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Communication with Self, with Others, and with Futures: Making Artefacts in Design Thinking Workshops

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Abstract

When language is a barrier to constructing knowledge, visualising and prototyping can facilitate communication internally with one's self, externally with others, and speculatively with the future. The cognitive effects of the making process help participants express tacit knowledge, and surface assumptions that may have otherwise gone unnoticed and unchallenged. Within design thinking workshops, the collaborative act of hands-on making helps mediate power dynamics and contributes to social learning. As ideas are explored, prototyping supports a speculative discussion about possible and preferable futures. This collaborative process of shared meaning-making helps give agency to previously excluded voices, such as youth and minorities, and has implications for socially inclusive practices. These ideas are discussed and illustrated verbally and visually.

Keywords: *co-design, design thinking, material, mediation, participatory workshops, social learning*

1. Introduction

This is not just another article about "design thinking", explaining how you too can innovate if you follow linear steps presented in a neat chart. This is a love letter to a process that sometimes results in more questions than answers, and an exploratory examination of the modes of communication that take place in these messy, physical, experiential activities inspired by design methodologies. This article strives to share the genuine excitement and optimism experienced by two early career design researchers observing non-designers reflecting, communicating, playing, and working through

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complex problems in creative and collaborative ways through the dialogic making of physical, material artefacts.

First, we discuss the current state of design as a discipline and what is meant by "design thinking workshops" through some of the foundational theories from established and contemporary experts in the field. Then, we closely examine the multimodal communication taking place in these workshops and how the process of making opens communication with one's self, communication with others, and speculative communication with the future. These three modes are distinctly framed in order to thoroughly investigate the ways that materials mediate inquiry and knowledge production taking place. However, this creative methodology is most impactful, of course, when it helps workshop participants to transverse seamlessly among the three. Design thinking is especially transformational in workshops that bring together diverse participants and structure the activities in a way that allows them to materially engage with the ideas in abstract, messy, and expressive ways. The discussion of these three modes of communication is interspersed with stories from the authors' personal experiences designing workshops with the XYX Lab at Monash University, Australia. XYX Lab is a team of designers and architects who explore the intersections between gender, urban spaces, and communication, hoping to contribute towards a more equitable and sustainable future rather than just a commercially viable, designed "thing".

1.1 Design thinking workshops

Today, many design thinking workshops fall into the spheres of research and social innovation. The participatory practices discussed in this paper are at the heart of the work the XYX Lab is doing. Therefore, the stories discussed in this paper are from recent workshops the XYX Lab has designed and facilitated within this context. While the exact project may vary, all of the workshops involve the use of creative, visual, and engaging activities to bring together diverse participants in order to co-create understanding and knowledge for a targeted purpose. Two major XYX Lab workshops discussed in this paper are described below:

1.1.1 The Victoria Pride Centre

This workshop brought community members, board members, and stakeholders together in order to craft a shared vision for Victoria's first Pride Centre in Melbourne. The workshop was designed to help reveal how the LGBTQI community's values, history, and culture could inform a mission statement and translate into the brief for the architects.

1.1.2 "Free to Be Design Thinking"

This workshop brought together over 60 diverse participants, including youth activists, city of Melbourne officials, Public Transit Victoria representatives, and various city council members, to examine sexual harassment in urban spaces. It was developed in response to a user-generated map developed by Plan International Australia and Crowdspot (see 2.1.1), which highlighted where in Melbourne people (mostly young women) felt safe or unsafe. The activities helped explore questions about the spatial and social factors that influence equal access to the city, and propose ideas about how to make Melbourne safer and more inclusive.

As a general methodology, XYX workshops follow four stages to enable diverse groups of people to come together around a complex issue: 1) Understanding: a brief introduction to design thinking and description of expectations and ideal mindsets for the workshop; 2) Thinking: sharing information and analysis of the issue gathered up to the time of the workshop; 3) Visualising: using design thinking methods to map the issue and brainstorm possibilities; 4) Making: physically constructing ideas and possible solutions through bespoke materials (see Figure 1).

