McMaster University | Institute for Research on Aging

MIRA Innovation Workbook

User-centred Research

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November 18, 2017 2:02 PM

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Introduction

Overview

The McMaster Institute for Research on Aging (MIRA) was established in the fall of 2016 in order to coordinate, facilitate and amplify aging research across all Faculties at McMaster. MIRA's approach is to generate human-centred solutions through active engagement of research end users and the consideration of perspectives arising from various disciplines and life experiences. The research approach is designed to generate solutions that are built upon the foundation of curiosity-driven activities, and that are practical, readily implemented, and promote aging in place.

Several members of the Institute engage in research activities that are already using this (or a related) approaches, which are derived from already well-developed methods, such as design thinking, critical thinking and participatory action research.

The workbook is intended to serve as a guide to support researchers in developing this way of thinking in order to broaden the perspectives used to inform research questions and amplify the impact of research outcomes. The term "design thinking" will be used, however there are several other terms that could be used to describe this approach. The workbook will complement other tools and resources developed by MIRA in support of these activities.

Context

This workbook is the outcome of a workshop held on design thinking for members of MIRA. The workshop was led by Harry Mahler (Professor, Faculty of Design, Ontario College of Art and Design University) and Robert Fleisig (Associate Professor, Walter G. Booth School of Engineering Practice and Technology, Faculty of Engineering, McMaster University).

In this workbook, a brief history and background of design thinking is provided, followed by the motivation for this work, a description of the process, a limited selection of supporting tools, and further reading.

Who is it for?

This workbook is intended for any researcher (including graduate students, research associates, postdoctoral fellows, faculty, etc.) interested in building an interdisciplinary research team around aging-related research. The workbook is a brief guide and not an exhaustive reference. A list of readings is provided for additional in-depth study.

Although this workbook is designed for members of MIRA, it could be conceivably applied to research themes other than aging. In thematic areas where the parties can identify and relate to a common end user of their research, it may be possible to use this workbook.

This work is motivated by the need for research that is more interdisciplinary and impactful in terms of contributing to the daily lives of our aging population.

Background

An extremely brief history of design thinking

The notion of 'design thinking' is relatively a contemporary one. Whereas the notions of design and designing have been applied to the practices of several trades and professions over the ages, it is only in recent decades that the importance of understanding this approach has been realized.

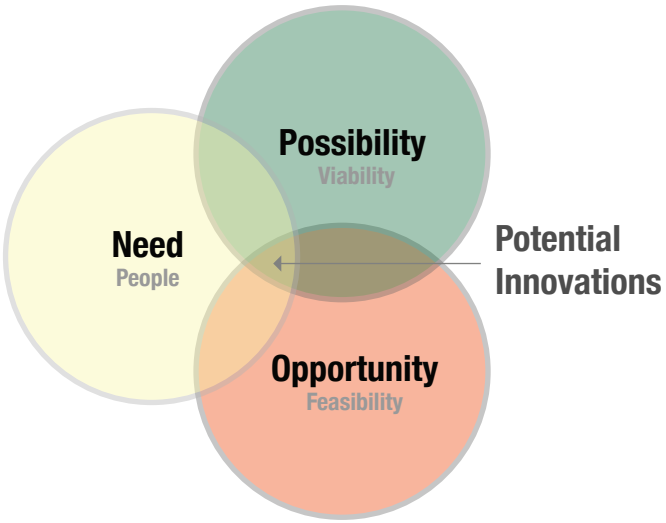

Figure 1. Innovative thinking starts with a human-centred point-of-view. Once you ask the questions, what do people need or want, you can only then make sense of the innovative possibilities and potential opportunities.

Nigel Cross investigated design and designing across several disciplines and professions. He identified four features of design ability[1]. These are the ability to (i) resolve ill-defined problems; (ii) adopt solution-focused strategies to solve problems; (iii) employ "what-if" thinking; and (iv) use non-verbal, graphical or spatial modelling.

