Critical Making

D2.2. Case actions and methodologies

Methodological Toolbox: Resource Bank for Reflexive Makers and Interdisciplinary Tools for Participatory Research on Grassroots Communities

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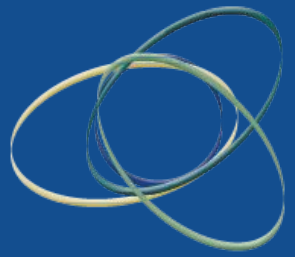
About this document



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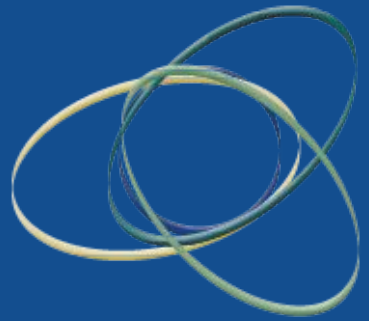


01

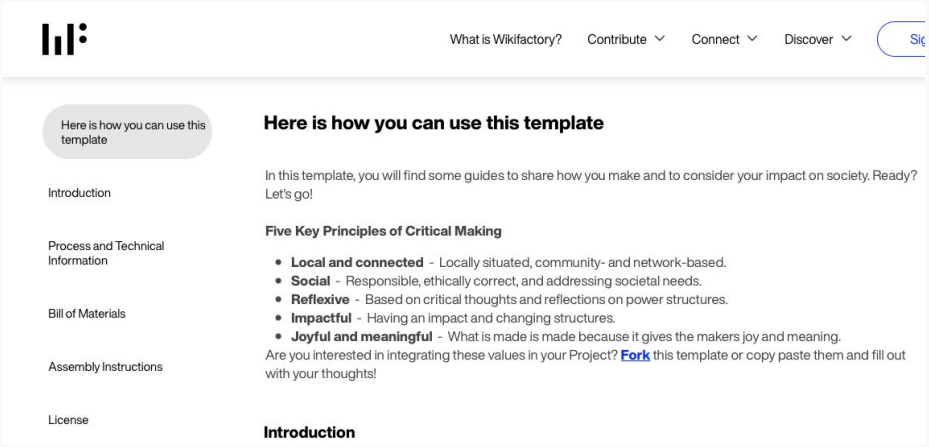
Introduction and Goals

Introduction

This document „translates“ the work and tools collected in the first year of the project into a language and visual representation accessible to and useful for maker communities and researchers. These include best practices of real-world cases, learnings from participative workshops held online due to the pandemic (digital/remote research) and the Critical Making Responsibility Framework “in action”: designed to inspire participatory-reflexive practices.

Goals

The goal is to develop a resource bank for those research and/or maker projects that aim to bring more reflexivity into their processes, and to allow them to learn from their peers by publishing Critical Making cases from around the world in a centralized, accessible format. An open access toolkit of various, hands-on tools is developed, which support the work of interdisciplinary responsible researchers engaging with grassroots innovators in participatory action projects. These tools are to be designed so that both academic and non-academic co-researchers can also use it.



