

# Material metaphors: method for physicalizing relations and experiences

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## Abstract

Physicalizing or materializing relationships between ideas and experiences can be an effective and creative tool for people to discuss otherwise hidden concepts around diverse topics. Earlier research has shown how toolkits can help people express themselves by representing concepts and relations physically but can demand effort to prepare and substantial time investment by participants and researchers. In this paper we discuss how these barriers to such physicalization toolkits can be lowered by using easily obtainable household materials. The Tangible Thinking workshop was analysed and critiqued, and an example is given of how to creatively iterate on it, resulting in the novel Material Metaphors workshop. By performing the Tangible Thinking and the Material Metaphors workshops, it became apparent that the diverse materiality of Material Metaphors helped the participants to tell a more personal story, due to the ability to adapt elements to their own meanings. This study gives an insight into what happens when people collectively seek for accessible tools to explore a connected future, like the one we were introduced to during the time of COVID-19.

## Author keywords

Thinking with things; Mental Landscapes; Co-design; Qualitative Research; Design Research; Material Practice

## Introduction

Physicalizations can be effective tools for exploring ideas, experiences, and relationship dynamics. People have used artefacts, drawings, arrangements, movements, and other physical representations to enhance the communication of ideas (Kirsh, 2010; Tversky, 2015). Creating physicalizations can help people communicate their ideas, feelings, or experiences that might be difficult to share with just speech. There are many tools to facilitate this process (Aguirre-Ulloa & Paulsen, 2017; Andersen, 2013; Fass, 2016; Lockton et al., 2019; Rygh, 2018; Rygh & Clatworthy, 2019). Often the resulting physical representations contain elements whose metaphoric meaning is derived either from their *topological* aspects (i.e. static properties), their *connective* aspects (i.e. relationship qualities to other elements) or their *performative* aspects (i.e. dynamic properties) (Lockton, Brawley, et al., 2020).

One tool that exploits all three aspect types is the Tangible Thinking (TT) workshop (Lockton, Brawley, et al., 2020), which takes the Mental Landscapes Toolkit (Ricketts & Lockton, 2019) as a topological core and adds connective and

performative elements in stages during a workshop. Participants are provided with cardboard cut-outs representing elements found in natural landscapes such as rivers, mountains, and clouds. Using these materials, metaphorical representations of experiences can be made and related to the physicalizations of other participants. This process results in a rich physical 'landscape' representing a dialogic understanding of the topic.

This workshop takes three to four hours and has mostly been applied to discuss the topic of interdisciplinary work (Lockton, Forlano, et al., 2020). We note a couple of points needing improvement:

- » The workshop is quite time-intensive both during the workshop and for preparation.
- » The materials are not easily accessible, as they require a large quantity and variety of laser cut cardboard in different colours, for a total of hundreds of individual elements.

We set out to make the tool more accessible for both researchers and participants from a time and material perspective. We adapted the workshop setup to a more limited list of materials qualities, which could encourage the creative use of materials by constraining the material freedom (Rosso, 2014). This resulted in the adapted method, coined Material Metaphors (MM).

In this study, we set out to answer the question: "How can a toolkit based on household materials help facilitate discussion about dynamic relationships with technology, through materialising metaphors?" As a case study, we examined the change of relationship between students and technology caused by the COVID-19 pandemic. This topic was chosen as it is a recent and impactful experience that participants could visualize (De' et al., 2020; Vargo et al., 2021).

Note however, that the focus of this research was not about this specific case, but to examine the workshop method, which should give insights into the collective use of accessible tools for exploring a connected future, as it was accelerated during COVID-19. This method is not intended to be constrained to creating physicalizations of relationships and experiences related to only technology. Ultimately, MM should also be applicable for use cases such as facilitating discussion through the materialization of relationships like those between co-workers as was done using Tangible Thinking (TT) workshops by Lockton et al. and beyond.



In the following sections, we first review related work on physicalizations and then set out the formative design and evaluation method. Next, the findings will be presented, discussed and finally be concluded into the core findings.

