# Towards Actionable Forms of Communicating and Sharing Design Knowledge

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# Towards Actionable Forms of Communicating and Sharing Design Knowledge

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## Abstract

Design research aims to construct knowledge that is useful for designers and non-designers in the processes of designing for various types of challenges: from making products to solving complex social problems. Designers and non-designers seek information and inspiration for their work both in a non-design world, e.g., in films, illustrated magazines, and in various sources and forms of design research. Conference papers are one of many sources of design research insights. Unfortunately, the textual format of conference papers does not allow to convey the richness of design research insights and express them in forms that are *actionable* and available to others, e.g., non-designers. As a result, members of design teams might feel disempowered or do not trust and accept provided design research outputs. Therefore, they do not act upon the provided design research insights and find it challenging to apply them in collaboration.

In this paper, we present the *actionable palette* that consists of nine qualities that act as building blocks of *actionable* forms of sharing and communicating design knowledge. Using the *actionable palette* to review design research outputs from 51 pictorials, we identified six forms of capturing design research insights. We characterize these six forms and analyze them in terms of *actionability* to inspire designers and non-designers to experiment with forms of sharing design research insights and first design ideas based on design research insights. Finally, we provide a set of guidelines to inspire and inform the process of reaching the particular qualities of actionability for design research outputs.

### Keywords

Actionable Design Knowledge; Design Research Outputs; Design Research Insights; Pictorials

The goal of design research is to construct knowledge useful for designers and non-designers in the processes of designing for various types of challenges: from making products to solving social problems. In this paper, we understand design knowledge as a reference to two types of outputs in design projects: design research insights and first ideas based on design insights. Design research insights are design opportunities that emerged from the design research process. They provide reexamined understanding of the studied phenomenon and mediate between research and design. The goal of communicating design research insights is to inform and inspire design and support decision-making within a team that is aiming to achieve a shared purpose (Sleeswijk Visser, 2009). An action of two or more people who are working together to create the shared purpose is defined as collaboration. In a design context, collaboration takes place between various stakeholders (e.g., designers, researchers, engineers, decision-makers) during idea generation, problem-solving, or decision-making meetings. When collaborating, designers use artifacts, e.g., design research outputs, to support the application of insights and first ideas. Such artifacts act as boundary objects

(Star & Griesemer, 1989). Therefore, collaboration needs artifacts to support goal-oriented activities and communication within a team. Non-designers, e.g., clients, need to understand and see the relationship between research and design to appreciate and accept the value of design research insights and design ideas. Unfortunately, designers are often not prepared to articulate arguments behind the process of synthesis that is transforming research into design. In consequence, clients reject such ungrounded design research outputs as they seem to be too risky, incomplete or abstract. Kolko (2010) indicates that the lack of formality in the processes of synthesis discounts the value of design research. He argues that there is a need for tangibility and actionability in the context of the outputs of synthesis.

To enable (others) act upon design research outputs designers experiment with various forms of documenting them. The form of design research output can be characterized by various qualities that make a given research asset, result or idea useful and actionable in collaborative settings. According to Manzini (2009 & 2015), in terms of form, design research insights and first ideas should be easy to discuss, clearly expressed, easy to apply and allow others act upon the work that was already done. Such outputs also should sustain empathy towards users and convey rich information in ways that are not overwhelming (Stappers et al., 2007). To present the scope and role of design research outputs, Stappers & Sanders (2012) use the term *the big picture*. *The big picture* is an abstract summary of the most critical learnings from research and the preliminary exploration of the design opportunities.

It is a challenge for design researchers to develop forms of design research outputs that are experiential and adapt to the requirements of different communities.

In academia, we distinguish intermediary design knowledge situated between general knowledge (e.g., theory) and contextual knowledge related to the particular artifacts (Löwgren, 2013). It is the space between verbal and design articulations, therefore is communicable through the combination of both (Pierce, 2014). Annotated portfolios, design guidelines, usability heuristics (Löwgren, 2013), bridging concepts (Dalsgaard & Dindler, 2014) or strong concepts (Höök & Löwgren, 2012) are examples of design research outputs that engage some theory formation or abstraction of concepts from practice and construct intermediate-level of knowledge.

Unfortunately, the nature of intermediary knowledge is not well-known outside the design community. Therefore, there is a risk that it is not easily accessed by non-design stakeholders (Höök et al., 2015).

Furthermore, the majority of academic research papers are presented in the textual format. Therefore, we miss design accounts in the archived contributions of design research outputs (Jarvis et al., 2012). Tacit knowledge embodied in interactions and gained by practicing of ‘making’ is hard to capture using textual forms of knowledge representation. Pictorial is the new format of full research papers that foregrounds high-quality visual components (e.g., sketches, photographs) over text and regards these visuals as the most critical part of knowledge articulation and main research contribution. Pictorials aim to promote and support the visual and experiential communication of design research outputs.

In design practice (e.g., design agencies, service design teams), documenting design research insights can be time-consuming (Dalsgaard & Halskov, 2012) and bringing *additional bridging work* that is a distraction (Höök et al., 2015*)*. Therefore, while deciding on a form of design research outputs, designers, especially novice once, often prefer to use well-known and accepted forms of design research outputs instead of exploring the needs of their audience and coming up with forms that are custom-made and actionable for non-designers. The examples of such *template* forms of capturing and sharing design knowledge are personas and customer journey maps (Cooper et al., 2007).

Summing it up, there is a need for actionable forms of capturing and communicating design research insights that will serve as sources of design inspiration and artifacts supporting collaboration both in academia and practice. We argue that knowing and exploring the actionable qualities of design research outputs designers will gain vocabulary to create forms that respond to the needs of a given team. As a result, designers, especially novice ones, will be more open to

experimenting with various forms of sharing knowledge, not only *templates*. Therefore, the results of this work are aimed to mainly support design practitioners, e.g., service designers, who currently mainly use *template* forms of design research outputs.

## Towards Actionability

The 2019 Merriam-Webster Online Dictionary defines actionability *as the quality or a state of being actionable*. *Actionable* means here *capable of being acted on*. The Free Dictionary adds to this the aspects of *relating to or being information that allows a decision to be made* and *capable of being put into practice*. Among synonyms of actionable, there are words such as *useful, usable, serviceable*. Interestingly, words *theoretical, academic,* or *unavailable* are the actionable antonyms.

Our work on actionable forms of capturing and sharing design research outputs was inspired by an example of communicating and crafting a good insight provided by IDEO, a global design company (Insights for Innovation Toolkit, 2017). An insight is understood here as the most critical learning from a project that we want to share with others. It has compelling quality and it:

- informs about people's needs and wants,
- inspires to take action,
- is memorable - it sticks and is easy to share with others.

When IDEO was conducting a project for Innova Schools in Peru, the design team learned that teachers were busy focusing on the children's needs and did not have time for their learning. Building on that knowledge, they presented the iterative process of crafting a good insight:

- 1st iteration: *Teachers do not have time for themselves*

  This sentence is informative, but does not provide a design opportunity and is challenging to remember.

- 2nd iteration: *Teachers crave connections to continue learning*

  It presents teachers' need, but it is still not memorable.

- 3rd iteration: *To reflect teachers need to connect*

  It is memorable, summarizes teachers need and shows directions for design.

Between the first and third iteration, we observe a transition from concentrating on the problem (a negative form of a sentence) to the action-oriented approach (a sentence that suggests a space for design action).

The textual form of an exemplary insight required reframing to become actionable. Qualities such as inspiring, informative, and memorable informed and structured the process of reaching the actionability. We argue that also, visual forms of design research insights require reframing to become actionable. We are interested in investigating the qualities that would act as building blocks of actionable forms of sharing and communicating design research outputs. Therefore, we decided to investigate the actionable forms of design research outputs. The goal of this study is twofold:

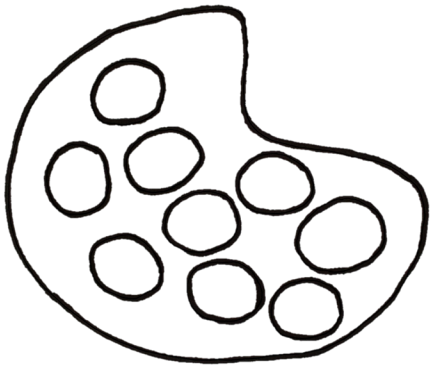
- Searching for forms of communicating and sharing design research outputs that provide *the big picture* (Stappers & Sanders, 2012).
- Identifying and defining qualities that are building blocks of actionability.

Stappers & Sanders (2012) define the five qualities of an effective *big picture* as follows:

- simple - including a concise visual summary of the main idea,
- memorable - easy to remember without taking notes,

- expansive - having many layers of meaning,
- grounded - referring to the sources of data,
- inspiring - showing new directions and perspectives.

Deriving from these qualities, the meaning of *actionable*, and the qualities of an insight proposed by IDEO we came up with a preliminary *actionable palette* (Figure 1) to sum up what is already known and prepare ourselves for reviewing design research outputs in 51 pictorials. The actionable palette presents nine qualities that are meant to inform the process of reaching the actionability of design research insights.