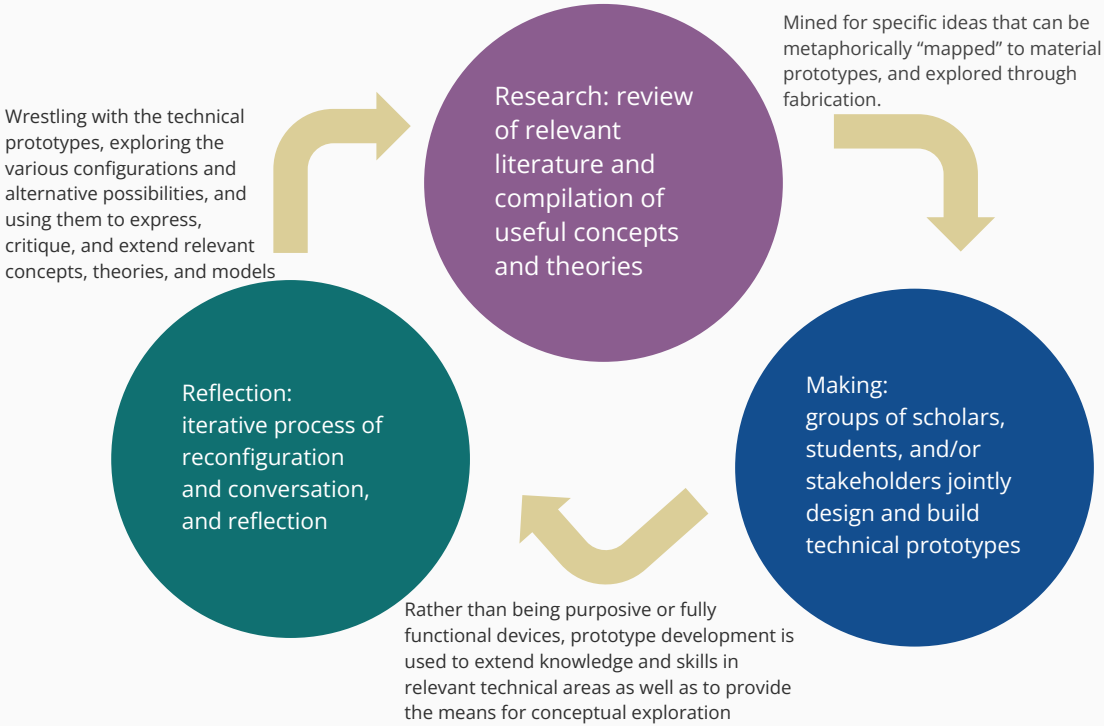
02

Theoretical Background

How to Make Critically

This overview is based on Ratto's 3 original steps of critical making (Ratto, 2011)

Critical making: "theoretically and pragmatically connecting two modes of engagement with the world that are often held separate—critical thinking, typically understood as conceptually and linguistically based, and physical "making," goal-based material work. (…) The practice involves three stages, analytically though not functionally separable. The project may start from any of these:"



Overview of the Principles

This visual contains a brief introduction to the 5 principles of Sustainable Making, which the Reflection Tool is based upon. This was developed by makers for makers (Nuesse and Wanalo, 2020), and the project builds on it.

1. **Make** things that make sense: Create products and solutions that solve fundamental, real-world problems.
2. **Integrate** Local Knowledge: Design with the community, leveraging on local knowledge and experience, as well as the local resources & assets available.
3. **Include** Ecosystem Services: Aim to give back more than you take from the environment and include accounting practices that value the natural resources used.
4. **Build** for Continuity: Design for the present and future; build social capacity & aim for financial self-sufficiency.
5. **Share** How You Make: Develop a set of guidelines that provide a framework for openly documenting everything about the making of the project.

Source: https://weall.org/how-can-makerspaces-help-build-climate-change-resilience
Visualization: Critical Making Consortium

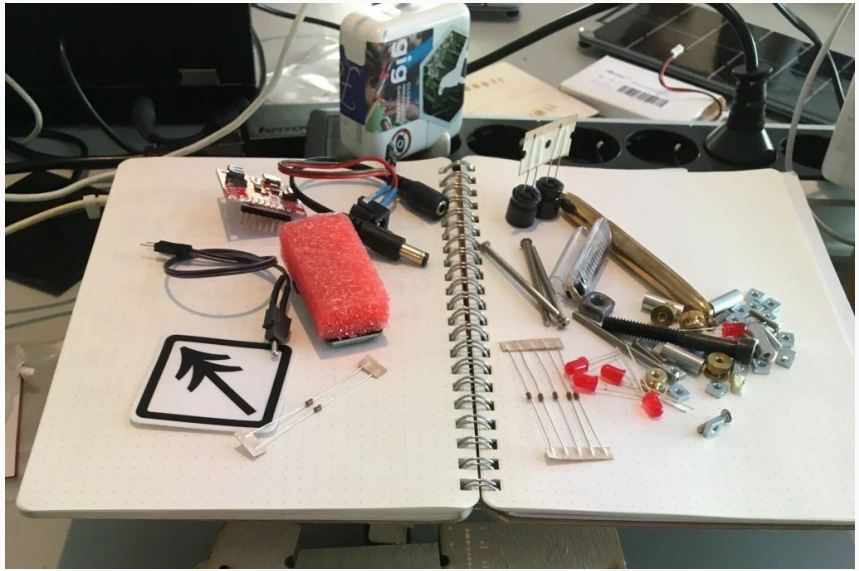
03

Participatory Methods and Tools

3.1

Participatory Practices - Academic Methods

4 practical, participatory academic methods of engaging stakeholders and research participants in meaningful, reflexive, critical ways are introduced below in a template format.



Reflexive handcraft-based practice

The aim of this practice is to work collaboratively on in-the-world projects that engage people at all stages of the research process to engender change towards more just worlds, e.g. through the digital augmentation of traditional craft practices.

Reflexivity in the practice:

- Thinking about the making practice in multi-layered ways, unpicking topics of research and the practices and methodologies that underpin the work.
- Working with organisations and communities who support or are made marginal in our world, to tell stories, unearth injustices, and co-develop systems of support
- Handcraft represents layers of meaning of their services and how the technologies and research projects supported these. The theoretical writing about the participatory research projects can relate to methodology, researcher responsibility, and notions of care, materiality, and justice, as well as research relationships, and the 'finishing' of projects – leaving research partnerships, including open ended issues; unfinished emotional business; and some threads of the relationships might continue after the project.
- The handcraft materialises a longstanding relationship with the issue; thinking about the ways in which participatory research practice often flows in spirals.
- Looking beyond the seams of the work – to explore the meaning of stitches, the intentionality of colour, material, and stitch length, and being metaphoric in our understanding of the process involved in making the pieces.
- Putting aside the strict rules of craft, even if just momentarily, to try new approaches, work across disciplines, boundaries, and media.