## Related work

A variety of physicalization methods use metaphors to make complex ideas and feelings tangible—from improvising using salt and pepper shakers to explain the offside rule in football, to constructive projective techniques in psychiatry and art therapy, to more formal methods such as LEGO Serious Play (Kristiansen & Rasmussen, 2014). In recent years there have been a number of design projects and toolkits in this domain. There is no ‘right’ way to externalise thoughts: (Jonassen & Cho, 2008), we often need “visual prostheses” to share our mental imagery with each other, inclusive tools to help people capture, and communicate the qualitative dimensions of their experiences, to enable discussion or peer support, or even to facilitate group or team sensemaking. Some approaches use abstracted metaphors of real-world elements, such as the ‘navigation charts’ (Rygh & Clatworthy, 2019)—supporting cross-disciplinary work in the healthcare sector, making communication otherwise hindered by jargon, more inclusive—or the Mental Landscapes kit (Ricketts & Lockton, 2019) which uses cardboard elements such as mountains, trees, fences, rivers, and more to facilitate the creation of a ‘mental landscape’ to physicalize career paths and project experiences. Other approaches use more abstract forms, physicalizing digital experiences in participatory design research (Fass, 2016), or Emotional Modelling (Luria et al., 2021), which uses geometric shapes from different materials and colours that can be connected to help participants communicate mental health experiences.

Other projects build further on material properties as metaphorical components. Relational Material Mapping (Aguirre-Ulloa & Paulsen, 2017) physicalizes systemic relationships (in public services) by connecting elements using different materials with multisensory meanings associated to them (e.g., hemp meaning nature, nylon meaning transparent, etc.). The Tangible Thinking (TT) workshop (Lockton, Brawley, et al., 2020) uses a three-phase workshop session. In the first (topological) phase participants create a landscape; in the second (connective) phase, the participants add material such as wires and strings to connect the elements in their landscapes, the materiality of the connective tissue giving metaphoric meaning to the relationships.

The last (performative) phase adds a time component to the landscapes, where the participants make their landscapes dynamic by moving elements or for example turning lights on or off.

There are more complex physicalization methods, such as Making Magic Machines (Andersen, 2013; Andersen & Wakkary, 2019), a workshop for children—and later adults—in which they create non-functional ‘magic machines’, lo-fi props that facilitate speculative use scenarios, physicalizing possibilities that new technology could bring. Equally, there are simple approaches to using metaphors for expression, such as New Metaphors (Lockton et al., 2019), a card-based workshop method for creating unexpected metaphors for difficult to describe ideas. The degree of customization or alteration encouraged of participants is reflected on by many authors. While the language used is often different, the meth-

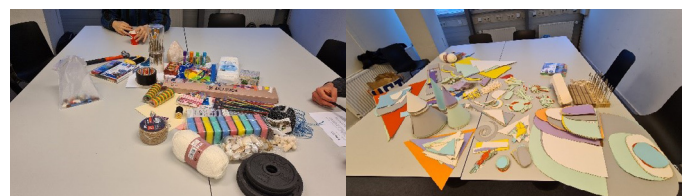
ods discussed in general physicalize ideas from a *topological*, *connective*, or *performative* point of view. Most of them are only based on one or two of these perspectives, and only the TT workshop integrates all three. There is a gap in methods that creates a representation of complex ideas in a topological, connective, and performative way. But as discussed in the introduction, this method takes a substantial time and material investment.

## Method

First, interviews were conducted to gain insights into which metaphors and mental models students use to discuss the chosen topic: “The change in the relationship between students and technology during the COVID-19 pandemic”. The choice to focus on relationships was due to an emphasis on physicalizing relationships in previous work done with the Mental Landscapes toolkit. Semi-structured interviews were conducted with five participants, which consisted of a series of open-ended questions that encourage spontaneous and in-depth responses (Ryan et al., 2009). Moreover, the sentence completion method was incorporated, in which the first part of a sentence is given to the participant, inviting them to complete the sentence (Dittmann-Kohli & Westerhof, 1997). The interviews were recorded and transcribed, and a thematic analysis was performed on the transcripts by multiple researchers. The themes were based on the metaphors that were used by the participants to describe their experiences during the interviews. The metaphors were translated by the researchers into a list of material properties, from which a selection of materials was made with which those metaphors could be represented (Figure 1). Materials were chosen to afford a diverse range of constructions and easy to purchase at budget hobby-stores.

## The workshops

The MM workshop had 4 participants and the TT workshop had 3 participants. In both workshops, the participants were asked to use the elements provided (Figure 1) to visualize their experience with the change of relationship with technology during the COVID-19 pandemic, which was the same topic shared by the explorative interviews in the previous phase. The session started with the participants working on their personal physicalization. Afterwards they were asked to present their creations to the researchers and to each other to see if the workshop would aid the participants in talking about their experiences, which started a group discussion and if it facilitated the dialogic joining of experiences together. A structured observation method was conducted during both workshops, as to analyse the process guided by research questions. Afterwards, the workshop was evaluated with the participants using open questions.