These features were spelled out in clear contrast to the abilities needed to perform research or scientific work. In particular, Cross compared problem-focused approaches adopted by researchers to solution-focused approaches adopted by designers. Whereas researchers are generally more interested in understanding a particular phenomenon in-depth and with rigour, the designer is generally faced with limited time and resources to search a design space for the best solution. The nature of the task is different for researchers and designers, as are the outcomes and strategies employed to achieve it. This difference is articulated by Simon as: "The natural sciences are concerned with how things are…design, on the other hand, is concerned with how things ought to be."[2]

Design thinking solutions are found at the intersection of need, possibility, and opportunity, as shown in Figure 1. The initial focus is entirely on learning about and understanding the needs of the end user. As the process moves towards exploring possible solutions, the feasibility (in-terms of solutions or technology or otherwise) and viability (in-terms of organizational, business, and financial issues) begin to shape the potential innovation. In essence, the process works holistically to understand and consider all stakeholders and issues in developing and implementing an innovation.

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[2] Simon, Herbert A. *The sciences of the artificial.* MIT press, 1996.

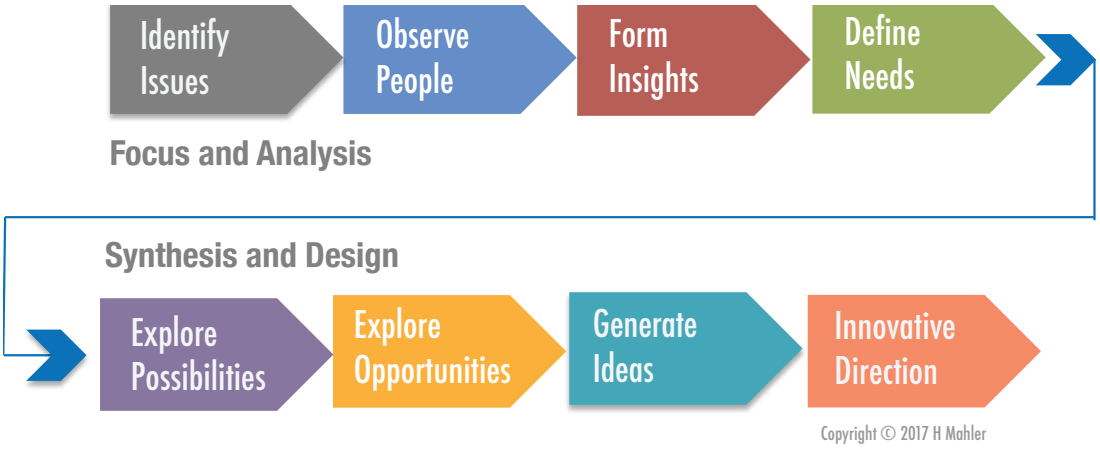

Figure 2. Typical design process.

Contemporary design thinking and methodology

Buchanan noted that "design has not been reduced to a single discipline — it remains a way of crossing disciplinary boundaries particularly in technology, art, social, science, etc."[3]

More recently, workers in Engineering and Business have broadened design into more than just the creation of artifacts (e.g., products, services, etc.). Faste sees the need for design of experiences as more important than artifacts. His notion of design thinking includes not only utility or functionality of an artifact, but also its usability and meaning to its users.[4] Similarly, in Business and Management, design thinking has been expanded to include the design of businesses and business models.[5]

A typical design thinking methodology follows the steps shown in Figure 2. Early on, the goal is to learn about the stakeholders. This step is often called empathize. From what is discovered, researchers aim to form insights, identify opportunities, and then generate ideas that would represent a more ideal state than what is currently experienced by the stakeholders.

Using this ideal state, the designers will make the creative leap to solutions and iteratively prototype them. In design thinking, prototyping is seen as an active way of testing ideas. It could include building physical models, but could be as varied as using role playing. Design thinking has often been compared to inquiry-based methodologies with the difference that designers are biased towards solutions and actions rather than new knowledge.

For the purposes of this workbook, the design thinking methodology will end just before detail design begins.

[3] Buchanan, Richard. "Wicked problems in design thinking." *Design issues* 8.2 (1992): 5–21.
[4] Faste, Rolf A. "The human challenge in engineering design." *International Journal of Engineering Education* 17.4/5 (2001): 327–331.
[5] Dunne, David, and Roger Martin. "Design thinking and how it will change management education: An interview and discussion." *Academy of Management Learning & Education* 5.4 (2006): 512-523.

Motivation

Why collaborate?

It is well understood and appreciated by researchers that collaboration adds unique perspectives and research approaches, and improves outcomes (see Figure 3). It is also understood in many disciplines that involving research stakeholders or end users as part of the research team is beneficial in terms of generating outputs that are most applicable and impactful.

