. This meant that the participants mostly also knew each other. This means participants were comfortable interacting with each other, which led to increased group cohesion (Sawyer, 2010). Increased group cohesion increases the idea output during a generative session (Spencer, 2008; DeDreu, 2011). Increasing group cohesion is also one of the supposed benefits of board games (Uz Bilgin, 2020), and this effect is negated by the selection of the participants.

Influence of coding schema

Protocol analysis always has some level of subjectivity, which is why it is recommended to check the correspondence of codes with at least three researchers (Goldschmidt, 2014). I did not have time to check the correspondence.

Furthermore, focusing on quantity rewards short ideas. This means that exploring more complex or interactive solutions is penalized in this research, as the total amount of ideas is significantly lower than just listing sounds. While focusing on quantity also increases quality (Reinig, 2008), I suspect my coding schema focuses too much on short ideas.

Fixed creative idea ouput

Within creativity research, there is no consensus on if creative output is fixed, or if this can be influenced in the short term (Nijstad, 2010). In the fixed view, creativity is a constrained stochastic process (Simonton, 2003), that is a consistently occurring random cognitive process. This randomization of thought happens at a fixed consistent rate and can then only be changed by long-term practice (Csikszentmihalyi, 1999). This is in contrast with the view that creativity is a controllable cognitive process, which means that it can be influenced in the short term (Perkins, 1981; Stein, 1975).

RECOMMENDATIONS

Recommendation Sound-driven design

For the future of the sound-driven design field, I recommend focusing on researching design tools and methods that are easily accessible. Accessibility, specifically the ease of implementation is one of the reasons the brainstorm method is still widely used (Williams, 2016). Within product sound design and sound design, it is common to develop custom tools to manage the complexity of the design process. Whilst these tools are useful, there is currently a gap in tools and methodologies that assist in early sound-driven design explorations.

For future research in sound-driven ideation, I recommend further exploring the fundamentals. This means making comparisons between generative session methods. Specifically, it would be interesting to compare nominal groups and brainstorm on all four-ideation metrics. These are idea novelty, variety, quality, and quantity (Shah, 2003).

It would be interesting to have an example of a project that sees sound-driven design through.

As another important next step for sound-driven design, I think it is time to consider the full design process. That is, include both diverging and converging steps, during a collaborative design project, that works on a sound-driven principle. This would lead to insights into how the coevolution of problem and solution occurs in the sound domain, something that was not considered in this project.

Recommendations: Soundstorm

During playtests, Soundstorm was a fun and silly game. This was somewhat lost during the validation, because of the more formalized setup. Because it is fun to play outside of a sound-driven design context, Soundstorm has some potential as a commercial board game. Developing Soundstorm further should be done by leaning into the silliness more. Including card art that supports this tone and would allow it to be played without reading the text. This would also make it playable with a younger demographic. They would also benefit from learning the sound description and audible sound connection (Liu, 2010).

To improve sound-driven ideation, I believe that it is vital that participants practice expressing sonic ideas, and that some initial social cohesion is formed. Kickstarting creativity just before the generative session starts is a good bonus, but if the session is longer than a few minutes this is not vital. Soundstorm is intended to combine these three activities into one. With a focus on low barriers to entry, by being fun and easy to do. Even if the results did show that this works, it would not mean that designers should put effort and attention into preparing participants for a productive generative session.

REFLECTION

As I conclude this master's thesis, I want to reflect on my main learnings during this project.

The main thing I will take with me from this project is that the way you design influences what you design. There is an inherent bias in the design expression that you use during the process. These expressions then influence the rest of your design process. Similar to Mcluhan's famous quote (1994), The medium is the message. Before this project, I used to reflect only on my personal biases and preferences on a design process, not on how the tools and methods you use also inform this.

When I started this project, I assumed that I would go on a co-designing adventure. Quickly the context of sound-driven ideation took me in a different direction. Still, I engaged with stakeholders from the context, and with play testers, on a level I had not yet done. While reaching out to others is still difficult to me, I now feel more confident in the steps that come after initial contact. Working iteratively on the game gave me confidence in my ability to do collaborative design and receive feedback on solitary projects.

I can confidently say that this report is the best thing I have ever written. I still don't like writing. But this thesis is proof to me that I can do it. Before this thesis, I was not convinced I would be capable of this. The writing methodology I used helped me tremendously and can also be used for other (hopefully smaller) writing tasks. That methodology is Bullet points of all my thoughts. Using AI as a spit balling machine, fleshing out these bullet points. Using this ai generated text to structure the initial bullet points. Writing a text for these bullet points. Leaning heavily on my peers for feedback and assistance. Iteratively improving the report until there is no time. With this approach, I am now also at the level of reporting where I write to much. For me, that is a step forward. Now I can start improving my skills in trimming my texts.

06
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