**Figure 1.** The materials used in the Material Metaphors (MM) (left) and Tangible Thinking (TT) (right) workshops.

## Analysis

A thematic analysis was done of the two workshop transcripts using the free and accessible analysis tool, Taguette (Rampin & Rampin, 2021). The themes used for this were focused on the workshop experience, in contrast to the interviews' themes, which focused on the participants' actual relationship with technology during the COVID-19 pandemic. Furthermore, the created physicalizations during the workshops were analysed based on material use and how the participant described their creation.

## Findings

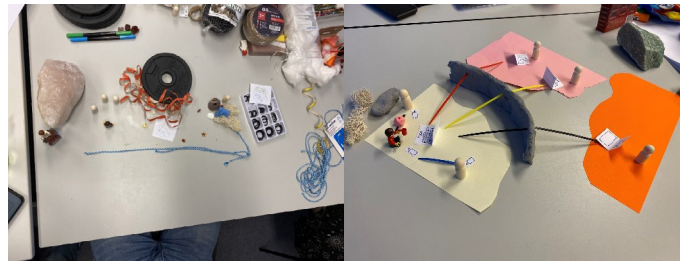
### Exploring metaphors

During the first interviews, a material qualities list consisting of 15 categories was created based on the metaphors used by the 5 participants (P). For example, P4 mentions: "I think it's difficult for me to see the balance between [work-life balance]" which lead to materials with the quality of creating balance or endangering it being included. Round or firm objects were considered, as well as objects with different textures to ensure that participants can express their (dis)comfort levels. P2 mentioned doing activities with their roommate to separate work and their personal life, which translates into the qualities of separation (clay, scissors, and varied materials to create spaces, like paper) and different actors (wooden statues, LEGO figures and objects with different shapes). P5 mentioned: "I've noticed that I find it hard to get to work when you're stuck at home the whole time", which translated into heavy objects, like the crystal rock and weight.

### The workshops

Metaphors analysed during the interviews reappeared in the explanations of the physicalizations during the MM workshop. Multiple actors, connectors and objects with different properties were used to explain special relationships or strong bonds. In every physicalization, diverse representations of actors and metaphors were being positioned in dependency on one another. As seen in Figure 2, ropes or cable ties were used to show the connections between actors and the different states of the relationship between themselves and technology. P7 describes a heavy feeling, represented by the crystal, which leads to a clutter of responsibilities, portrayed by the strings of confetti. These were metaphors for the time spent working at home, which eventually led to a more structured work-life balance, shown by sponges that represent nature and the structured packaging of the sealing rings. P6 visualises space by building paper islands connected by cable ties but separated by a clay wall. The participant's loved ones and colleagues were in different countries and every interaction had to happen through digital environments. Heavy objects were used to show either a strong bond between two loved ones or a crushing feeling of technology. Connectors, like a rope or a cable tie were used to express relationships, closeness, and correlation, but were also used to portray an arrow to show the movement of time.

The biggest similarity between both workshops was that the combination of both metaphoric and non-metaphoric elements by participants in their landscapes. Moreover, they liked the group aspect, due to them being helped and influenced by the others their stories and materials used. Although



**Figure 2.** Physicalizations from the Material Metaphor (MM) workshop: timeline landscape from P7 (left) & island landscape from P6 (right).

the materials were different for both workshops, both groups appreciated the variety offered. Both groups found it difficult to start creating their landscape. However, the TT group started quicker, as the materials being pre-made helped them with creating metaphors.

The biggest difference in both workshops was adaptability. The MM group quite enjoyed the number of options offered whereas the TT group wanted more elements or the ability to customize them. Moreover, some TT participants mentioned that they would like to have the objects made of different materials.

MM was experienced as a bit chaotic, as participants wanted a more structured overview of the provided materials. The variety of materials ensure due participants were inspired by others using different materials. One participant even used residual materials from another participant. Some would have liked a larger quantity of certain fabrics, as some were scarce. However, the participants found that the diversity of materials made it more challenging to create a shared landscape. They ended up not combining their unique dual landscapes but positioned them relative to each other instead. However, the TT group did combine them (Figure 3). The MM group mentioned that they sometimes got ideas by looking at certain materials and other times picked materials based on ideas they already had; the TT group only stated the latter.