1.2 The evolving role of design

These participatory co-design workshops reflect the evolving role of design as a field, but also build upon strengths of the discipline that have been integral to design since the beginning. To understand the increased presence of design in the context of research and social innovation, it is important to have a sense of how it has evolved, particularly in the last twenty-thirty years. Sanders and Stappers are internationally influential academics and practitioners who are leaders in the field of Co-Design, a contemporary field of design in which users are included throughout the design process instead of just as a consumer of the product. When they share their experiences of the changing landscape of design since the 1980s, they describe a shift from design as a practice concerned with styling and creating material artefacts for market and technology-driven innovations, to a more user-centred design practice with expanded notions of what could constitute design (such as systems, interactions, public services, etc.). This movement emphasises the importance of ensuring design meets the needs of the users, and has resulted in designers increasingly being involved in the context framing of a design project. In these situations, designers are often confronted with having to deal with "wicked problems", that is, typically systemic and social problems that are ill-defined, with intricately connected variables and no one right answer (Buchanan 1992). In tackling wicked problems, designers increasingly need to work more collaboratively to respond to the affordances and demands of technology, globalisation, and new ways of organising civic society (Sanders, Stappers 2013).

1.3 Visual, verbal, tangible – What making facilitates

This increased collaboration between designers and non-designers and experts in other fields has given rise to the now well-known phenomenon of "design thinking" workshops. This once discipline-specific mode of inquiry and problem-solving technique has evolved to become widely systematised and easily adopted in different contexts, both to positive and negative effects. In these workshops, participants leverage "designerly" ways of communicating about problems and projects, such as sketching, modelling, and prototyping in order to formulate, test, and discuss ideas (Cross 1982; Kimbell 2009). Unfortunately, one vital element that is often overlooked, or intentionally left out in the interest of time and scalability, is the physical modelling and prototyping that is so integral to creative practice. These acts of creation are often what distinguishes a designerly way of reflecting, problem solving, and testing ideas from other disciplines. The act of making is highly influential in design as an iterative process that embraces intuitive insights, suspension of judgement, and the exploring of multiple possibilities. Kimbell criticises, "The concept 'design thinking' with its suggestion of cognitive styles neglects to account for the artefacts without which design practice cannot proceed and which constitute design" (2009, 10). This creative generation of artefacts contrasts with other predominantly analytical and verbal techniques like post-it note brainstorms, discussion, and written or oral summaries. Unlike prototyping, these familiar methods condense and converge all the different perspectives and potentialities generated by a diverse group into succinct, definitive points.

Design methods acknowledge that while communication is always necessary, it is not always necessarily verbal. In fact, there are times when language is actually a barrier, as experienced by anyone who has ever had an idea just on the "tip of their tongue" or tried to explain something to a larger group, only to discover that other people were not fully comprehending the intended message. In these situations, making and prototyping can act as an intermediary – helping to distil, form, and communicate concepts through the process of creating a visible artefact. These acts of creating can be complementary to more traditional and rational problem-solving activities. While these methods may ultimately result in better design solutions, the literature and examples from case studies of XYX Lab workshops indicate that the making activities themselves are valuable in their own right. A holistic examination of the question being asked is possible through reflective making and these acts of creating can be complementary to more traditional and rational problem-solving activities. These activities act as a way to reflect internally, with one's self; share and collaborate externally, with others; and speculatively engage with potential futures.

Figure 1

Figure 2

2. Communication with self

While there are many things that need to take place in order to effectively communicate, arguably one of the most important foundations of communication is the ability to articulate the message. When people want to express a concept that they are still formulating or an abstract idea that is difficult to put into words, these creative modes of making can facilitate the process. Through making, workshop participants follow a "path of expression" (Sanders, Stappers 2013) that helps reveal their tacit knowledge and fledgling concepts, without first having to form explicit words. In this way, making can act as a way of communicating with one's self.