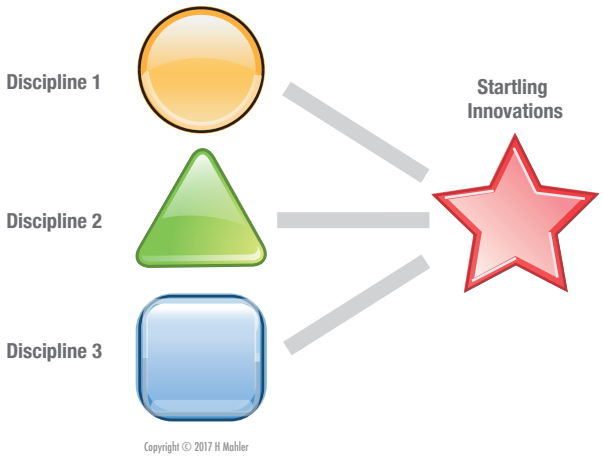

Figure 3. Different disciplines collaborating can discover richer and unexpected innovations, based on the fact they are coming to the project from different mindsets.

How to use design thinking to collaborate

The IDEO or Stanford approach to design thinking starts with the "deep dive"[1]. It advocates bringing people together around a problem, but with highly varied backgrounds so that there is a stronger understanding of the problem/question/situation, which results in richer outcomes. At this stage, the collaboration of subject-matter experts, end users, and other stakeholders leads to defining the issues and problems based on a combination of expert knowledge and tacit knowledge of end users and practitioners. As the problems and issues are defined, the process moves to a solution-focussed searching approach. New ideas are quickly tested through using visual tools. This can include low-fidelity prototypes, sketches, role playing, etc. The process becomes highly iterative with input from both the subject-matter experts and end users.

It is important to note that participants in the collaboration do not necessarily contribute equally from their disciplinary expertise at all stages of the process. Selecting appropriate collaborators is critical so that complementary perspectives and expertise are present throughout.

Another central component of the collaboration is a shared definition of the end user of the work. All participants must agree that their research or outcome of the process will affect the same person or persons. For example, engineering researchers working on smart home technology and researchers focused on chronic disease might work together to find new ways to use technology to help individuals manage chronic diseases at home. Both groups are focused on the person with chronic disease living at home, but bring different perspectives to the collaboration.

[1] ABC Nightline — IDEO Shopping Cart, https://www.youtube.com/watch?v=M66ZU2PCIcM.