1. inspiring
2. informative
3. memorable
4. experiential
5. playful
6. multilayered
7. grounded in research
8. providing design opportunities
9. capable of being acted on

Fig 1. Nine qualities that act as building blocks of *actionability*

## Method

We assumed that pictorials are a valuable source of visual forms of communicating and sharing design research insights. Pictorials provide opportunities for acting upon (somebody's else) research. Therefore, it is an interesting format to search for forms providing *the big picture.*

The goal of this paper is to answer the questions: *How do designers articulate design research insights and first ideas to provide the big picture? What are the qualities of these forms that build actionability? What does make a given form informative, inspiring, grounded in research, etc.?*

In order to answer these questions, we took an explorative and qualitative approach to analyze 51 pictorials published at The Designing Interactive Systems (DIS) conference (2014-2018) and Creativity and Cognition (C&C) conference (2017). Papers were identified by searching in the Association for Computing Machinery (ACM) Digital Library for the format of pictorials.

For each pictorial, we read the work, summarized its goal, methodology, and presented results. Then, we conducted a pattern analysis of visual elements in pictorials inspired by the method shown in Desjardins et al. (2015) and Desjardins et al. (2016).

For each pictorial, we took screenshots of chosen visual and textual representations of design research outputs. We collected 287 screenshots. For each screenshot, we had notes summarizing the role of a given output. All screenshots appearing in this paper come from selected pictorials used with the permission of the authors themselves.

We printed out each screenshot and wrote each unique statement concerning a given screenshot on an individual post-it note, e.g., *a process of unpacking movement into physical visualization is presented in the way that is experienceable*. The analysis was conducted *on the wall* (Sleeswijk Visser, 2009; Sanders & Stappers, 2012). We created an immersive visual display of analyzed materials to support patterns' finding. The pattern analysis *on the wall* was conducted by the first author of the paper what is a limitation of the study. The other authors of the paper were involved in discussions on the reliability and authenticity of the identified patterns.

The analysis was conducted in three iterations (Table 1) to finally receive the set of six forms of capturing and sharing design research knowledge.

| | |
|---|---|
| 1st iteration | We searched for examples of design research outputs that present a reexamined understanding of a studied situation and examples that are assigned to be further used in design processes, e.g., design insight, inspiration. In this way, we strove to pick out representations that have actionable qualities - motivate, inspire, provide opportunities, or that have collaborative capabilities. |
| 2nd iteration | We clustered notes and screenshots representing identified examples of design research insights using the affinity diagram technique (Beyer & Holtzblatt, 1998) in terms of the form and purpose of the design research outputs. We deepen the analysis by asking the questions, e.g., *Why is this output presented visually? What is the role of the text?* Using conventional content analysis (Hsieh & Shannon, 2005), we obtained six forms of capturing and sharing design research knowledge. |
| 3rd iteration | We investigated *What makes a given form actionable?* We used the primary actionable palette to investigate all actionable qualities of the six forms. |

Table 1. Three iterations of data analysis

## Six Forms of Capturing and Sharing Design Research Insights

We present six forms of providing *the big picture* meant to document design research work and trigger idea generation, inspire and inform design processes. We define each form, present its key elements, mechanism of working, and subcategories. We use selected screenshots from our data set to provide visual examples of a given form.

### *1. Inspiring Collection*

It is a set of images that visually emphasizes a given phenomenon, presents work that was already done, or captures the chosen experience. The collection works as a *whole* that consists of *multiple elements* (Keller, 2005), e.g., photos of project results, snippets from user studies, organized according to a chosen strategy, e.g., theme, emotion, timeline (Figure 2). A collection is a dynamic object - once created by somebody for an implicit purpose it can grow over time by adding new elements to the collection.

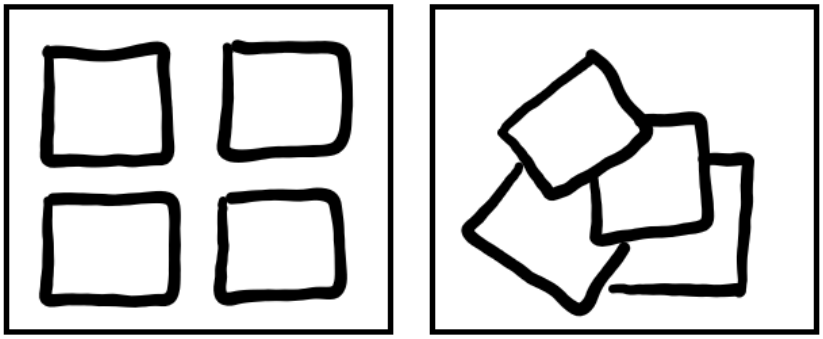


Fig 2. Two layouts typical for collections: structured organization of images on a grid (collection as the design research output) and unstructured clusters of materials (collection as a research tool or method, e.g., collage).

The goal of a collection is to provide a visually rich overview, bring a collective insight into a phenomenon that is studied, and provide a fresh perspective.

We identified four sub-categories of inspiring collections:

***Inspirational test-bed*** (Wensveen et al., 2014) – a catalog containing a set of carefully selected images (Figure 3). It summarizes various materials to introduce emerging field, industry, or theme. It acts as a mediating research artifact, educational material, as well as information for designers or business stakeholders.

***Referential inspirations*** – a collection of sources of inspirations, e.g., objects or interactions that were crucial for developing ideas in the given work. Such collection offers insight into a design process and shows what was before the idea (Figure 4).

***Collages*** – an unstructured collection of visuals, e.g., images, notes, sketches used during the design research process to capture experiences or ideas that are difficult to verbalize. They mediate between understanding and ideating and spark a generation of metaphorical meanings. (Figure 5).

***Inspiring puzzles*** - a subcategory of collections that emerged from the works of Eli Blevis (Blevis & Blevis, 2018; Blevis, 2017; Blevis, 2014; Blevis, 2016). These are galleries of high-quality photos carefully selected and juxtaposed to visualize a chosen theme, e.g., everyday life, and provide space for a reflection (Figure 6). These collections are "*designed to be experienced"* (Blevis, 2017).

**TexTales:** what started as a personal exploration of Estonian craft qualities and involved into a co-crafted concept for a storytelling service was eventually launched at a crowd-funding platform. While not raising enough funds it did create a larger appreciative community for smart textile services.

**Vibing at the Beijing Design Week 2014:** After several iterations starting from material innovation and personal crafting to collaboration and switching from light to vibration Vibe-ing was realised. Vibe-ing is a self-care tool in the form of a garment, which invites the body to feel, move, and heal through vibration.

**Unlace**: An interactive lace lingerie garment which allows partners to connect through touch, time and warmth. The slow change in 'transparency' and warmth increases awareness of touch and creates time to explore the woman's body together. Unlace won an industry award for its re-appreciation of the old craft of bobbin lace through unconventional and smart materials.

**Tactile dialogues**: a pillow with integrated vibration elements that react to touch. The goal of the textile object is to enable a dialogue by triggering physical communication patterns between a person with severe dementia (the care receiver) and a family-member, spouse or caretaker (the care giver).

Fig 3. Inspirational test-bed. Wensveen et al. (2014) developed an inspirational test-bed to show the growth of the smart textile industry. They present images of experiments, e.g., with textile technologies, material innovations, crafting techniques for various stages of design, e.g., incubation, adoption.