2.1 Surfacing tacit knowledge through the path of expression

Tacit knowledge refers to the sort of intuitive, personal, and hard-to-define ideas that are difficult to express or have yet to be formalised into a concept, or examined before. Though sometimes unnoticed, tacit knowledge is deeply rooted in action, commitment, and involvement (Nonaka 1994), sometimes making it important to reveal in more explicit ways. Elizabeth Sanders, a leader in her creative work designing participatory design tools, suggests a model of surfacing this sort of knowledge and insight, based upon a path of expression (Sanders, Stappers 2013). This path explains how people reason about a topic, moving between reflections about the present, through memories of the past, and explorations around the future. The activities that correspond with this path help people say what they have experienced, reflect on what they do, and then make physical and visual representations that help participants express their "thoughts, feelings and dreams" in order to surface attitudes and insights that otherwise would be unobservable (Sanders 2002, 4). It is through this process, and especially during the reflection on the visuals created that participants' tacit knowledge is revealed and made more explicit.

2.1.1 Surfacing tacit knowledge

Youth activists from Plan International Australia took on the challenge of addressing sexual harassment in Melbourne (Australia) through the "Free to Be" campaign. Partnering with Crowdspot, a customisable online mapping tool for crowd-sourced input, they co-designed an App that let users map where in the city they felt safe or unsafe. In this workshop, the participants went through a series of activities designed to take them through the stages of a path of expression (Sanders, Stappers 2013). They engaged with materials to help them understand the project, consider the

complex social contexts, reflect on their own lived experience throughout the workshop as they empathised with others, and share their learnings and realisations with each other before coming together to visually prototype the potential impacts of the ideas with a paper city (see Figure 2). Each group worked on their visualisation separately but when the parts of the city came together there was a surprising abundance of open green spaces with art and people in them. While no group had actually decided to come up with ideas for parks or gardens, and the prompts did not speak to sustainability issues – it was an assumed element of a preferable and more inclusive city, even though it was not initially listed in the considerations at the beginning of the workshop – it naturally emerged through the making as a common feature and was incorporated into discussions at the end of the activity as groups spoke about their ideas.

2.2 Revealing preconceptions and assumptions

The use of materials in communication can serve as a "trigger" of tacit knowledge (Akama *et al.* 2007). Once tacit ideas have been surfaced through material expression, they can be better reflected upon, interrogated, and discussed. The creation of an artefact includes many small decisions (size, positioning, texture, shape, colour, proximity, connection, weight, movement, etc.) that are often made subconsciously or would take too much time or effort to articulate verbally. Because this underlying tacit knowledge plays such a crucial role in framing the conscious construction of an idea, the process of having to build a physical abstract representation often better reveals unconscious assumptions and provides a chance for reflection on these influences.

2.2.1 Surfacing assumptions

The power of making to reveal one's implicit assumptions can result in better understanding. For example, in a visioning workshop with the Victorian Pride Centre, participants were modelling and representing the sorts of spaces and activities that would be needed in the new centre. In one group, an archivist and a librarian gathered several of the abstract shapes (see Figure 3) that had previously been labelled as things like "books and historical artefacts" and concepts like, "knowledge of the past," and "appreciation of struggle". These were stacked onto a bigger shape that was then labelled as the library archive. Someone who did not work in the library moved these archives to a lower area in the visualisation, commenting that archives were not the first thing visitors see when they go into a building.

Figure 3

The archivist in the group jokingly mentioned being sick of always being in the basement, which prompted a chat about why everyone had been assuming that the archives were not for the public. This physical diagramming revealed an implicit assumption that when designing future spaces to house the Pride Centre archives, the only concern was that they would be kept securely locked away for preservation. As the group discussed the different ways the archives and library could actually interact with the public, the person who moved it admitted they always thought of history as something to read about but not as part of their lives. This prompted discussion about how to create a more outward-facing, and dynamic archive and resulted in the addition of a history walk that would translate knowledge of the past into a more interactive and public-facing experience.

The cognitive processes involved in abstraction and visual representation allow for a different mode of reflecting, and then the artefact itself can become the source of deeper reflection and interrogation, often revealing preconceptions and underlying attitudes. As a communication tool, these materials serve to instigate deeper understanding of one's own viewpoint and how that may be framing the context of the project being discussed.