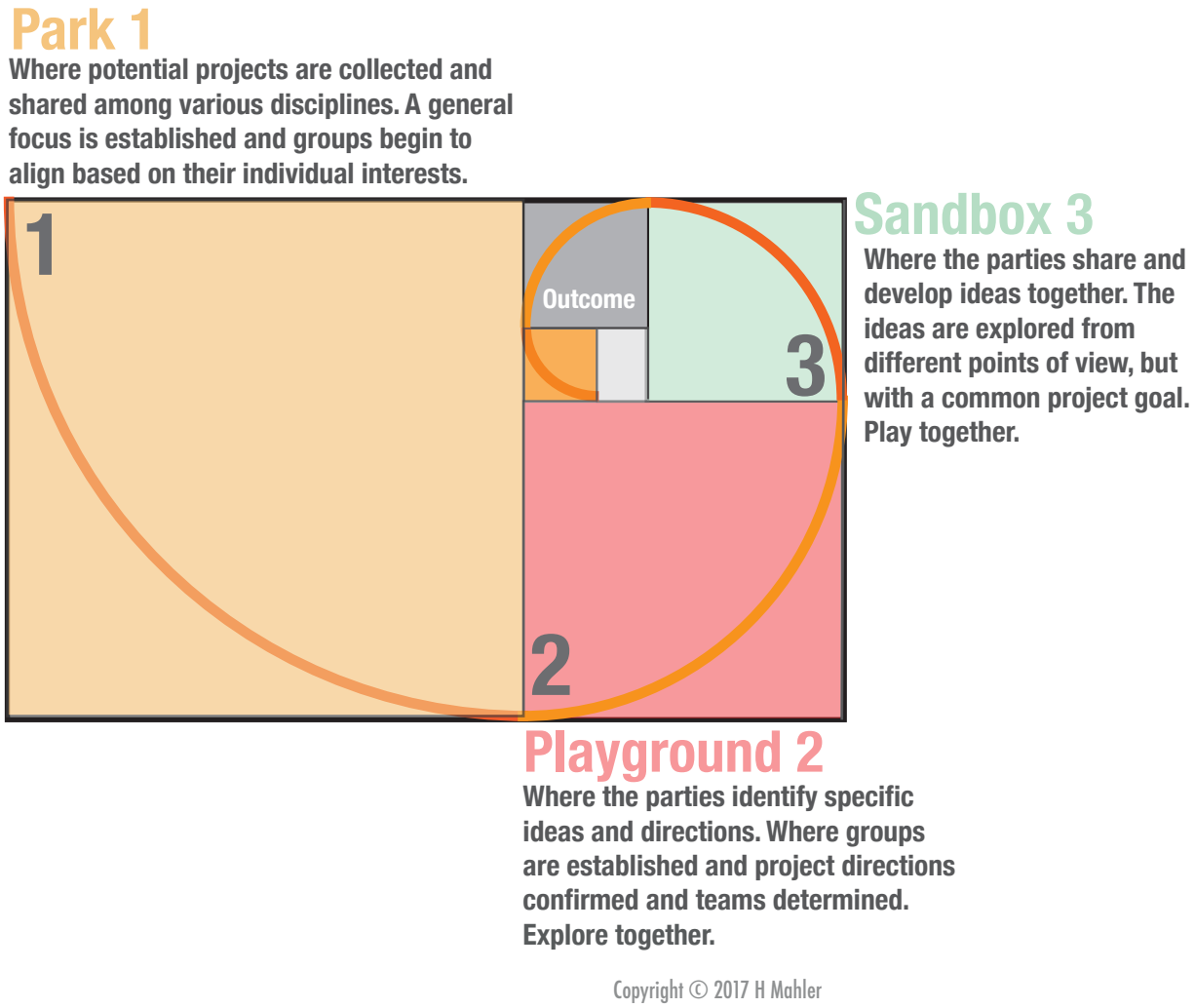

Figure 4. User-centred research model.

The process explained

In principle, design thinking applied in research follows the same process as its application by practitioners to real world problems. The difference primarily, is that the aim is not to develop a solution, but to explore a new future state which leads to research questions for each of the parties involved.

Using the metaphor of play (see Figure 4), the design process for interdisciplinary research projects has three phases:

1. Park — Where potential projects are collected and shared among various disciplines. A general focus is established and groups begin to align based on their individual interests.

2. Playground — Where the parties identify specific ideas and directions. Groups are established, project directions are confirmed and teams are determined.

3. Sandbox — Where the parties share and develop ideas together. The ideas are explored from different points of view, but with a common project goal.

The process begins with parties and potential project ideas and ends with defined research teams and directions for research. In each phase, the parties iteratively move closer and closer to finding a common direction.

The process will not work for all aging researchers or fields of research. Design thinking focuses on understanding the needs of end users related to the problem at hand. Where participants have in common their ability to affect or benefit the same end user, then they may be able to collaborate using design thinking to find an interdisciplinary direction of research.

As an example, researchers with complementary expertise in driver rehabilitation, community mobility and automotive technology may find that they have in common a desire to facilitate the wellbeing and independent mobility of older adults living who wish to continue using their personal vehicles.

How to work together

The design process is effective because:

- The participants speak a common language. They discuss how their research and knowledge can benefit a specific end user or end users in a specific context.

- Participants suspend their interests in their own research for the duration of the process, but bring their wealth of knowledge, experience and ideas about how it could help someone.

- The participants work to define future benefits in a way that utilizes the multiple perspectives of the parties. In essence, participants allow themselves to learn from other participants.