Interaction-wise there were also some differences in both workshops. The TT group had more social interaction during the workshop itself. When somebody talked about what they were doing and what materials they were using other participants asked questions or shared memories. Once a negative experience came up, more negative stories were told, which occurred less with MM. While the original topic was the same for both workshops, the generated themes differed: MM physicalizations often visualized relationships, while TT often depicted more barriers.



**Figure 3.** Combined landscapes of the Material Metaphors (MM) workshop (left) and Tangible Thinking (TT workshop) (right).

## Discussion

The workshop toolkit was created based on a research question *“How can a toolkit based on household materials help facilitate discussion about dynamic relationships with technology, through materialising metaphors?”*.

The diverse set of materials helped the participants to decide which story they want to tell. The representations of the timelines varied by person as well as the presented detail of different relationships. When comparing the details of the two workshops, it could be argued that the more material is available, the more personal the creations will be. Seeing the difference in storytelling, chosen colours and amount of detail let us believe that people can identify themselves more with different materials and can tell their story in a personal way.

The materials provided in the MM workshop had too much variety, which made it harder to combine them and confused instead of inspired participants. Therefore, it is important to select more essential materials and sort them in a coherent way, like keeping the materials within specific themes. Making these changes might improve the combining of the landscapes phase, which is an essential, as it triggered much discussion. Seeing others work might also make the process easier for people who are less familiar with creative processes.

The differences in the discussed themes between both workshops could be attributed by the materials provided by the toolkits. The rivers and mountains from the TT workshop might explain the barrier theme, due to these being large barriers found in nature.

Moreover, future research is necessary to see if the adapted toolkit is also suitable for other topics. Lastly, more work could be done on the selection of materials and their perceived metaphoric meanings. We anticipate that our adaptation will be useful for design researchers at the initial and ‘messy’ phases of their design research.

## Conclusion

The aim of this research was to compare the Tangible Thinking (TT) workshop to an adapted more accessible version. Interviews were conducted to gather data on how material metaphors could be created around the stories participants expressed. Out of this, the Material Metaphors (MM) workshop was created based on a diverse list of material qualities.

MM has been tested and compared with TT during two workshop sessions. The goal of this research was to analyse the impact of allowing participants more freedom to customize and adapt the materials offered to them when making a physical representation of their past experiences and to discover what the impact is of offering a larger variety of accessible materials. It is difficult to make strong claims about the data collected during this research due to its small scale and qualitative nature. However, some interesting observations can be made, which are summarised in table 1.

**Table 1.** Observed similarities and differences between the MM group and TT group.

Material Metaphors	Tangible Thinking
Inclusion of both metaphoric and directly representative elements in the created land-scapes	
The group aspect was experienced as positive and participants inspired each other	
Participants appreciated the variety of materials	
Accessible material selection	Defined materials, needing machinery for workshop preparation
Highly adaptable and Diverse materials	Standardized materials
More chaotic and slower start	Structured and faster start
Material exploration and inspiration	Pre-made metaphors
Difficult to combine landscapes	Easy to combine landscapes
Landscapes were positioned next to each other	Landscapes were combined into one super-landscape
Materiality inspired ideas, leading to the selection of materials used in landscapes	Ideas defined materials used in landscapes
Positive stories visualizing relationships	Negative stories depicting barriers
More personal landscapes	More shared experiences

It was shown that the material qualities of the MM workshop have a positive effect on participants storytelling and recollection. More personal and experienceable stories were created and shared, which led to in-depth discussions. This could be derived from the tactile experience of the material or from different methods of material storytelling. The materials were selected based on a variety of potential themes. Separation is encouraged by some materials, while others encourage communication. The relative weights of various materials played a role in the final selection. The contrast between the rough and highly smooth surface promoted unique ways of thinking. This workshop and the characteristics of the materials could serve as the basis for future research.

The MM workshop is more accessible than the TT workshop, as researchers do not have to have access to machines that produce the materials, and no additional preparation is needed aside from gathering.

The TT workshop's strength is to communicate shared experiences due to the possibility of combining the created landscapes, which was found difficult in the MM workshop. This workshop creates more personal physicalizations of experiences that cannot easily be combined. However, MM can facilitate discussion among participants comparing their created works.

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