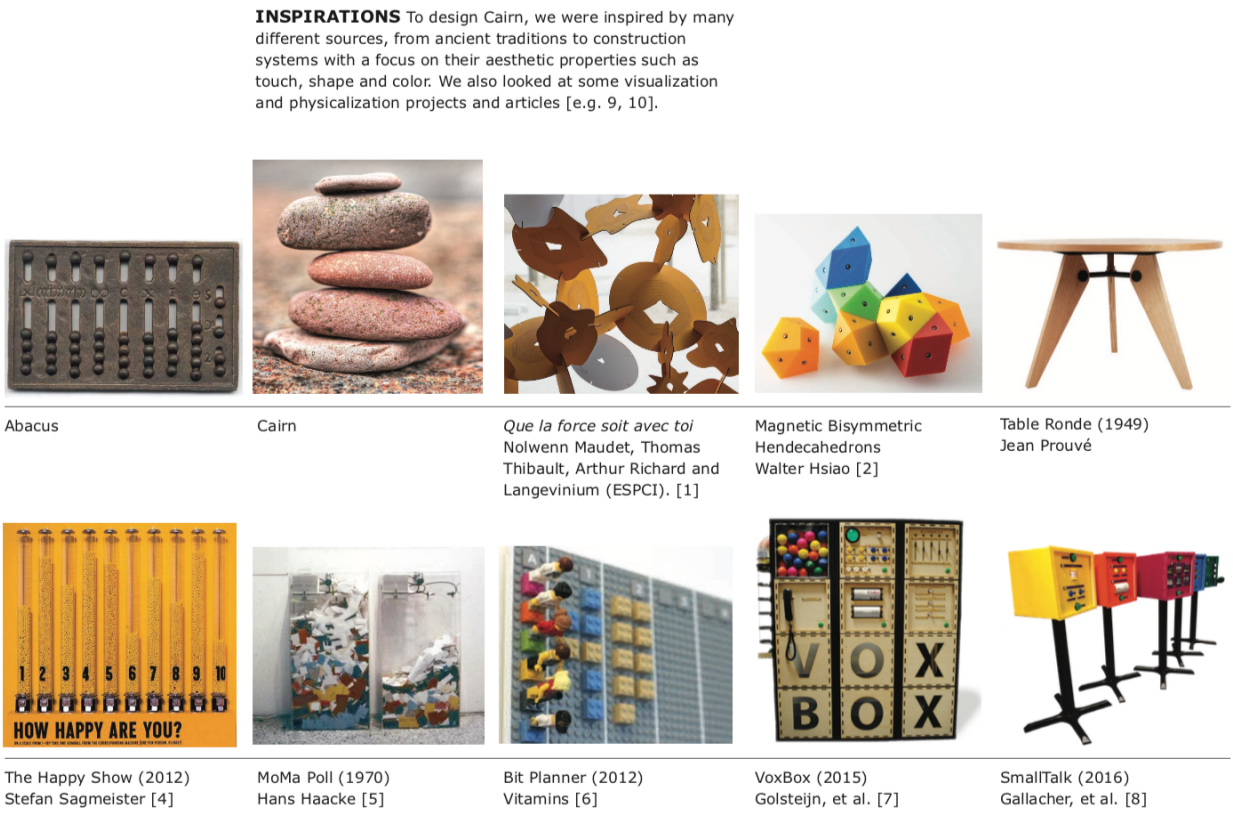



Fig 4. Referential inspirations. Gourlet & Dasee (2017) enrich visual examples of inspirations with references to literature, so it is possible to work with these inspirations further.


Fig 5. Collages. Beuthel & Wilde (2017) present the experience board that is a combination of images, notes, materials, and sketches selected by the participants of the study to express their inner sensations (migraine). For example, an image of insects attacking a human ear was chosen to express experiences occurring during the migraine. Then, this representation has been translated into the sound the crinkled tinfoil. Tinfoil-base material let to use vibration motors in the final prototype.

Fig 6. Inspiring puzzle titled “Woman at Desk.” The author of this photo has strong compositional and curatorial skills, and he fluently plays with visual elements to create inspirational visual puzzles for the viewer (Blevis, 2017). Here, we are invited to contemplate on the image that is out of focus. This task is meant to be regarded as a technique or material quality of interaction design (Blevis, 2017). Eli Blevis © 2017

### *2. Referential Resources*

A set of references, e.g., hashtag, hyperlink to, e.g., a video, a visual gallery that adds interactivity and enriches the standard textual representations of knowledge (Figure 7).

The goal of referential resources is to introduce a context of the given work using interactive media, present research materials, show aspects of design knowledge that were challenging to verbalize and offer design tools or methods in the form of an open-source platform.

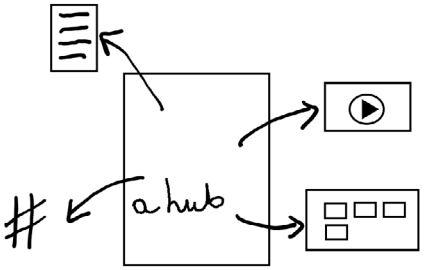



Fig 7. The referential practice of sharing knowledge contains two elements: a hub that is the primary design research output, e.g., full research paper, and a set of references to linking materials or external repositories of knowledge that complement or extend the knowledge presented in the hub.

We identified two sub-categories of inspiring collections:

***External supplementary materials*** (Figure 8) – links to videos, hashtags or open-source platforms embedded in the standard research papers that add an experiential layer to the presented material, e.g., readers of the paper are recommended to watch the video to better understand the dynamic qualities of presented interactions (Peeters et al., 2017).

***How-to-guides*** (Figure 9) – instructions or open-source templates showing step by step how to replicate the work presented in the given paper, e.g., how to create a metaphor card (Logler et al., 2018).

*Figure 11. A selection of stills from documentaries of participants describing their experiences of living with their Datactcher. All 54 films can be accessed at vimeo.com/channels/datacatcher*

Fig 8. External supplementary material. Boucher (2016) provides a link to a video to refer a reader to documentaries in which participants of the study describe their experiences. © Interaction Design Studio

1. Take the bulldog clip apart; it should have three parts (Figure 6, step 1).

2. Drill a hole in the back of the bulldog clip to allow the cable to come through. Protect the cable with the grommet as the metal can be very sharp and start to cut the cable (Figure 6, step 2).

3. Take the copper board and score separations to accommodate for as many connections as you wish to make. Figure 6 demonstrates a clip for four connections.

4. Strip the end of the cable you have just fed through the drilled hole and solder each cable to the edge of the copper board. Here it is important to create as low a profile solder joint as possible to allow for better clamping (Figure 6, step 2).

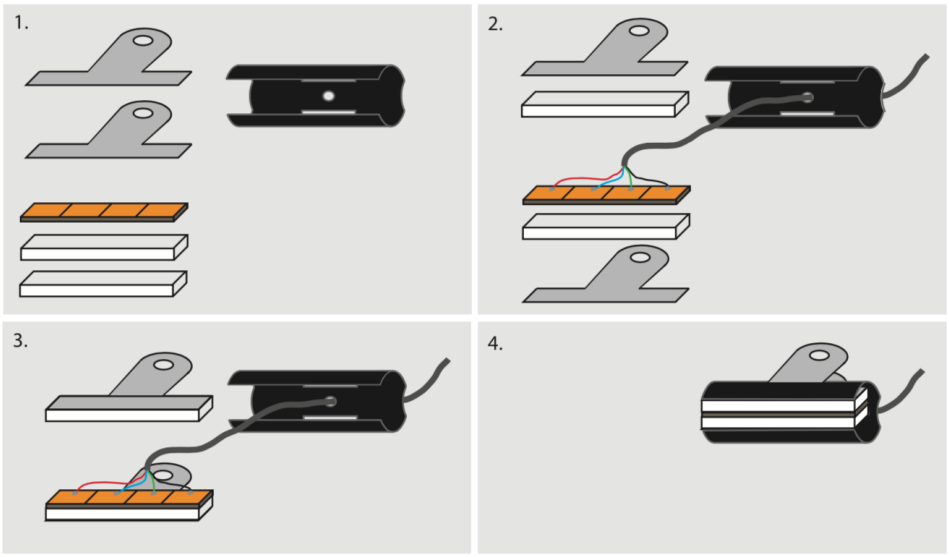



**Figure 6.** A step by step guide to making the bulldog connector.

5. Superglue the two pieces of acrylic to the edge of the metal clamps of the bulldog clip. This makes the 'biting' angle of the bulldog clip less aggressive and helps to create a more reliable connection with the paper. Let that dry and then superglue the back of the copper board to one side of the acrylic (Figure 6, step 3).

6. Now for the tricky part. Hold open the cylindrical part of the bulldog clip and feed everything back in, taking care not to damage your solder joints (Figure 6, step 4).

When connecting this to a paper circuit it is important to have a slightly bigger gap between the printed connectors than on the copper board to prevent short circuiting (see Figures 4 and 5).

Fig 9. How-to-guide. Shorter et al. (2014) invite readers to replicate their make-lab process by providing instruction for building the bulldog clip connector.

### *3. Tacit mediations*

Tacit mediations exploit the characteristic attribute of a chosen form of visualization, e.g., a photograph to provide a tacit layer of meaning to the presented knowledge (Figure 10).

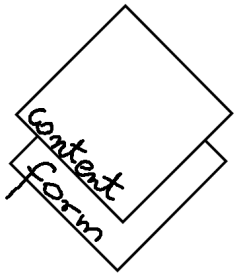



Fig 10. A compound form of capturing design research knowledge. The form adds tacit meaning to the presented information (content).

The goal of tacit mediations is to provide an experience of a chosen phenomenon by utilizing the qualities of the form.

We identified two sub-categories of tacit mediations:

***Photographs*** – various types of photographs that present outputs at the various stages of the design process:

- *the discover stage* - these are, e.g., photos from the field that are usually non-edited and of low-quality, taken by designers, design researchers or participants of the study (e.g., photos captured using mobile phones). They document the events or inspirations to provide direct insight into a situation that was studied, the everyday lives of people, and the *making of* research materials (Figure 11).
- *the define stage* - these are, e.g., portrait photography, drone photography, performative photography that act as a design tool. Visual stimuli construct new realities to provide insight into the future. These photos are abstract, provide artistic value and quality (Figure 11).
- *the develop and deliver* - these are, e.g., product photographs. These photographs present the final outputs of the design process, e.g., research artifacts, prototypes. These photos are usually curated, of high-quality and styled. The goal of these photos is to provide the best possible presentation of a design (research) output and/or show it in the future context of use (Figure 13).

***Experiential knowledge*** – activity or puzzle to be experienced or solved to get a tacit or experiential insight into the studied phenomenon (Figure 14). The mechanic of a puzzle or the experience is based on the metaphor or mimic elements, e.g., a translation of the interaction to the form of the design research output.