3. Communication with others

Furthermore, once people more fully understand their preconceptions and are more able to communicate those personal and hard-to-articulate ideas, making material artefacts promotes understanding and communication within groups of people. Once these internal concepts have been explored and the ideas have been voiced, physical making facilitates conversation and collaboration. Unlike a fleeting thought or spoken word, an artefact becomes a physical and constant presence and a consistent point of reference for deeper reflection and interrogation. Within groups, this form of making also offers opportunities to overcome traditional power dynamics and mediate conflict.

3.1 Boundary objects and the process of creation

In collaborative scenarios, like design thinking workshops, one of the major hurdles is finding a common language in order to clearly communicate, especially when dealing with experts from other fields or people with vastly different experiences. In these situations, created artefacts can act as an intermediary allowing for shared understanding and communication between participants. "Boundary objects" are material artefacts used to bridge gaps in knowledge where communication is difficult or could break down. They can be theoretical, abstract visuals, and material artefacts or more concrete like maps and field notes. These objects are valuable tools because they help people from one field explain discipline-specific knowledge to other people or help communicate experiences (Marheineke, Velamuri, Möslein 2016).

A boundary object is useful within the group creating it as well as to other groups, participants, or researchers. It provides a point of reference for discussion within the group, an accessible and negotiable representation of the group's concepts coming together, and serves as a consensus-building tool. It helps visually communicate and illustrate ideas, but it also serves as a prompt for what needs to be discussed further. Through objects like drawings and storyboards, participants clarify their viewpoints (see Figure 4). Photographed, documented, and annotated, these objects can also act as a reminder of what the group was discussing. Later, the documentation of these artefacts helps outside observers and researchers process and recall the information and insights shared, even when the context is complicated (Marheineke, Velamuri, Möslein 2016; Sanders, Stappers 2013).

Figure 4

3.2 Decreasing cognitive load

The combined mental efforts of diverse people working together can illuminate problem spaces and reveal unexpected insights. Edwin Hutchins' theory of distributed cognition explains how cognitive processes such as problem-solving can be distributed across groups of people in collaborative teams, and across people in what he describes as "technologies" or physical tools (Dalsgaard 2017, n.p.). Peter Dalsgaard, in his article "Instruments of Inquiry: Understanding the Nature and Role of Tools in Design" discusses the application of this theory to the work done by design teams, translating the idea of distributed cognition with technologies to the types of tools and materials of creation and communication discussed in this paper. This theory supports how the material exercises help groups work together to communicate, as this externalisation helps "overcome our limited abilities to grasp and manipulate complex constructs by offloading cognition to our environment through externalisations" (*ibidem*). As people creating and making together they are able to tackle more complex problems, they also tend to build consensus and overcome traditional power dynamics.

3.3 Navigating power dynamics

When addressing wicked problems, bringing together diverse and underrepresented voices is crucial in order to best inform the project. Co-design

is often seen as an equalising force, creating inclusion and addressing power dynamics in small ways, as it "contests dominant hierarchically oriented top-down power structures", and it requires and results in "*mutual learning* between the stakeholders/actors" (Fuad-Luke 2009, 147). However, if overly systemised and simplified into a routine series of steps, design thinking risks being either a sort of banal design for the average, or worse, a counterproductive, reinforcing of existing social structures or mores (Lloyd 2004). Even acclaimed design perspectives (such as participatory design and co-design) risks, "reproducing tacit forms of coercion, or turning the change agent into a collaborateur, colluding with current exploitative regimes of consumerism and politics of domination (Cooke, Khotari 2001, 13)" (von Busch 2017, 338).