Dr. Angelika Strohmayer's presentation:
https://www.youtube.com/watch?v=PEXkSjwdrWI&list=PLUGM9odWOqO6tuX9lZxcluqzrec4fKV3N&index=3

Recommended reading:

- Angelika Strohmayer: 'Digitally Augmenting Traditional Craft Practices for Social Justice: The Partnership Quilt'. Palgrave Macmillan; 1st ed. 2021
- feminist Science and Technology Studies: de La Bellacasa, M.P., 2017. - Matters of care: Speculative ethics in more than human worlds (Vol. 41). U of Minnesota Press.
- textiles and craft literatures: Shercliff, E. and Holroyd, A.T., 2020. – Stitching Together: Participatory textile making as an emerging methodological approach to research. Journal of Arts & Communities, 10(1-2), pp.5-18.
- philosophies and practices of feminist and justice-oriented ways of working: Asad, M., 2019. - Prefigurative design as a method for research justice. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), pp.1-18.

Experience-centered design

Experience-Centred Design (ECD) is used as a critical approach for design and innovation that counters neoliberal approaches to the digitalization of humanitarian services that aim to improve health and food security. This practice is based on design research Dr. Talhouk has conducted with refugees in the Middle East and Europe.

- ECD as enabler to understand people's experiences and the experiences they aspire for while also understanding the social, political, cultural and economic factors that shape lived experiences.
- Dialogical, empathetic and responsive approach to design that aims to engage with people's beliefs, values and experience.
- The designers' role is to facilitate the development shared understandings of everyone participating in the design process, including the designer themselves.
- Criticality is in line with decolonial design that continuously questions and challenges Western approaches to design and innovation.
- Co-design is key: spending time with people negotiating the design endeavour, design tools and methods.
- Socializing is a major part of the design process, especially at the beginning: enable everyone participating to reach a shared understanding of each other.
- Critical reflection is necessary, and to continuously engage in critical reflection along with the participating people. The practice is shaped by our identities, beliefs and values but also by the people we are working with, the researcher has to be open to changing it.
- Considering the value of co-created artefacts that are not related to the final design but rather are made along the design journey, and design outcomes are to be oriented towards supporting participants while configuring interactions in which they have more agency.

Dr. Reem Talhouk's presentation:
https://www.youtube.com/watch?v=fRI14ULfcKw&list=PLUGM9odWOqO6tuX9lZxcluqzrec4fKV3N&index=5

Recommended reading:

- McCarthy, J., & Wright, P. (2015). Taking [a] part: the politics and aesthetics of participation in experience-centered design. MIT Press.
- Jayne Wallace's work on ECD
- Altorki, S., El-Solh, C. (1988). Arab Women in the Field: Studying Your Own Society (Contemporary Issues in the Middle East)

Future-oriented participatory foresight and drama methods

Foresight methods, such as imaginative perspectives through drama and shared vision building, roadmapping, and possibilities that the innovation ecosystem approach captures within foresight. Futures building is seen here as a learning process that builds on collective and participatory questioning and exploration of alternative futures.

Foresight methods: action-oriented and participatory strategic thinking that focuses on potential and alternative perceptions of the future, and these (e.g. imaginative perspectives) can be developed through drama:

- Qualitative, systematic, participatory, and multi-disciplinary nature, a space for different stakeholders and experts for systemic thinking and developing future-oriented knowledge.
- Futures building as a learning process that builds on collective and participatory questioning and exploration of alternative futures. Innovation ecosystem approaches can be used, such as vision building or roadmapping.
- Creating a shared vision and action paths towards the vision, by exploring different, possible futures of the subject matter collectively.
- Combining different working methods to acquire and process data is possible, these could include office work, workshops, web inquiries etc.