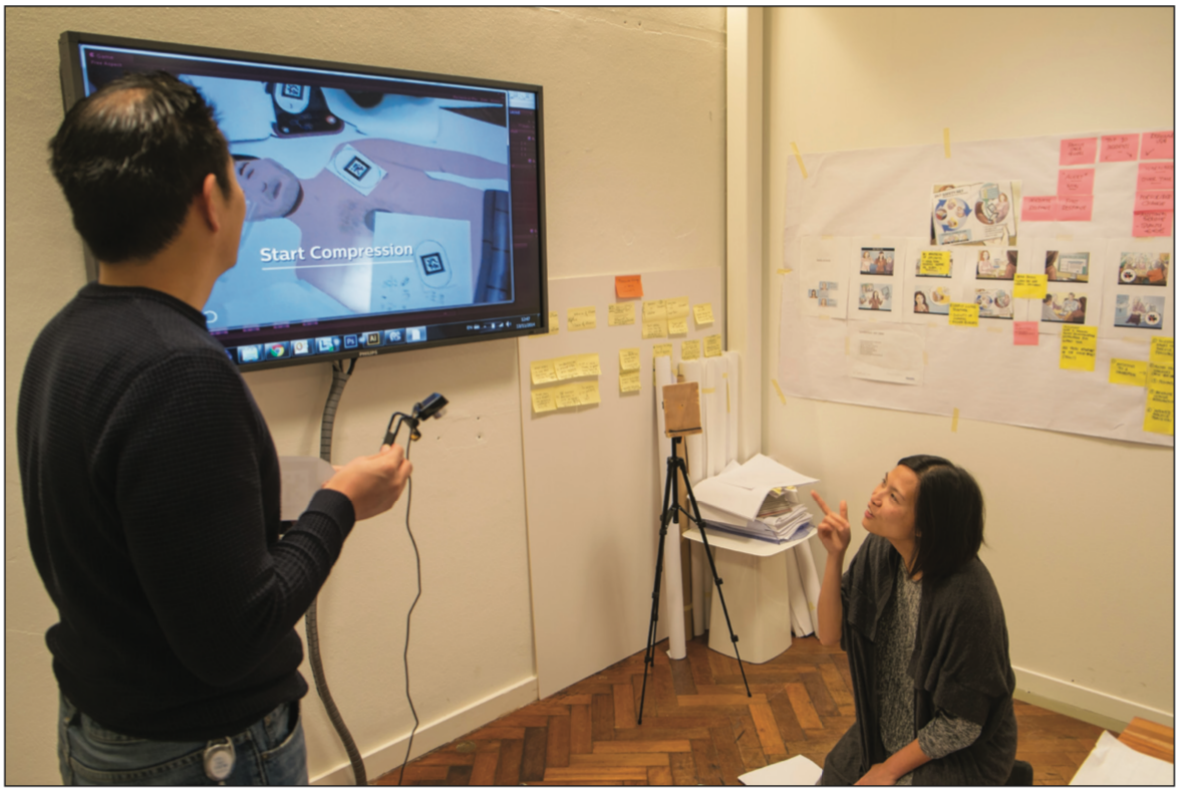



Fig 11. Photograph used at the discover stage of the design process. The *making of* a low-cost AR simulation of a sudden cardiac arrest emergency (Djajadiningrat et al., 2016). Copyright Koninklijke Philips N.V., 2016.

Fig 12. Photograph used at the define stage of the design process. Experimenting with the panorama function in the mobile phone (Time and Space in Broken Panorama; Simbelis, 2017).

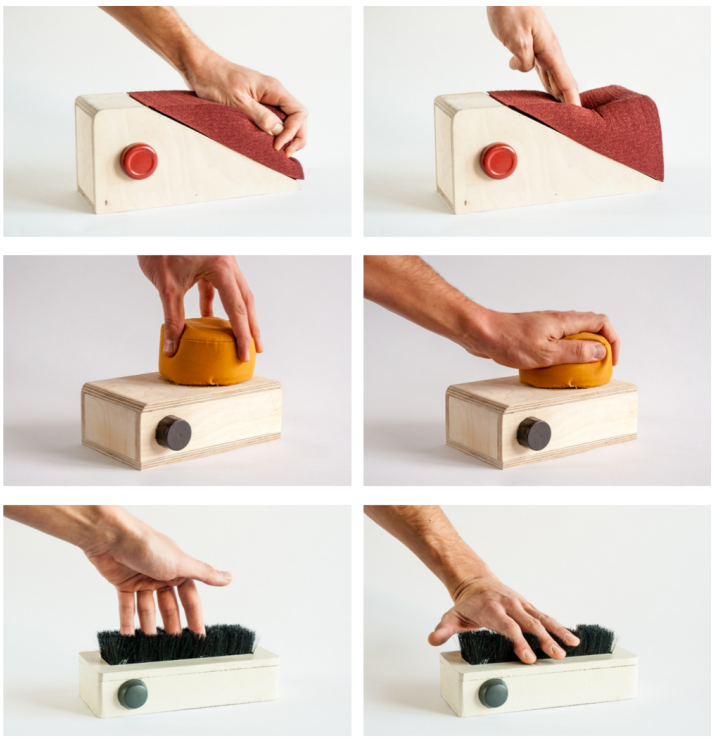


Fig. 13 Photograph used at the develop stage of the design process. Tuning a radio – the exploration of performative qualities of materials (Karana et al., 2016).

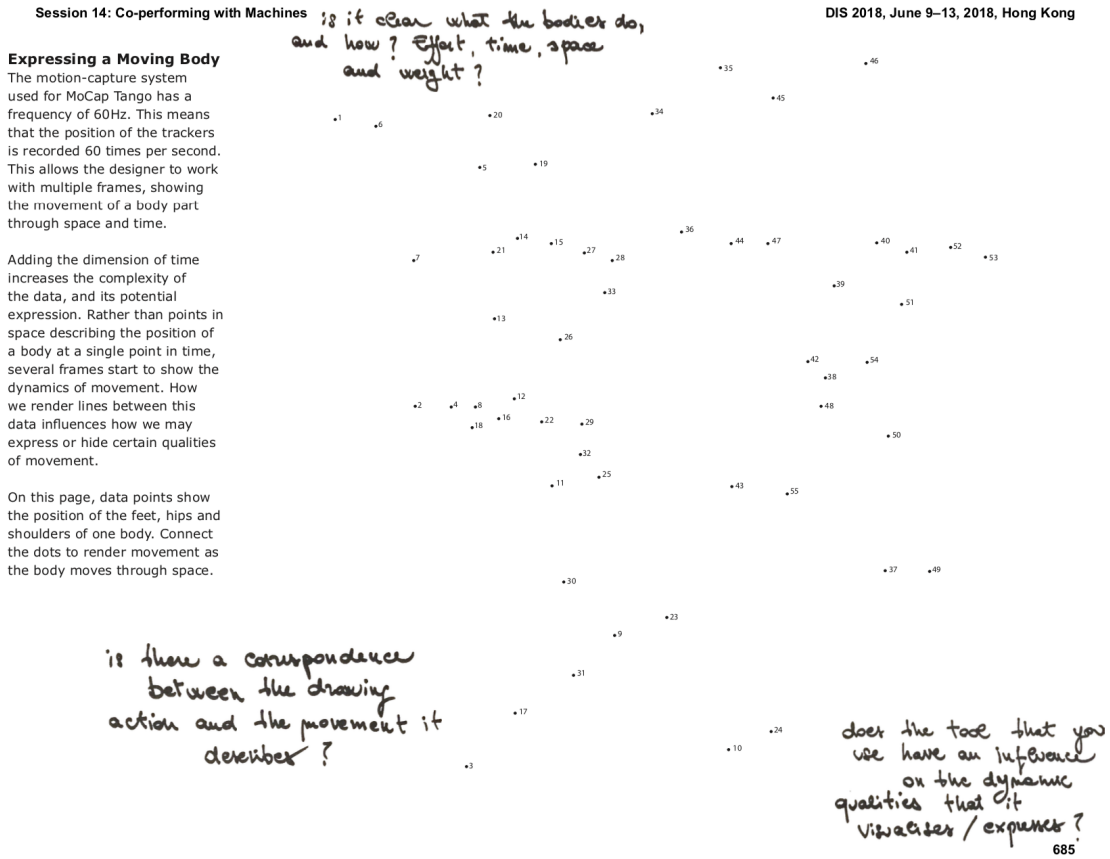



Fig. 14 **Experiential knowledge.** Peeters and Trotto (2018) developed a puzzle containing a sequence of numbered dots. They invite a reader of their paper to connect the dots to *render the movement as the body moves through space* while dancing the tango. The way we draw lines is a metaphor for expressing the qualities of movement. Authors complement the puzzle with follow-up questions to encourage reflection, e.g., *Is there a correspondence between the drawing action and the movement it describes?*

### *4. Engaging Narratives*

The visually enhanced questions and dialogues embedded in the design research outputs. They are meant to add interaction, catch the attention of a reader, and invite to a discussion on a presented knowledge (Figure 15).

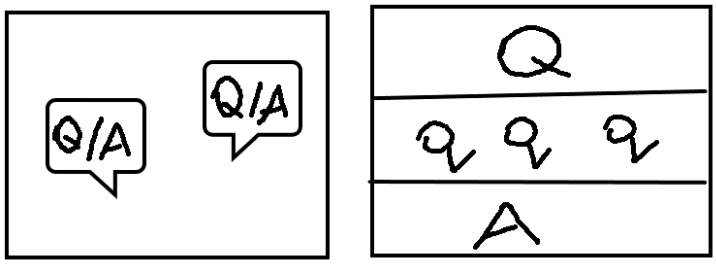



Fig 15. Questions are fundamental for doing research. They set expectations, encourage reflection, and evoke curiosity. Questions build narration by providing answers or constructing engaging dialogues.