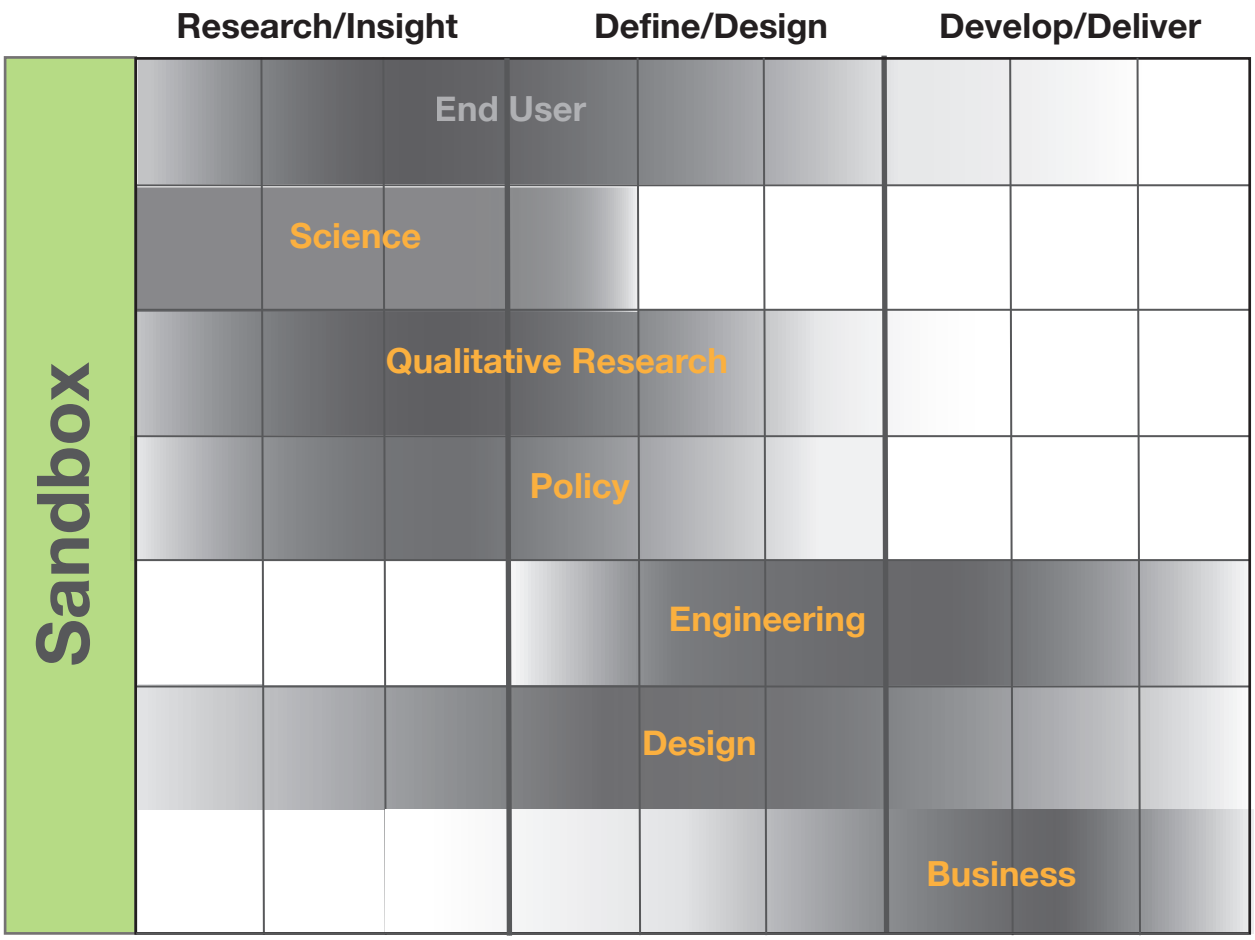

Figure 5. The figure identifies in general terms where different disciplines tend to concentrate their efforts within the design process. By collaborating within teams, the process gaps can be evened out and the resulting outcomes tend to be more thorough and innovative.

Contribution and timing of different disciplines

The collaboration of multiple disciplines will naturally lead to differing contributions both in substance and in timing (see Figure 5). Often in design projects, contributions in the early phases which aim to understand end users and issues will come from the end users themselves and the experts with understanding of problem-related issues such as scientists and policy experts. As the work progress, those with expert knowledge in the technology, solutions, and implementation such as engineering and business are more likely to make greater contributions. Nevertheless, it is vital that all disciplines participate and contribute throughout the process to ensure a holistic and interdisciplinary outcome. Those trained in design often make contributions throughout the process.