Drama methodologies: action-based, embodied, participatory way to imagine, simulate and design the realities collectively

- Subjective insights, nurturing imagination and creating inspiration, novel knowledge through differentiated, polyphonic discussion/dialogue

Jouko Myllyoja's presentation:
https://www.youtube.com/watch?v=6p2btiKkYP8&list=PLUGM9odWOqO6tuX9lZxcluqzrec4fKV3N&index=4

Recommended reading

- Ahlqvist, T. (2015). Foresight. In: STRADA - Decision-making and support of change in complex systems. Nieminen, M. & Hyytinen, K. (Eds.). VTT TECHNOLOGY 218.
- Hancock, T. & Bezold, C. (1994). 16 Possible futures, preferable futures. Healthcare Forum Journal. 37 (2), 23 - 29.
- Ackroyd, J. (2000). Applied Theatre: Problems and Possibilities. The Applied Theatre Researcher, Number 1, 1443-1726.
- Mackey, S. (2016). Applied theatre and practice as research: polyphonic conversations, Research in Drama Education: The Journal of Applied Theatre and Performance, 21:4, 478-491.
- Preston, S. (2016). Applied Theatre: Facilitation: Pedagogies, Practices, Resilience. Bloomsbury Publishing.

Co-Designing Divergent Futures through Critical Questioning and Practice

The aim is to shift preconceptions around learning and worldmaking by deeply questioning centuries of
enforced believes in a particular idea of progress and its underlying political, social and anthropocentric philosophies, which divorced our imagination from holistic and enduring conceptions.
Makerspaces in this case are incubators of divergent futures, i.e. tech-hubs configured as a popular school of design resolutely open to its environment as whose objective is above all to be a radical device for global critical questioning of modern human societies.

The practice:

- Critique of subtle mechanisms of R&D by which false reality, false freedom, false determination is created.
- Addressing issues of mega-cities, "Colonat" as the possibility of a final form of coloniality.
- The city of tomorrow projected onto the framework of a fractal network of innovation places, each of which would have the vocation to transform its environment (the radius of 1-2 kilometers around).

3 layers:

- HubCité: an experimentation of a modality for the development of technological environments that do not reduce the potential of connection (with nature and with the group).
- Lomé, Togo: people as smart citizens or antibodies to the future problems of the city which, imbued with a sense of digital collectivism, would impose the conditions and the screen of openness, inclusiveness and redistribution of everything.
- WoeLabs: free tool for education, giving the means to residents and the surrounding young populations to develop their own imaginary, share, and be immersed in with open source resources, to the stakes and potentials of technology (IoT, AI, data, blockchain) and addressing urban issues such as waste management, resource availability, mobility, etc.

Sename Koffi Agbodjinou's presentation:
https://www.youtube.com/watch?v=8YrEcf3zY1w&list=PLUGM9odWOqO6tuX9lZxcluqzrec4fKV3N&index=6

3.2

Participatory Practices - Workshop Tools

This part highlights **practical reflexive and critical tools** that have been used in the project in interactive workshops, selected and designed to support the participative process.

Participatory Vision Building Process I - theoretical background

Vision is a carefully formulated and clearly articulated description of a future state of affairs that an individual or group finds desirable. The motivation to formulate visions is that they underpin and promote change (Brien & Meadows 2007). Therefore, visions are usually formulated in participatory processes to create commitment to the desired change towards the vision.

Wiek and Iwaniec (2014) have identified quality criteria for sustainability visions. According to their analysis sustainability visions should be: Visionary, sustainable, systemic, coherent, plausible, tangible, relevant, nuanced, motivational, and shared.

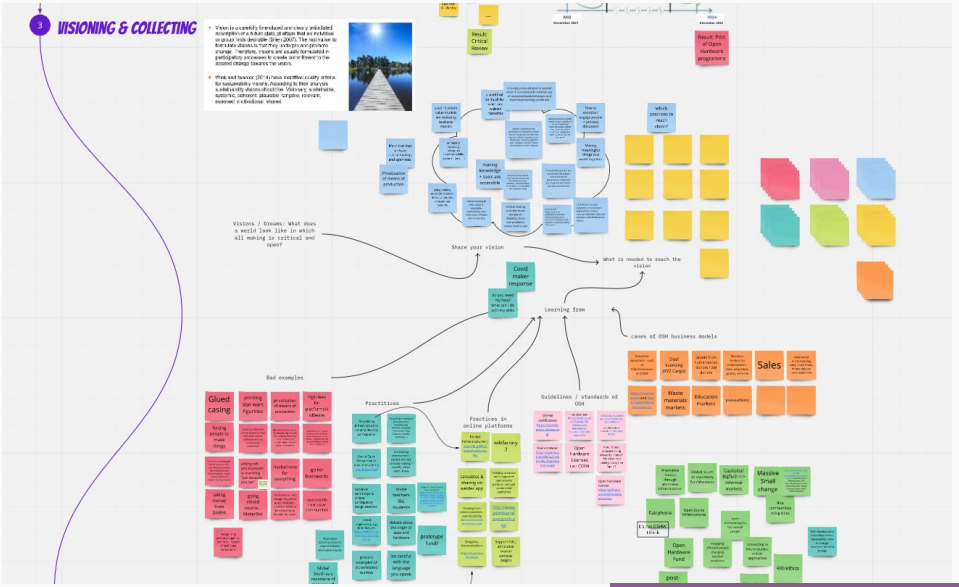
Key aspects

- Visions are typically formulated by participating **different stakeholders**
- Vision building is an equal, **social process** that allows different opinions to be shared
- Vision building is about building **shared understanding** and learning on different topics
- Visions allow **different kind of action paths** towards the desired state of future
- Vision building embeds to an methodological entity, where other kind of methods can also be applied as a part of the larger **knowledge creation** process.