We identified three sub-categories of engaging narratives:

***Visually enhanced anchoring question.*** It is a visually distinguished main research question of the presented work meant to catch attention and bring focus towards answers, solutions, arguments or facts (Figure 16).

***Auxiliary questions*** - a set of factual questions working as a mechanism to get complete answers and various perspectives on the presented phenomenon. Auxiliary questions derive from the Five Ways questions: *who? what? when? where? why?* complemented with *how?* question.

***Comics*** - it is a medium to express ideas and simplify the presentation of research materials. It combines visuals and text. Textual elements, e.g., speech balloons, give voice to various characters and indicate sound effects. Panels with images are presented as a sequence to create a narration. Images provide an insight into the design process and its context.

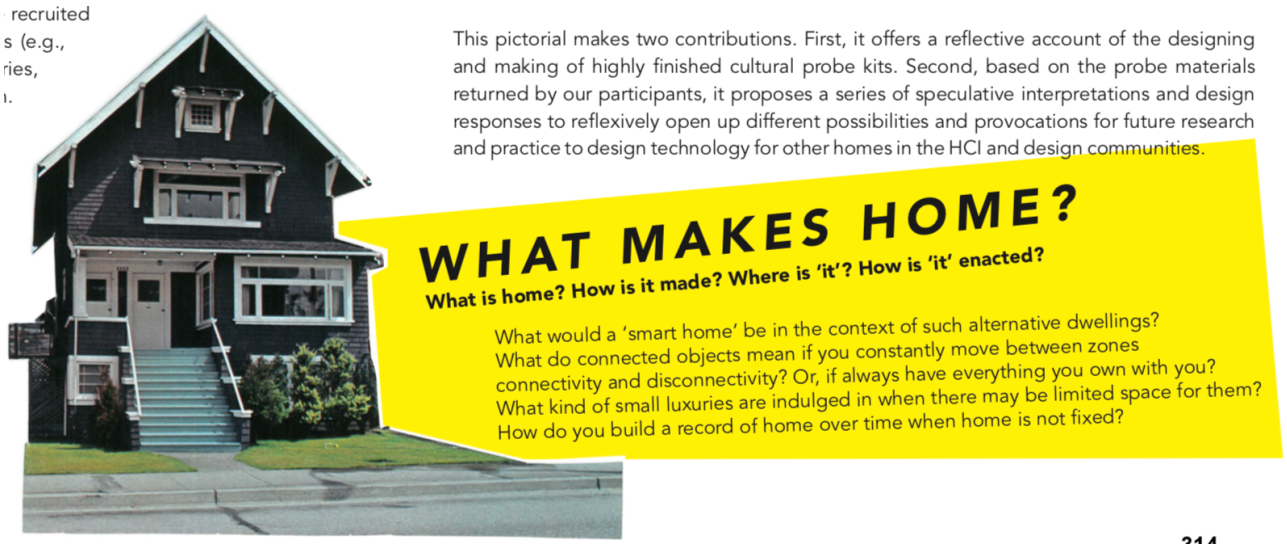



Fig 16. Visually enhanced anchoring question. Oogjes et al. (2018) structured their paper as an answer to graphically presented a set of research questions what catches the attention of the reader. © Everyday Design Studio

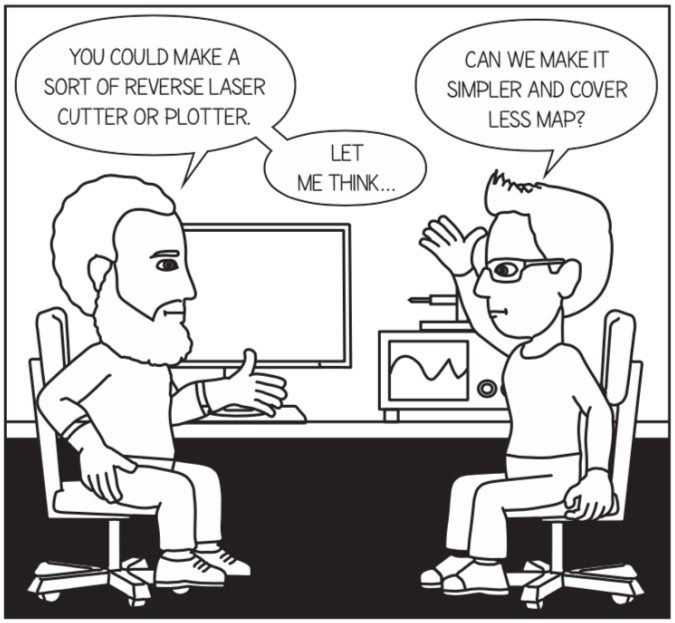



Fig 17. Comics. Dykes et al. (2016) structure their work as a dialogue between two characters: a designer and a technician. Conversations between them add dynamics to presenting knowledge and give an insight into challenging moments in the design process.

***5. Granular Discoveries***

It is a concise textual or visual digest relevant for a given project. It brings a fresh perspective on the investigated topic and sets a direction for the future (Figure 18). Granular discovery results from design research processes, e.g., a synthesis that is abductive sensemaking (Kolko, 2010) or insightful observation.

The goal of granular discoveries is to inspire and inform the design and motivate to action.

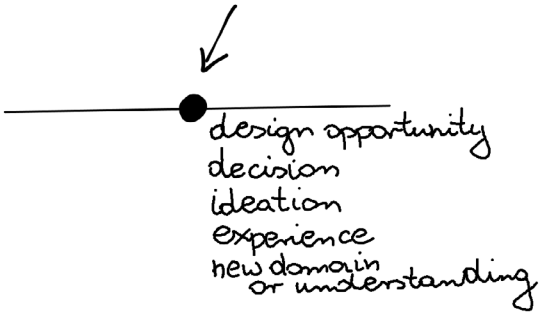



Fig 18. Granular discoveries provide design opportunities, compound presentations of the users' needs or insights into new fields. They usually have a textual form that is supported by direct references from the research, e.g., photos, quotes, videos.

We identified five sub-categories of granular discoveries:

***Design opportunity*** - a precisely defined sentence, theme, or category that results from synthesis and presents opportunities for design (Figure 19).

***Tools supporting decision-making*** - a compressed and structured compilation of various sources of knowledge meant to inform and guide decisions (Figure 20).

***Grounded ideation*** - visual accounts, e.g., photos that document steps of idea generation to bring trust towards novel concepts (Figure 21).

***Pallets of experiences*** - photos that bring the chosen moments of the everyday life of people into

the design (Figure 22) or visualizations that provide a fresh perspective on something, e.g., an emotion-centric timeline to show a high-level game progression (Wei & Durango, 2017).

***Introduction to a new domain or new understanding*** - a structured presentation of new chunks of knowledge that introduces emerging methods or fields (Figure 23).