In design workshops that take participants through material and visual activities, the artefacts created are imbued with meaning from the participants. Within the group, the process of creating objects means the participants have a shared understanding, and the objects themselves become an embodiment of this shared understanding. Equally, moments of conflict that surface in the making activities become a part of the history of the artefact, and serve as a physical reminder of the compromises and choices that were made in the group. By holding opposing embodied ideas in tandem and materially exploring ambiguity or tensions, participants go through a sort of problem-finding, which is described by creativity psychologists Mihaly Csikszentmihalyi and Keith Sawyer as an activity which "confronts the person with a general sense of intellectual or existential unease" about the way the problem is being considered, and allows framing the rejection of the obvious to ask a whole different question (Csikszentmihalyi, Sawyer 2014, 81). This making process has further value as a communication and mediation tool when debating emotionally charged or contested issues. When faced with opposing viewpoints during discussions, there is a tendency for communication to shut down. Furthermore, this "backfire effect" often serves to only further polarize opposing viewpoints, undermining opportunities for progress within diverse groups (Kaplan, Gimbel, Harris 2016).

3.3.1 Compromise and parallel thinking through the transformation timeline

Several groups actually visually recorded and factored in a fight over resources or power, or position – acknowledging that some organisations had competing interests and needs, and even some community members had different values that needed to be aligned. The need to be inclusive to everyone seemed like a given, until one of the ideas that emerged was a women-only safe space. This was seen as necessary and healing for some women, while it was seen as excluding people who were not born female or who have more complex identities. An issue like this is enough to derail conversations and alienate partners, but through the visual methods used the ideas were able to sit

side by side, and they were added to as a group wanted a space for historically important movie nights, and another group wanted a book club, and a meeting space. These ideas all became the impetus behind having several adaptable private spaces that could easily be booked for certain events by certain groups.

Figure 5

This compromise happened because instead of having people arguing for their side, all the perspectives were made visible and developed in tandem. The flexible and easy to rearrange materials (see Figure 5) helped the group explore different paths forward and let them see the commonalities in the type of space needed. Through this participants physically rearranged, grouped, and moved the idea of a women-only group meeting space next to the movie night, and it became the bookable rooms for community use. This ensures that groups have some control over who they invite into their group spaces during the sessions they have booked, while the centre remains a home and community hub for all. This solution emerged organically and because it was not mandated or suggested by just one person – the whole group was part of contributing the ideas and so while it was tense for a moment, no time was wasted – we were able to continue working while keeping in mind the issue, and then a solution became visible as we arranged the cards.

Embracing multiple ideas and possibilities at once is an important part of the design ideation process. In groups, it might be tempting to never let conflicting ideas come together (perhaps following Edward de Bono's concept of "parallel thinking", which emphasises divergent thinking and avoiding conflict; de Bono 1994). However, while this strategy is excellent

for more prolific idea generation, it is less effective in stimulating the kind of meaningful social learning that can occur when one's views are challenged. Embracing this tension requires workshop participants to explain their perspective and widen their framing of the problem in more depth. In these moments where conflicting viewpoints converge, making activities become a scaffold for connecting the intersections of these perspectives. The making then becomes an exercise in reframing the problem and context, rather than finding the "solution".

For example, during the "Free to Be Design Thinking" workshop there was a group that was focused on addressing the issue of sexual harassment and sexual assault on public transport. This group had representatives from the police, public transit officials, and youth activists all discussing the issue. During initial brainstorming and mapping, this group struggled to find common ground, with many having strong and conflicting opinions about the best way to address this issue. However, when the activity transitioned into making (see Figure 6) the conversation shifted towards building connections for their different ideas. This also revealed to the group that there needed to be a system in place to connect the various actors within this complex issue. In this particular case, the act of making allowed these different perspectives to not only exist simultaneously, but the task of model-making forced the group to conceive of connections between seemingly disparate entities, shifting the way that individuals in the group had been framing the problem.

Figure 6

The value of challenging one's own viewpoint is echoed in Transformative Learning Theory which defines frames of reference as "the structures of assumptions through which we understand our experiences. They

selectively shape and delimit expectations, perceptions, cognition, and feelings" (Mezirow 1997, 5). Exposing these frames of reference through an unfamiliar making process becomes important because, according to this theoretical view, "actions and behaviors will be changed based on the changed perspective" (Cranton 1994, 730). Changes in perspective, though often hard to measure, can lead to concrete changes in action. For example, in a follow-up survey to the "Free to Be Design Thinking" workshop, there was evidence of concrete change being implemented as a result of the workshop. As one participant mentioned, "I have considered the design of urban spaces and included this learning into our guidelines for undertaking Crime Prevention Through Environmental Design assessments" ("Free to Be Design Thinking", follow-up survey 2017). The workshop has already informed this and other policy recommendations, and led to the creation of a "bystander campaign" (*ibidem*).