Participatory Vision Building Process II - in practice

“Visions/Dreams: What does a world look like in which all making is critical and open?”

Steps designed for the participants of the Critical Making Interactive Workshop, a collaborative session on WP5 Openness:



Vision

1. Share your vision
2. Learning from:
   a. ...bad examples
   b. ...practices
   c. ...practices in online platforms
   d. ...guidelines/standards of OSH
   e. ...cases of OSH business models
3. What is needed to reach the vision?

Designing a Co-Design Process

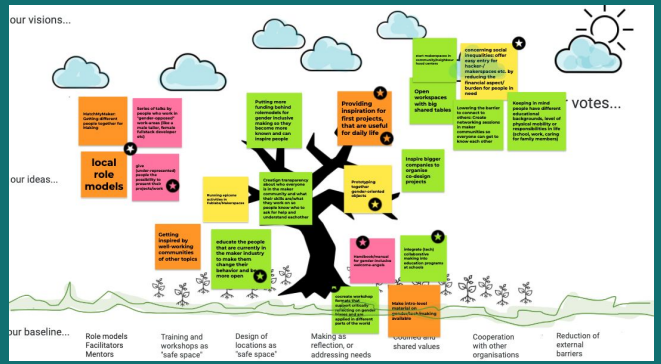
This is a collection of tools and toolkits we would like to recommend. These demonstrate considerations in and the “state-of-the-art” of co-design processes.

Recommended Tools

- “Responsible Design for Digital Communities”: A toolkit that considers digital right questions, demonstrates best practices, workflows and useful tools: https://responsibledesign.tech
- “Participedia”: A global network and crowdsourcing platform for researchers, educators, practitioners, policymakers, activists, and anyone interested in public participation and democratic innovations. They offer a wide range of methods for inclusive co-design: https://participedia.net/search?selectedCategory=method
- “Action Catalogue”: an online decision support tool that is intended to enable researchers, policy-makers and others wanting to conduct inclusive research, to find the method best suited for their specific project needs: http://actioncatalogue.eu/search
- “OpenDot healthcare co-design toolkit”: useful templates for co-design, especially in healthcare, but applicable to various participatory contexts: https://www.careables.org/resource/opendot-healthcare-co-design-toolkit/
- “RRI Toolkit”: various tools built with and for the Community of Practice https://rri-tools.eu/search-engine#keywords=@filterOption=40105@order=@page=1
- “Social Innovation Manual”: for innovators, intermediaries and public/private sector to improve their Social Innovation deisgn skills https://www.silearning.eu/sic-manual-for-si/

Setting up a Co-Design Process

Engage those concerned from the very start to ensure the relevance, applicability and impact of your research (inspired by Zamenopoulos et al. 2018)



Co-Design: the who, how, why?

Who

- Identify & reach out to participants - use networks and communities
- Make sure to also reach marginalised groups
- Reflect on who is included/excluded

Why

- Empowerment & ownership of those involved
- Democratise society & knowledge
- Find meaningful, useful solutions
- To achieve a specific purpose

How

- Invite participants
- Create/use a forum: set up physical or virtual workshops or other spaces, select collaborative methods/tools
- Make sure to only use one platform to not overwhelm the participants
- Which roles will be attributed to participants?
- Think of giving back: What do participants get from their involvement?

Round of introductions in Online Workshop Sessions

Methods to set up an inclusive space in online meetings

Setting up an inclusive space

Who

- Invited participants in an online workshop setting
- Moderator, facilitator, etc

Why

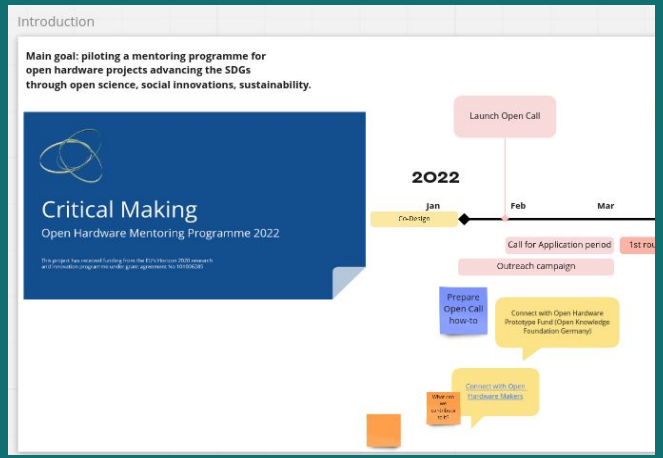
- Getting to know each other, overview of participants, networking
- Warming up: to make everyone speak/interact in the beginning of a workshop to ignite a collaborative spirit and make everyone feel welcome
- Establishing a hierarchy-free atmosphere