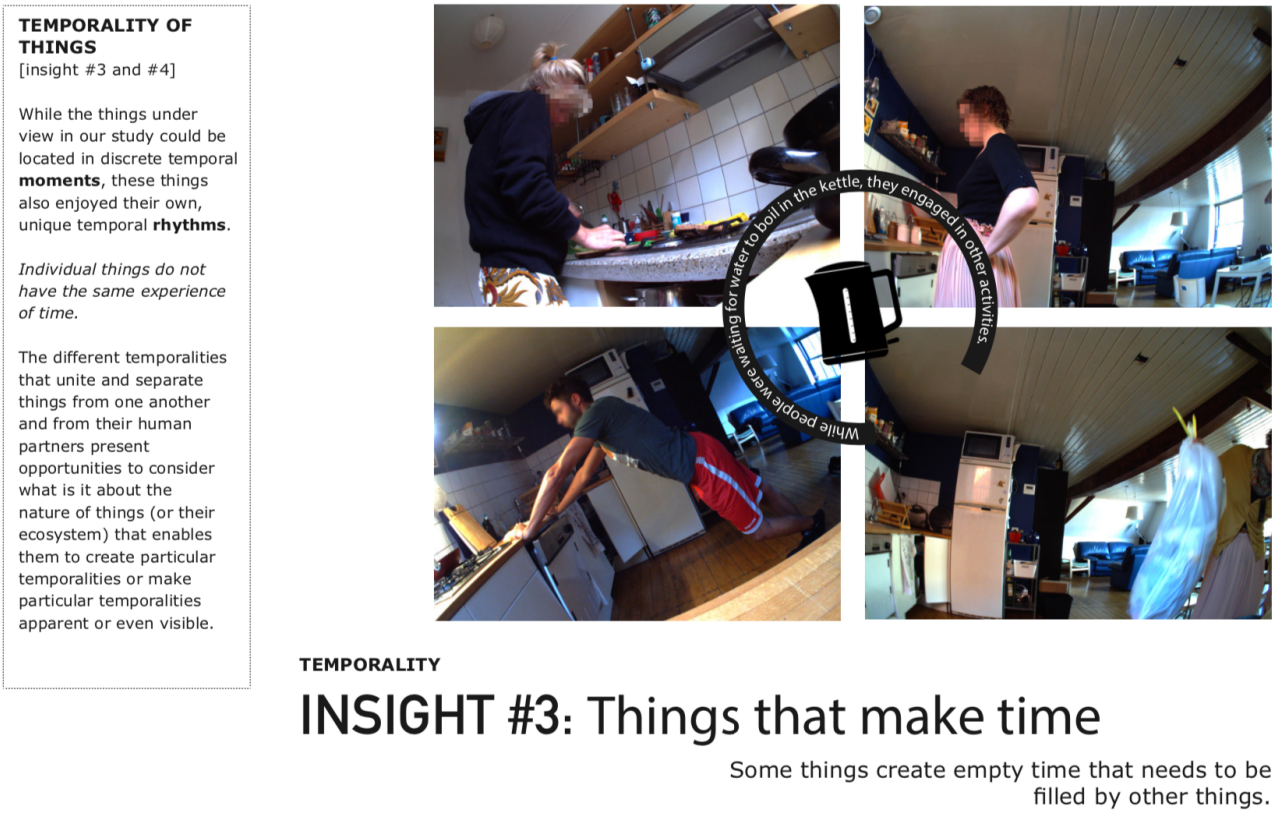



Fig 19. Design opportunity. Giaccardi et al. (2016) use themes called *insights* to structure the presentation of their work. Each of the six insights is a sentence that summarizes clustering and presents new knowledge inspiring design, e.g., *things that make time*.

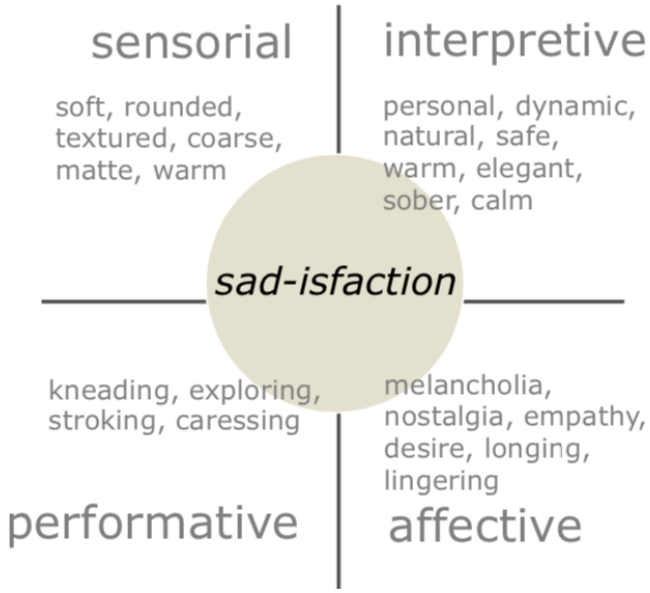



Fig 20. The tool supporting decision-making. Karana et al. (2016) present the 'Materials Experience Vision.' It is a grid structure that visually summarizes various findings. The 'Materials Experience Vision' acts as a compass and a reference design tool that guides decisions in a design process.

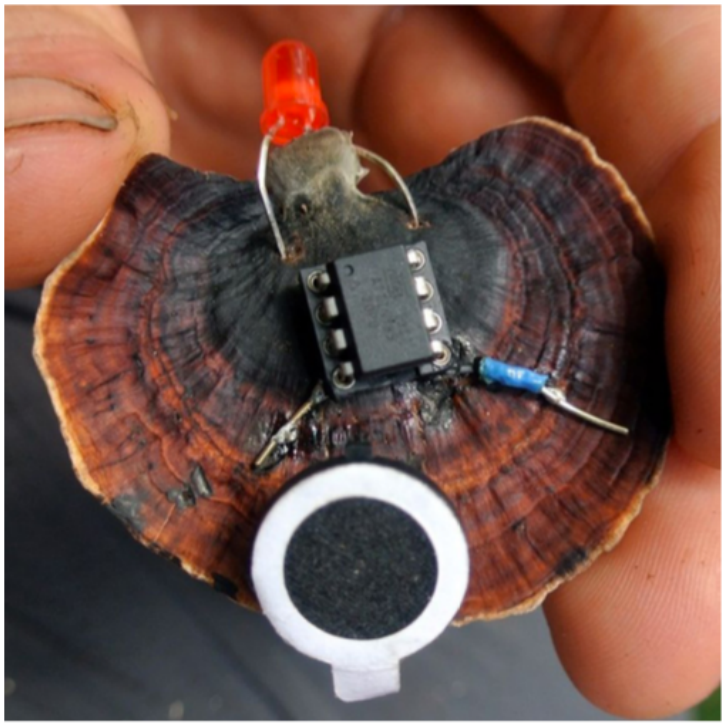


Fig. 21 Grounded ideation. Quitmeyer (2017) shows how the unique context of conducting design workshops (in the woods), introduced interplays between natural and technological materials. He shows a photo of a mushroom that works as a breadboard for prototyping electronic circuits.

**Being Housebound**

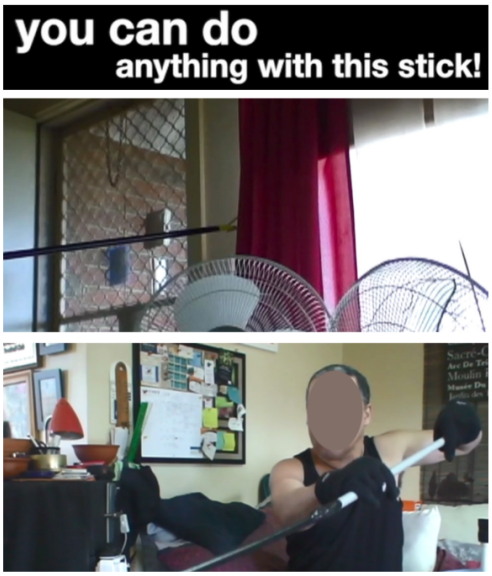
*"Dragging a wheelchair around you've got to plan everything. There's a lot of shops around here that I can't even get in to. I have shops about 20 meters away - there's a whole group of shops and they've all got a step."*

In this screenshot from the video (right) Jim indicates the height of the step.

**Baby I'm Bored**

Jim's motorized scooter is decorated with a sign on the back (right), which aligns with his description of being confined to the home due to chronic illness:

*"I miss working. I want to work. I want a job. I want to do work for the dole, I can't even do that. I'd love a job because not having a job is as boring as all shit."*


**The Stick**

During the video story Jim demonstrates a curtain rod he had refashioned to use as a tool to help him manage day-to-day life given his mobility constraints.

He used the stick to open and close the door, turn the heating and cooling on and off, and close the blinds, as shown in the screenshots above. Throughout the video, Jim wore compression gloves, needed to manage the discomfort created by his medical condition.

Fig 22. The pallet of experiences. Waycott & Davis (2017) show what does it mean to be housebound. They present two multilayered visual stories of housebound participants of their project. These visual-textual stories are organized around selected quotes that provide crucial snippets of daily routines of housebound people, e.g., *You can do anything with this stick.*

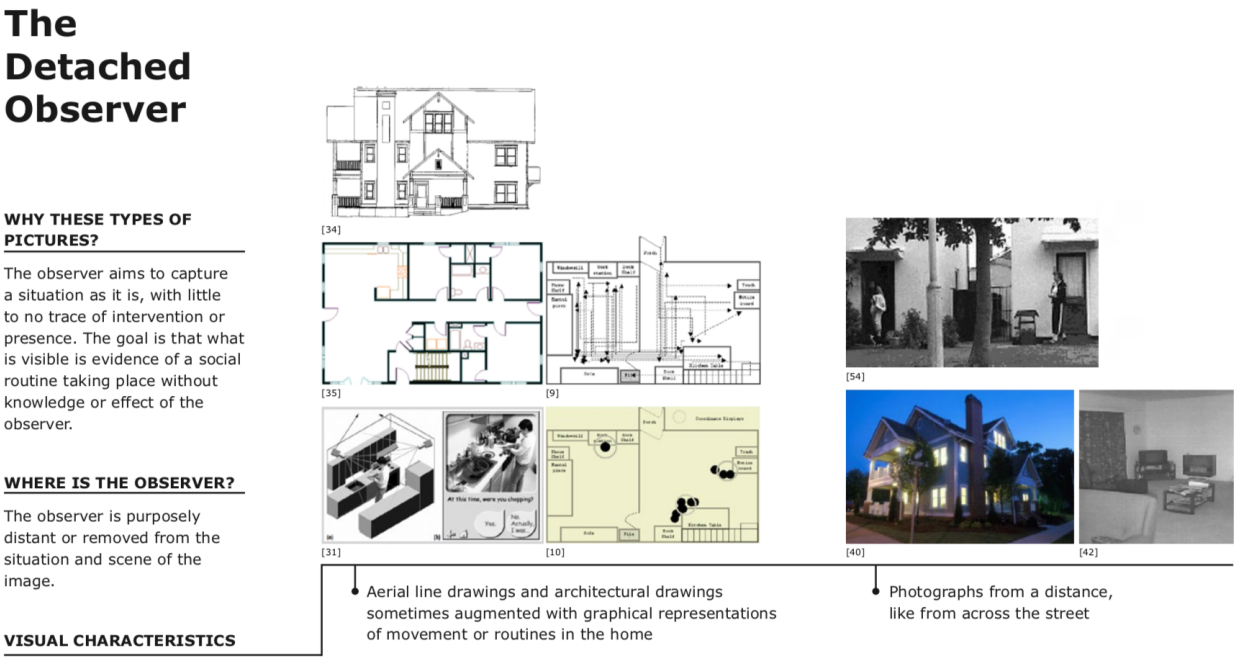



Fig 23. Introduction to a new domain or new understanding. Desjardins et al. (2016) present seven types of observers that can be associated with epistemological commitments in research. Each page of the pictorial presents a single type of observer. It contains a title, photos organized in clusters, research questions, and answers to these questions. Visual organization and identical structure of each page of pictorial enable comprehension and comparison of the presented design knowledge.