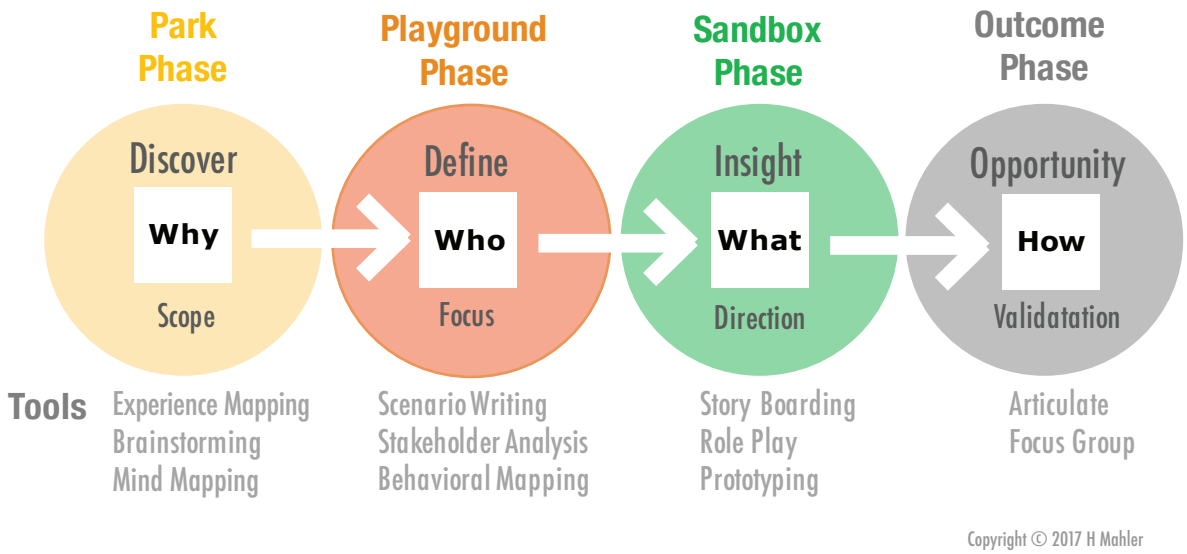

Figure 6. Application of design tools in the user-centred research process.

Recommended tools

Many of the following tools are from the book, “Universal Methods of Design” by Martin and Hanington. The complete reference can be found at the end of the workbook.

Tools for the park phase

At the beginning of the park phase, the parties are looking to find potential partners and common area of focus. Speed dating is an effective and quick way to find partners with a common area of interest.

Tools for the playground phase

Once the parties have confirmed their desire to work together in the playground phase, they need to first identify a common group of end users of potential future research (i.e., older adults). This should include a description of the potential end users and in what context or occupation the research is intended to create benefit. Personas can be used as a way to capture this knowledge.

Techniques that can be effective are brainstorm graphic organizers and mind mapping. The parties work together a develop a central question to brainstorm. This might be, “how will the future smart home for people with chronic disease feel or look like?”

At this point, end users should be involved in defining the benefits. Common methods for involving end users include interviewing, observation, and co-design.

The outcome of this phase should be some key ideas and concepts which can be further developed into a direction in the next phase.

Tools for the sandbox phase

With a few common ideas or concepts of how the future might look, the parties may wish to dive deeper into those ideas or concepts to develop a more detailed understanding. Although this phase may be seen as a way to refine the ideas and concepts from the playground phase, it is also where knowledge will be shared to develop a deeper understanding amongst the parties by exploring different perspectives.

Common tools and methods

Common tools for this phase can include (see Figure 6):

- User observation — https://www.interaction-design.org/literature/article/how-to-conduct-user-observations
  Develop an understanding of the broad issues and identify essential insights for exploration.

- User Interviews — http://www.designkit.org/methods/2
  Gain a deep understanding of the users' needs through direct engagement.

- Storyboarding — http://www.designkit.org/methods/35
  To walk through, in detail, the description of a future ideal state. Used to identify issues and problems and develop understanding. Similar to a scene by scene movie outline.

- Behavioural Mapping — http://designresearchtechniques.com/casestudies/behavioural-mapping
  A way of documenting human activity in order to develop insights about people.

- Scenario Writing — https://www.interaction-design.org/literature/article/design-scenarios-communicating-the-small-steps-in-the-user-experience
  A way of explaining the issues and possibilities through storytelling, focused on the end user. The narrative can be written in the negative or the existing situation, followed with a more positive description that resolves the identified issues in the first scenario.

- Expert Interviews — http://www.designkit.org/methods/43
  Develop an understanding of the broader context and history on issues and trends in an industry.

- Experience or Journey Mapping — http://www.designkit.org/methods/63
  A Journey Map allows you to identify a user's normal daily experience in a visual form.

- Brainstorming — http://www.designkit.org/methods/28
  Work with others to generate a base of ideas, analyse and synthesize them together.