How

1. Start with a round of short introduction statements, take notes of each person (up to 15 people, depending on the workshop duration)
2. Participants are asked to share 3 keywords representing themselves
3. People can share answers to prompts in a chat (if time is tight or there is a large group of participants)
4. When possible, cameras should be turned on - at least for this part to improve interaction (but respect any wishes for privacy or weak connection - pictures might be an alternative)

Tools for Online Workshop Sessions

Methods to set up an inclusive space in online meetings



Designing an inclusive space

Who

- Invited participants in an online workshop setting
- Moderator, facilitator, etc

Why

Every participant should be able to:

- contribute
- see other people's contributions
- know where to find the infos
- have access to the materials also after the workshop

How

1. Use an online whiteboard that everyone is invited to edit in
2. Use a collaborative text document if media proficiency might be an issue
3. Have only one space for the meeting

Participatory methods applied in Critical Making

The following **responsible, participatory research methods** that could be applied in researching Critical Making were collected during the Critical Making Consortium's Interactive workshops

Responsible, Participatory Research Methods

Borrowing from **user research** to develop maps, understand the feelings, struggles, desires of other people in a methodological way.

Diaries put the participants in charge and gives them autonomy over what they want to share - and what they do not.

Participatory activities emerging from **applied theatre.** A **specific topic** is defined beforehand, the workshop creates the sense of equalness: no references are made to organizations, no last names are used, the focus is on what the shared aims, commonalities are that unite the participants.

This **equalness** is echoed in terms of gender, race, sexuality, and other categories to allow for **critical reflection based on an awareness of power relations.**

Constellation: people use their own bodies to position themselves in the room around questions and topics to highlight new, previously invisible relations.

Participatory methods applied in Critical Making

The following **recommendations for responsible researchers** were collected during the Critical Making Consortium's Interactive workshops:

Recommendations for Responsible Researchers

01 Regardless of the methods, research should be done in a very **sensitive** and **reflexive** way and allowing for **transformative learning** on both "sides".

02 **Participatory observation**: the researcher defines interview methods with the interviewees, and in general, **projects are co-developed and co-evaluated from the start** so the right methods can be found together.

03 The responsible researcher uses **mirroring** and **active listening** (e.g. sharing interview insights with the interviewees before publishing these), or **spends together time in silence**, to allow for real engagement to happen.

04

Cases and Methods of Critical Making - Tools for Critical Makers

The Critical Makers' Checklist

This questionnaire, designed based on the Responsible Making Principles will be uploaded as an interactive tool for maker communities on Wikifactory:

Is your community making critically?
This checklist helps you think about whether you "check all the boxes":

Is our project local and connected?

- ❑ Does it integrate local knowledge?
- ❑ Does it include the community, or build a network?

Is our project socially responsible?

- ❑ Is it ethical?
- ❑ Does it address social needs?

Is our project reflexive and critical?

- ❑ Is it based on critical thoughts?
- ❑ Does it reflect upon power structures?

Is our project impactful?

- ❑ What types of impacts does my project have?
- ❑ Does it change structures?

Is our process joyful and meaningful?

- ❑ Does the process give makers joy?
- ❑ Does it mean a lot to them?

Critical Making Cases

Best practices (as mapped in the case actions, where applicable at this stage in the project) are highlighted in this section.

The goal is to create brief, succinct snapshots **for projects, co-researchers, and maker communities** to get inspired by these.

A template is proposed below, which will be released under an open creative commons license.

Best Practice Template

Project Name or Code (if anonymised)	
Relevant data: • Location and reach • Year founded • Type of organisation • Website	Short description of practice: • Who is the practitioner, community, who participates? • What does the community do?
How is it critical, reflexive, or responsible?	What participatory (e.g. maker) practices are used?
What key practice makes this project a Critical Making Project?	

Case Analysis

Analysis of role-models in YouTube

Relevant data:

- A research method
- Conducted in 2021 by ZSI (www.zsi.at)
- Described and presented in detail …. (here I would add the Zenodo link, as soon as the document is published)

Short description of practice:

- Female and nonbinary role models are important drivers of a greater gender inclusivity in maker spaces
- This research method investigates in how far female and nonbinary makers in youtube are perceived as role models.
- It is based on the analysis of chat discussions with regard to the 5 most important qualities of role models (Price-Mitchell, 2017)

What key practice makes this a critical making project?
This analysis contains a careful investigation of open comments shared by the YouTube community related to maker videos of female and nonbinary role models. It fosters reflections about the importance of social media in driving gender inclusivity in technology and making. The outcomes show diversified approaches of how role models attract others and share content.