### *6. Juxtapositions*

Juxtapositions of various materials, visual and/or textual that create new meanings, spark ideas and encourage reflection (Figure 24).

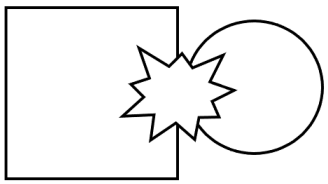


Fig 24. Textual representations of knowledge usually provide explanations, arguments, or solutions. The text brings objectivity, precision, and it is a tool to define the authors' position. Visuals are multilayered. Therefore, they leave space for reflection, interpretation, and discoveries. Juxtapositions bring new understanding and meaning.

We identified three sub-categories of juxtapositions:

***Visual juxtapositions*** – juxtaposed images that interact which each other and create relations. We can juxtapose visuals to increase their similarities or indicate differences, to contradict, and create something new that surprises (Figure 25).

***Visual – textual juxtapositions.*** As text and visuals present different layers of information, their deliberate juxtapositions, e.g., photographs with literature, provide a new dimension of insight into the presented phenomenon (Figure 26).

***Meta juxtapositions*** – a complex visual-textual artifact used as an inspiration, a design research output, a design method or tool, summary, or educational material (Figure 27). Such artifact is multilayered, and it juxtaposes numerous visual and textual elements (e.g., cognitive elements, frames, colors, bold or highlighted text). It has a navigation element to facilitate its use and an interaction with it, e.g., a diagram that presents a sequence of steps.

**Relation 1**
We see the figure of a woman lying on the rocks in a position that maximises her contact with the rocks. Her face is not visible, suggesting she may not want to be recongisable. From the point of observer she is anonymous. She is just a physical entity: a human body in relation to the rocks. The woman wears a red dress that might be considered an interface between the surface of the rocks and the surface of the body. Since the dress is very thin, it does not prevent the woman from the effects of hard rock surface but it provides a degree of protection and comfort. The performer explained that her relation with the rocks without the dress would have taken a different form because of the presence of some other people around.


Fig 25. Visual juxtaposition. Kocaballi and Yorulmaz (2016) use performative photography to create a set of novelty relations of human-technology-world. Then, they use these relations as an inspirational resource for research and design. © Baki Kocaballi.

## OUR PARTICIPANTS

In recruiting our participants, we reached out to people living in non-normative living situations. We soon realized how these living situations extended to values and lifestyles that at times overlapped. We will describe these on this page.

**Zero-waste** living aims to reduce landfill waste in everyday life, which entails consuming less, using less plastic, shopping packaging-free and being resourceful and thoughtful about materials in everyday life.

Zero-waste to an extent overlaps with minimalism, which some of our participants adopted as well. **Minimalism** also focuses on consuming less, but rather than being environmentally motivated, minimalism looks to establish more fulfilled lives with less stuff. The Tiny home movement is in part connected to minimalism, as an effect of space limitations and similar anti-consumerist motivations.

Other participants adopted **Urbanism** in taking maximal advantage of the city's infrastructure, e.g. bike- and car-shares and public transport. Further, our participants all advocated and promoted their living situations in response to the housing crunch in Vancouver.

The **Tiny Home Dweller** lives on Gambier Island. Her tiny home set up consists of one 16 x16 house, a separate 8x8 bathroom and a woodshed and cold room for food storage. She has lived there for 13 years. As a sustainability educator, she is knowledgeable of rules, regulations and impact around waste and specifically through living on the island where waste collection is sparse, she has over time grown into living more zero-waste. Her husband comes to the island in the weekends, and during the week works in Vancouver. He lives in a **Micro Loft Tiny Apartment**. Both of these places are considered home to the couple with an ongoing exchange between them.

The **Van Dweller** spent last year converting her second van and has been living in a van for 4 years. She organizes monthly Vehicle Dweller Meetups in Vancouver to get together with other van dwellers and to promote the van lifestyle. She works as a shuttle bus driver.

The **Boat Dweller** has been living on her boat with her family of four for several years. Advocating slow and steady living, she sails her boat to unconnected zones on local islands and the open ocean to get a break from city life.

The **Nomadic Pet/House-sitter** moves with her suitcase from one house to the next to take care of cats whose owners are away. Through word of mouth, family and friends and online platforms she has been living rent-free for more than a year. She continually adapts herself to different neighborhoods, cats and living spaces. She sometimes rearranges the furniture, and erases all her traces when it is time to leave. The Nomadic Pet/House-sitter adopts a zero-waste lifestyle and is highly connected to the cities infrastructure, e.g. through her ever-changing commute.

The **Urban Condo Dweller** lives with his five kids and utilizes the city and technology to enable his downtown family lifestyle. He is a keen promoter and self-described urbanist, minimalist and technologist and blogs about his lifestyle.

We recruited five **Collective House Dwellers** who had recently started a collective based on their shared ideas of what they wanted a house to feel like. The collective holds biweekly house meetings to continue these commitments, including maintaining a supportive community, creating a safe and inclusive space and drawing energy from each other's support.

Fig 26. Visual-textual juxtaposition. Oogjes et al. (2018) use juxtapositions to the participants of their study with selected values and lifestyles. They play with color, highlighted text, and lines to show interplays between discussed variables. Such playful representation simplifies the description and invites to come up with various levels of interpretation: to search for new connections, similarities, differences or to add new elements of an interplay. © Everyday Design Studio


Fig 27. Meta juxtaposition. Eclipse: method aimed at eliciting subjective qualities of people's experiences of and relationships with public places (Wakkary et al., 2014).

To sum up, in the table below (Table 2) we present the overview of the six forms of design research outputs indicating their purpose of use, the context of an application and the result of the application. Furthermore, we are suggesting who are the potential target users of the given form.

| Form | Purpose of use | Target Users | Context of application | Result of application |
|---|---|---|---|---|
| **Inspiring collection** | To provide a rich overview of the work that was already done. To emphasize an investigated phenomenon. To sum something up, catalog, or archive. | Designers, researchers, students, non-design stakeholders, e.g., business decision-makers. | When we want to introduce a new concept, field or industry. During business meetings, when we want to provide an insight into a design process. When we educate or present research results. As research materials – collages. | The inspiring collection is a tangible reference point for conversation. It invites to be developed and updated. Collaboration, new ideas, and reflections. |
| **Referential resources** | To add interactivity to textual formats of presentation. To link various materials and present elements that are difficult to verbalize. To simplify a presentation by placing additional materials somewhere else. | The readers of (research) papers, reports, or summaries. Designers, researchers. | When we have limited possibilities of presentation. To share materials, e.g., how-to guides. When we conduct a collective research process and use digital media. When we want to enrich textual formats of presentation. | An action, e.g., somebody downloads the provided material, shares material on Instagram, or is watching a video. Replication of the presented process. |
| **Tacit mediations** | To provide an insight into a design process. To present speculations of future possibilities. To inspire. To provide access to tacit knowledge. | Designers, researchers, readers of research papers, reports, summaries. Study participants. | When we want to present something that is difficult to verbalize. When we want to provide access to tacit knowledge. | Experience and reflection on the presented theme, phenomena, or stage of a design process. |
| **Engaging narratives** | To engage and invite to the reflection on the presented material. To invite to searching for answers to the posed question. | Readers of the reports, research papers. Participants of the workshops and presentations. | When we want to engage, and invite to reflection, present various roles of people in a project and indicate challenging moments in decision-making processes. | Reflection, discussion dialogue, and idea generation. |
| **Granular experiences** | To present the most critical learning (new chunks of knowledge) in the given project and indicate a design opportunity. To inform, inspire, and motivate to action. | Designers, researchers, business stakeholders. | When we need structure to simplify complex materials and synthesize various sources of knowledge. To mediate between research and design. | Ideas, speculations, explorations of indicated research, and design opportunities. |
| **Juxtapositions** | To spark ideas and encourage reflection. To create new meanings and surprise. | Designers, researchers, students, participants of design sessions. | When we conduct idea generation or speculate. When we educate, want to sum up our work or offer design tools. | New ideas, reflections. |

Table 2. Mapping the characteristics of the six forms of communicating and sharing knowledge.

## Discussion

In the previous section, we presented six forms of sharing and communicating design research insights. Such forms support collaboration and communication between designers and non-designers by making intangible aspects of design knowledge shareable and available to others. Here, we add details to the model of the *actionable palette* by discussing the nine qualities of actionability and providing guidelines for actionability.