However, as we have discussed, there is additional value beyond these concrete outcomes because these workshops are unique environments for social learning with ripple effects into communities. As one participant reported, "I have spoken with some friends studying urban planning about the things I learnt, they found it really interesting that they have never learnt anything about it" (*ibidem*). Creating deeper understanding and agency allows participants to teach others, resulting in wider impacts, like these urban planners who now have an increased awareness of the spatial factors influencing sexual harassment. As another participant said, the workshop "allowed me to expand my thinking and I learnt a lot" (*ibidem*). These design thinking methods create deep, multi-modal social learning within a limited time frame through simultaneous visual, verbal, and physical communication strategies.

4. Communication with Futures

In addition to facilitating communication with one's self and with others, the process of making has also opened up the ability to engage with speculative futures. Design as a field is extremely future-oriented and embraces an iterative process of testing and prototyping to change present conditions into alternative future scenarios. While science and the humanities tend to investigate questions of "what is" design is always concerned with "what might be" (de Bono 1994). This transformational framing becomes very useful when discussing complex issues like gender. Critical designers Dunne and Raby champion the value of speculative futures and the idea of "using them as tools to better understand the present and to discuss the kind of future people want, and, of course, ones people do not want" (Dunne, Raby 2013, 2-3).

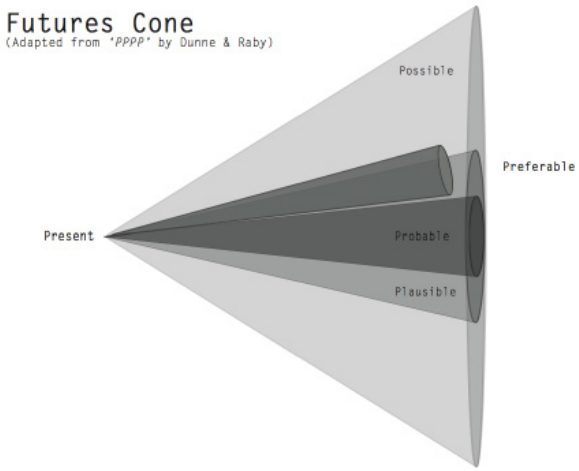

Figure 7

In the above "Futures Cone" (Figure 7, adapted from an illustration by Dunne and Raby, 2013, 5), it is possible to see the value of imagining alternative and preferable futures. Each level emanating from the centre, represents futures that are possible, but less and less likely to happen. The central "probable" zone is where most planning and designing tends to occur, within the confines of what is expected to happen next. However, when addressing complex social problems with the goal of creating change, it is useful to project forward and imagine future scenarios that may be more unlikely. The "preferable" future intersects with the probable and the plausible and represents an alternative course, if changes are made in the present. While the idea of preferable is not straightforward (since a "preferable" future may vary depending on who is asked), through collaborative and speculative prototyping, it becomes more possible to engage with these concepts and reframe conversations in the present. As Bergold and Thomas summarise, "The participatory research process enables co-researchers to step back cognitively from familiar routines, forms of interaction, and power relationships in order to fundamentally question and rethink established interpretations of situations and strategies" (2012, n.p.).

Through prototyping, participants in these workshops are better able to integrate their ideas within a socially-situated, preferred future. Prototypes are both manifestations of specific concepts and also instruments that help designers interact with and reflect upon aspects of potential futures (Dalsgaard 2017). Through prototyping multiple future scenarios, participants can dis-

cuss impacts and consequences of scenarios that have not happened yet, then reflect back to figure out what steps to take towards the preferred future(s).