What Maker Practices are used?
The maker practices used by the female and nonbinary role models comprise traditional and digital fabrication technologies for inventing, designing, and making artifacts. All role models are strongly committed to their respective communities by being responsive and engaging. They share learning and their making skills and practices not only on Youtube but also other media channels.

How is it critical, reflexive or responsible?
The online role models drive a critical reflection of gender issues in making, they act in strong communities, are responsive and committed to their communities, drive innovation and learning related to technology, have impact on their followers and show how joyful technology and making can be.

Case Analysis

Analysis of role-models in YouTube

Marilyn Price-Mitchell, **What is a Role Model? Five Qualities that Matter to Youth**, retrieved from https://www.rootsofaction.com/role-model/

Case Analysis

GoSanitize project

Relevant data:
- South-Sudan
- Started in 2020, aims to expand in 2022
- Organised by GoGirlsICT
- More to find under: https://gogirlsict.org/gosanitize/

Short description of practice:
- This practice explores producing hand sanitizers using locally sourced raw materials instead of costintensive imported materials
- It brings together chemistry experts from secondary schools and local female brewers to exchange knowledge and ideas on the production of high quality and affordable hand sanitizers.

What key practice makes this a critical making project?
By working with local female brewers the aim is not only to foster resilient infrastructures and bottom-up innovation, this practice should also trigger critical reflections about women's role in the South Sudan society and strengthen the interest and engagement of young girls in making and biotechnology.

What Maker Practices are used?
In the Gosanitize project hand sanitizers are made from locally available resources such as lemon epicarps, aloe vera and locally brewed alcohol. The project is connected to other initiatives around the world, e.g. Mboalab in Cameroon, to exchange best practices on the local production of hand sanitizers. Lessons learned are documented and shared on global scale.

How is it critical, reflexive or responsible?
This project acts locally and is connected to the worldwide maker community; it fosters local sustainable innovation and production, and by interacting with female brewers and schools in local communities it's stimulates the engagement in biotechnology of women and girls who are amongst the most vulnerable groups in the South Sudan society.

Case Analysis

GoSanitize project

#Gosanitize
Knowledge exchange between secondary school chemistry teachers, local female brewers and GoGirls team

#Gosanitize
A presentation during Gosanitize knowledge exchange event

Pictures retrieved from https://gogirlsict.org

A detailed report to be retrieved under
https://gogirlsict.org/wp-content/uploads/2021/06/GoSanitize.pdf

Case Analysis

Critical Making Workshop MboaLab

Relevant data:

- A 3-days workshop hold in February 2022
- In Yaoundé, Cameroon
- Organised by MboaLab
- A documentation of the practice, its benefits and lessons learned will be shared online.

Short description of practice:

- This workshop aims to get young women from Yaoundé with different socio-economic backgrounds interested and engaged in production and making
- In the three days, women define together what to make, with the aim to develop something that makes their lives easier and supports them in earning money.
- While making, classical gender stereotypes in technology and making are critically questioned.

What key practice makes this a critical making project?
By working with local women the aim is not only to foster bottom-up innovation and sustainable production, this practice should also trigger critical reflections about women's role related to technology in Cameroon and strengthen the interest and engagement of the female participants in making.

What Maker Practices are used?
MboaLab has a strong focus on biotechnology, but the female workshop participants will decide on the first day which traditional and digital fabrication technologies they will use for inventing, designing, and making their artifacts. Design thinking and collaboration will be some transversal skills applied and the lessons learned from the workshop documented and shared on global scale.