- Stakeholder Analysis — https://www.interaction-design.org/literature/article/map-the-stakeholders
  Identify and categorize all of the people or components of the project that will be impacted by the outcome of the project, in the format of a series of charts.

- Mind Mapping or Framing your Idea — http://www.designkit.org/methods/60
  Starting with the end user in the centre of the map, identify all the issues that will impact the project, use images if possible.

- Metaphors — http://www.howdesign.com/articles/metaphor/
  A word or phrase applied to an object to which it is not literally applicable but represents or is symbolic of something else, especially relatable concept (e.g., 'oasis on the street').

- Lifestyle Mapping — https://dl.acm.org/citation.cfm?id=1541980
  Describes the way in which a person expresses his/her acceptance of certain advertising or products designed to appeal to the end user's lifestyle or way of life.

- Role Playing — http://www.designkit.org/methods/36
  Individuals form a stakeholder group, take roles and act out an event from the point-of-view of the end user, much the same as actors in a scene of a play.

Now what?

The starting point for any user-centred research (or design thinking) project includes finding collaborators from other disciplines and identifying a common end user. The next step is to recruit that end user to be involved in the process from the park through to the playground where the research questions are identified. For all of these steps, MIRA can help mobilize people to support your work.

Figure 7. https://www.thespec.com/news-story/4335777-a-simply-ingenious-device-helps-fill-sandi-s-gas-tank-painlessly

Example of the application of design thinking

Design thinking underlies an annual first-year design project which is the collaborative work of Dr. Robert Fleisig (Engineering), Dr. Brenda Vrkljan (Rehabilitation Science), and Dr. Lovaye Kajiura (Biology). This project involves students from a mandatory first-year Engineering course, and student volunteers from both Rehabilitation Science (graduates) and Biology (undergraduates). The contributions of the faculty and students vary throughout the project but follow a design thinking methodology. The outcome is a simple device built by students on a shoestring budget in the space of about six to eight weeks. Figure 7 illustrates one of these projects from 2013. The end user was Ms. Sandi Mugford, a local community member.

Park

The “walk in the park” began before initiation of this project. Brenda and Robert had already been working together a research project. Lovaye later joined the project after hearing about it from her colleagues. Robert’s Engineering class needed a project and it was from Brenda’s network of community members that she put him in touch with Sandi. Sandi was approached with the understanding that she would be involved in the project but without a specific idea of what the project would be. Sandi is a giving and dynamic individual. She actively explores solutions own her own to the many challenges she faces. These were key to a successful collaboration with her on the project. With Sandi, mobility related to her rheumatoid arthritis (RA) was identified as the key issue we would work on together.

Playground

After a number of conversations, it was learned that Sandi has difficulty using gas stations due to RA. Her ability to independently use the gas station was important to her because it kept her engaged and mobile. Robert and his TAs visited a local gas station with her and videotaped how she parked her car, got out of her car, paid for her fuel, used the nozzle, and returned to her car. Here we discovered a number of mobility issues, including difficulties using and holding a credit card, using the keypad, and lifting and activating the gas nozzle. At this point, Engineering students, working as both designers and engineers, actively began exploring possible solutions to these problems. Initially these were done with pencil sketches and then with low-fidelity prototypes.

Sandbox

As the work progressed, the Engineering, Occupational Therapy (OT), and Biology students met to discuss the projects. Always central to these discussions were the use of visuals, most importantly low-fidelity prototypes. The Engineering students brought these prototypes to the meetings, made discoveries by doing stakeholder walkthroughs of the prototypes and then modified the ideas and iterated, building new prototypes. Sometimes the end user was also available for feedback. Occasionally, the prototypes led to new discoveries that required the entire rethinking of the problem and proposed solutions.

Ultimately, the prototypes were refined into a final design that was used by the end user. Sandi still uses the device built by the students for her in 2013.

Each of the disciplines brought its unique perspectives to the project, and the contributions were not even or consistent in timing or amount. Brenda, as an Occupational Therapist, provided the initial introduction to the end user and direction for the project. The Engineering faculty and students took that problem and explored solutions. The OT and Biology students asked questions and provided perspectives on iterations of the design that the Engineering students would not have realized on their own. The final designs were a synthesis of multiple points of view, including that of the end user, whose tacit knowledge of the problems and issues strongly influenced the final result.

Further reading

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21. IDEO, Human-Centered Design Toolkit, http://www.ideo.com/work/human-centered-design-toolkit/

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