4.1 Prototyping preferable futures

In the "Free to Be Design Thinking" workshop participants were asked to imagine a more inclusive future city and to model their ideas into a collaborative future vision. In the figure below (Figure 8), we see the police, young women passengers, and the public transport system being linked through a collaborative initiative called "Stand with Us". Prototyping this scenario allowed participants to discuss what was a preferable and plausible future, then reflect on what needs to happen to achieve this.

5. Dialogic influence of materials

As participants move through these three modes of communication, there is a conversation between the concept being expressed, and the process of constructing the artefact. Physically constructing an idea requires a commitment to the concept as the participant tries to accurately represent the idea and its visceral, messy cloud of associated musings and assumptions. Simultaneously, the act of making influences the ways ideas are expressed as the affordances of the actual materials encourage or discourage certain representations, and the technical ability of the maker privileges certain aspects of the idea that can be feasibly represented. The materials and activities developed for these workshops seek to encourage this interplay between the two different modes of thinking and making, by providing materials that are easy to edit and adaptable to reflect the changing understanding and expression of the concept. These materials enable conceptually motivated construction and constructionally driven conceptualisation.

5.1 Material mediation

This material mediation is well researched and understood by designers, and integral to the process of learning through making. As described by industrial designer Jonathan Chapman, "far more than form giving skins, materials mediate between the physical and psychological worlds, cultivating meaning, expectation and prejudice" (2017, 193). Sometimes the mediation is intentional and fully realised in the moment, however, sometimes the material making acts as a serendipitous partner in the expression and refinement of ideas.

Figure 8

Figure 9

5.2 Influence of material mediation

A group was prototyping the ideas they had related to ways of spreading knowledge. As they were modelling different communications for different audiences, they took advantage of the space by taping their models to a window and saying they want it to be seen by the outside world. They then arranged the objects in such a way as to reflect what was facing people involved in the organisation, compared to what was now external and literally facing the outside word (see Figure 9). As they discussed their idea, they mentioned that because they were making it on the window they started exploring notions of transparency and presentation. This theme was picked up by the next group, and became a minor theme throughout the discussions. In this example the physical materials and affordances being used to model the idea impacted the discussion, and informed the outcomes.

5.3 Why material mediation matters

As ideas take form through materials, the materials themselves can influence the ideas, much like the language of the question can influence and frame the answer. Creating a physical prototype of an idea is like asking a question in a more abstract, amorphous way that allows the answer to be ambiguous and easily amended. This method of questioning accepts that there is not a right or wrong answer and prioritises the journey of thinking through the problem space over arriving at the proper conclusion. The suggested re-prioritisation, discussed throughout the examples in this article, allows for more discursive answering of the question which helps reframe the original question or problem, and allows for more synthesis of ideas as making expresses deeper insights. This type of answer starts to examine aspects of the human experience that are messy and harder to realise, and are exactly the ideas that can help inform innovative solutions that help take steps towards a preferred future.

6. Conclusion

This article is not so much a critique of existing practices, nor a criticism of design thinking workshops. The problems that are addressed through these design thinking methods are comprised of intricate galaxies of complexity, the untangling and examination of which is too vital to be squished into key take-aways and flattened onto a post-it to talk about. These materially mediated workshops avoid the temptation to charge through parts of the problem that are murky and ambiguous in order to emerge at the end of the day with convincing-sounding solutions. This communication with self, with others, and with futures allow for a more holistic examination. Sometimes, this hands-on and experiential aspect of design thinking gets left out, at the risk

of generating "solutions" to issues that fail to challenge the norms in which they were created. The most viable idea is voted on by those present in the room or privileged enough to have a voice in the discussion. This results in important voices being excluded and ignored: voices of minorities, people with less political power, or limited vocabulary or knowledge of the problem.

However, as evidenced in the stories from process-focused, materially-mediated design thinking workshops, this mode of imaginative making creates tangible thought experiments that shed insights into what *could* be. Communication through artefacts allows for the re-framing of current modes of thought and challenges more traditional, linear approaches to problem-solving and knowledge creation. When facilitated in these design thinking workshops for social innovation, it allows for reflection and communication with one's self, collaborative communication with others, and creative communication with possible futures. This expanded notion of conversation through use of materials can be more accessible as well as more imaginative, creating conversations that help us progress socially towards more inclusive and sustainable futures.