### *The Characteristic of Nine Qualities of Actionability*

We inspected each of the six forms of design research outputs, e.g., inspiring collection, tacit mediations, to identify which qualities of actionability they meet. By asking questions about each of the nine qualities (Figure 1) e.g., *Is it inspiring? What makes the juxtapositions inspiring?* we obtained answers that informed the definitions of all the nine qualities of actionability. These answers also led us to identify the practical strategies of reaching particular qualities.

Based on the analysis of actionability, we identified that only two forms of sharing and communicating design research outputs fulfill all the nine qualities of actionability. These forms are *granular discoveries* and *juxtapositions*. These are the most complex and synthesized forms of design research outputs. They combine and juxtapose various elements and present information on different levels of sense-making (from key top-level takeaways to visual sources of data). We argue that the more designers contextualize and synthesize design research outputs, the more actionable these forms are.

We also identified the basic qualities of actionability. These are three qualities: *informative*, *inspiring*, and *capable of being acted on*. All six forms met these three qualities. We argue that reaching these qualities does not need *additional bridging work* (Höök et al., 2015) in comparison to reaching the other qualities such as, e.g., *experienceable, memorable*, or *playful.*

The least actionable form of sharing and communicating design research outputs are *referential resources*. They fulfill the three basic qualities (*informative*, *inspiring* and *capable of being acted on*) and are also *experienceable* as through mechanism of references it is possible to interact with various types of materials, e.g., videos and how-to guides.

Below (Figure 28), we present definitions of nine qualities of actionability resulting from the analysis of the six forms of design research insights.

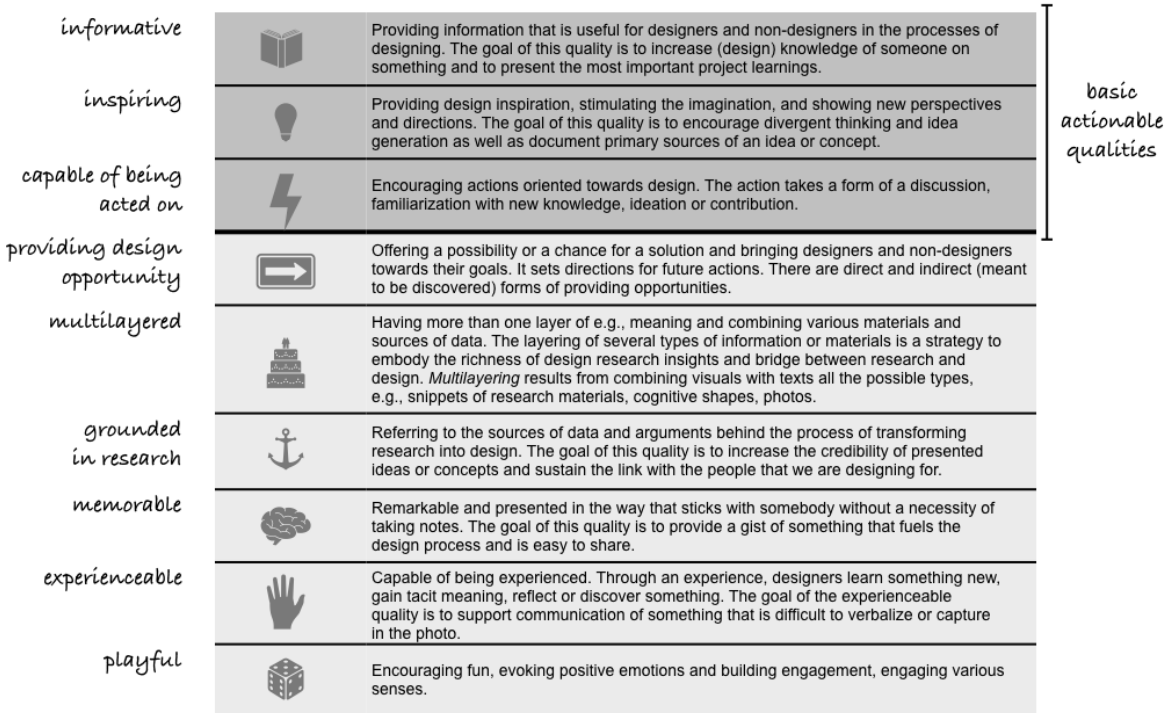



Fig 28. The nine qualities of actionability.

***Guidelines for actionability***

Inspired by the definitions of the nine qualities of actionability and the six forms of communicating and disseminating design research insights, we developed guidelines for reaching particular actionable qualities (Table 3). These guidelines are directions and inspiration for design practitioners (especially novice ones) for developing design research outputs for collaborative settings. We argue that these guidelines are more useful at the conceptual stages of a design process.

| Actionable quality that you want to reach | Guidelines |
|---|---|
| ***informative*** | - provide a rich visual overview of the investigated phenomena,<br>- instruct by sharing templates and how-to guides using e.g., open-source platforms,<br>- set expectation by asking the right questions and ask auxiliary questions,<br>- offer a visual or textual digest,<br>- juxtapose visual and textual materials,<br>- create design tools to use design research insights and ideas in practice,<br>- create booklets to sum up your project,<br>- provide tacit meaning by exploiting a chosen form of knowledge representation. |
| ***inspiring*** | - show a chosen theme from various perspectives, e.g., combine photos with quotes,<br>- show the path of developing an idea and sources of inspiration,<br>- add interactivity to the chosen main form of a design research outcome,<br>- make something to enable to feel something, make intangible tangible,<br>- use metaphors,<br>- ask questions to steer towards new directions,<br>- present portraits of people. |
| ***providing design opportunity*** | - present associations for a chosen theme by using collages or mind-maps and invite to search for new elements of these visualizations,<br>- construct new realities, e.g., by making photographs,<br>- provide concise statements to indicate needs and wants to set directions of future actions,<br>- present key top-level takeaways,<br>- share speculative concepts,<br>- juxtapose various materials to create new meanings. |
| ***multilayered*** | - create associations, e.g., collages, using various materials,<br>- create complementary pairings, e.g., full research paper + pictorial,<br>- combine digital media, e.g., the Instagram hashtag to collect feedback, video to show a context,<br>- create posters and comics,<br>- ask auxiliary questions to provide various perspectives,<br>- exploit the intrinsic qualities of chosen forms of presentation, e.g., photographs, to create layers of information,<br>- juxtapose various elements to tell your story, e.g., cognitive shapes, photos, text, frames; use various colors and techniques, e.g., zoom in, polarize. |
| ***grounded in research*** | - provide an insight into a study using videos, diaries, photographs, etc.,<br>- create documentaries – the 'making of' perspective on your project,<br>- show how did you obtain the better question in comparison to the ones you have at the beginning of your project,<br>- offer snippets of research materials, refer to sources of data, |
| ***memorable*** | - sum up your discovery in one sentence that is easy to share and remember,<br>- provide stunning visuals,<br>- pose questions that create a memorable impression,<br>- create surprising juxtapositions,<br>- create puzzles, jigsaws, games that can be remembered because of their experiential form,<br>- prepare a collection in the form of memory cards. |

| | |
|---|---|
| ***capable of being acted on*** | - invite to add new elements, e.g., to a collection,<br>- encourage to post a comment or share something on e.g., on Facebook,<br>- enable to download or upload materials,<br>- encourage to use templates, how-to guides,<br>- share speculative concepts, novelty realities and open a discussion about them,<br>- ask questions that drive towards solutions,<br>- add navigation to suggest the particular steps of action,<br>- create frameworks,<br>- create generative tools. |
| ***experienceable*** | - create engaging activities, jigsaws, puzzles, games,<br>- enable to browse something, e.g., a collection, gallery with curated photographs,<br>- think of the possibility of transferring the main interaction of your product to the form of design research output,<br>- think of sequences of actions, e.g., watch the video first, then read a paper, etc.,<br>- create a performance,<br>- create design tools and methods. |
| ***playful*** | - create games, puzzles, jigsaws, e.g., connecting the dots,<br>- create comics – give voice to various characters,<br>- create engaging and surprising compilations of various sources of materials,<br>- create design tools enabling to apply the new knowledge in practice,<br>- make intangible tangible, draw the emotions,<br>- surprise by juxtaposing various materials. |

Table 3. The guidelines for actionability.

## Conclusions and Future Work

In this paper, we presented *the actionable palette* that is a set of nine qualities acting as building blocks of actionable forms of sharing and communicating design research insights. We developed the model of the actionable palette based on the literature review. Then, we provided the model with details by reviewing 51 pictorials published as full conference papers. We end with a set of guidelines for reaching the actionability for design practitioners that work in collaborative settings.

Future studies will focus on the needs of designers and non-designers who capture and share knowledge in the particular processes of designing for various types of challenges, e.g., complex social problems.

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methodologies that help in creating societal impact through multiple stakeholders collaboration; not only in concept phases but as well as in implementation stages.

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David Lamas is a professor of interaction design at Tallinn University's School of Digital Technology. His main research interest is design theory and methodology. He heads the academic area of human-computer interaction, including the master's program in human-computer interaction.