References

Akama Yoko, Cooper Roslyn, Vaughan Laurene, Viller Stephen, Simpson Matthew, Yuille Jeremy (2007), "Show and Tell: Accessing and Communicating Implicit Knowledge Through Artefacts", *Artifact* 1, 3, 172-181, doi: 10.1080/17493460701800207.

Bergold Jarg, Thomas Stefan (2012), "Participatory Research Methods: A Methodological Approach in Motion", *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* 13, 1, <http://nbn-resolving.de/urn:nbn:de:0114-fqs1201302> (11/2017).

Buchanan Richard (1992), "Wicked Problems in Design Thinking", *Design Issues* 8, 2, 5-21.

Chapman Jonathan (2017), *Routledge Handbook of Sustainable Product Design*, London-New York, Routledge.

Cranton Patricia (1994), "Self-Directed and Transformative Instructional Development", *Journal of Higher Education* 65, 6, 726-744, doi: 10.2307/2943826.

Cross Nigel (1982), "Designerly Ways of Knowing", *Design Studies* 3, 4, 221-227.

Csikszentmihalyi Mihaly, Sawyer Keith (2014), "Creative Insight: The Social Dimension of a Solitary Moment", in Idd., *The Systems Model of Creativity*, Dordrecht, Springer, 73-98.

Dalsgaard Peter (2017), "Instruments of Inquiry: Understanding the Nature and Role of Tools in Design", *International Journal of Design* 11, 1, 21-33, <http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/2275> (11/2017).

de Bono Edward (1994), *Parallel Thinking: From Socratic to de Bono Thinking*, London, Viking.

Dunne Anthony, Raby Fiona, eds (2013), *Speculative Everything: Design, Fiction, and Social Dreaming*, Cambridge-London, MIT Press.

Fuad-Luke Alastair (2009), *Design Activism: Beautiful Strangeness for a Sustainable World*, Abingdon-New York, Earthscan.

Kaplan Jonas, Gimbel Sara, Harris Sam (2016), "Neural Correlates of Maintaining One's Political Beliefs in the Face of Counterevidence", *Scientific Reports* 6, <https://www.nature.com/articles/srep39589> (11/2017).

Kimbell Lucy (2009), "Beyond Design Thinking: Design-as-Practice and Designs-in-Practice", paper presented at the CRESC 5th Annual Conference, Manchester, 1-4 September.

Lloyd Peter (2004), "Paradox of the Average: Why Users Need Designers but Designers Don't Need Users", *Design Philosophy Papers* 2, 1, 43-57.

Marheineke Marc, Velamuri Vivek K., Möslein K.M. (2016), "On The Importance Of Boundary Objects For Virtual Collaboration: A Review Of The Literature", *Technology Analysis & Strategic Management* 28, 9, 1108-1122, doi: 10.1080/09537325.2016.1181744.

Mezirow Jack (1997), "Transformative Learning: Theory to Practice", *New Directions for Adult & Continuing Education* 1997, 74, 5-12, doi: 10.1002/ace.7401.

Nonaka Ikujiro (1994), "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science* 5, 1, 14-37, <http://www.jstor.org/stable/2635068> (11/2017).

Sanders E.B.-N. (2002), "From User-centered To Participatory Design Approaches", in Jorge Frascara (ed), *Design and the Social Sciences: Making Connections*, London-New York, Taylor & Francis, 1-8.

Sanders E.B.-N., Stappers P.J. (2013), *Convivial Toolbox: Generative Research for the Front End of Design*, Amsterdam, BIS Publishers.

von Busch Otto (2017), "Hacking the Probe-Head: Manipulations for Social Sustainability", in Jonathan Chapman (ed.), *The Routledge Handbook of Sustainable Product Design*, London-New York, Routledge, 335-348.