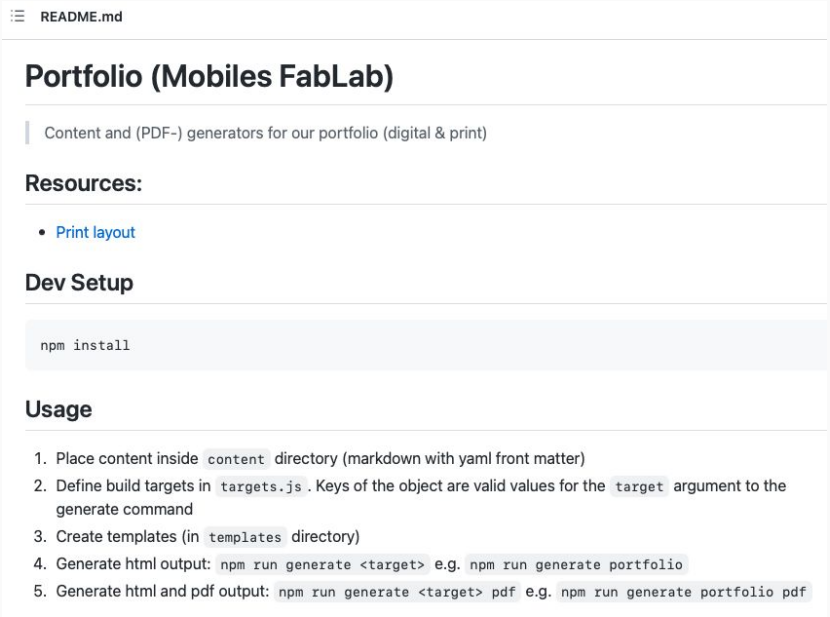
How is it critical, reflexive or responsible?
This project aims to address social concerns of the female participants involved, acts locally and is connected to the worldwide maker community; it fosters local sustainable innovation and production, and stimulates the engagement in technology and making of women and girls.

Educational Portfolio Tool for Makers I

This tool addresses one of the research questions of the Education Work Package:

How to help the many makerspaces offering educational workshops for school children engage with schools…

The Oberlab makerspace community is building a framework which takes markdown files (a digital format that open source community is familiar with):



README.md

Portfolio (Mobiles FabLab)

> Content and (PDF-) generators for our portfolio (digital & print)

Resources:

- Print layout

Dev Setup

```
npm install
```

Usage

1. Place content inside `content` directory (markdown with yaml front matter)
2. Define build targets in `targets.js`. Keys of the object are valid values for the `target` argument to the generate command
3. Create templates (in `templates` directory)
4. Generate html output: `npm run generate <target>` e.g. `npm run generate portfolio`
5. Generate html and pdf output: `npm run generate <target> pdf` e.g. `npm run generate portfolio pdf`

It has a digital version for makers to fill out:

https://github.com/oberlab/portfolio

Educational Portfolio Tool for Makers II

And the second part of one of the research questions of the Education Work Package:

… how can teachers find such offers?

… and the tool converts educational workshop descriptions into a visually appealing and straightforward educational offering portfolio, which can be printed to meet the needs of the teachers:

Example portfolio of a mobile makerspace:
https://alexanderkutschera.com/portfolio-hosted/

Including:

- title of course
- picture
- classes it's suitable for
- curriculum references
- length
- description
- learning goals, etc.

05

Critical Making Responsibility Framework

Critical Making Responsibility Framework

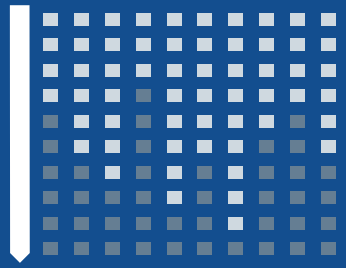
Developed by the Critical Making consortium to analyze responsible innovation processes in grassroots innovation, through a combination of the dimensions of the Grassroots Innovation Movements (GIM) analytical framework and the Responsible Research and Innovation (RRI) procedural responsibility dimensions

GIM

RRI Competence

	Anticipation	Reflexivity	Inclusiveness	Responsiveness
Context	Ability to understand and act upon the ongoing changes in social, historical, political, economic, cultural, religious contexts (trends & weak signals) and other circumstances and what kind of opportunities, restrictions and requirements they may provide in the future.	To become aware of how social, historical, political, economic, cultural and religious contax have affected on ones activities (innovations, projects etc.) and what kinds of contexts their reactions & innovations might create, (eg. vicious circles or hope, and for whom?)	To become aware of exclusive, contextual patterns - to understand that you don't by accident exclude others (like women, elderly, etc) - understanding how exclusion works and supporting people based on the contextual patterns of exclusion	To understand the particular societal needs arising from the context and to respond to them through making & innovations and in addition knowing "how to react and whom to contact to influence the societal rules of the game.
Framings	not applicable	To become aware of how used language and terminology shapes the taken actions and what kinds of values and interests are mobilised, maintained or challenged with the language used. Shared framings can help and hinder dialogues and once that is recognized, something new can be learned.	To reflect upon and become aware of the wordings that are used, or the setup of the space, and whether they create inclusion or exclusion? Does the shared umbrella of interpretation lead to missing any perspectives?	not applicable
Spaces/ Strategies	To become aware of one's own strategies to act, to learn to deliberately build strategies towards desired futures and to be able to anticipate what kinds of futures (and future spaces of action) the applied strategies create.	To become aware of how chosen strategies influence other people or environment - what are the risks and rewards for the surrounding community and environment of the chosen strategies	To become aware of the norms and conventions that "made the space" of making & innovations: if excludes someone, become aware of these norms and conventions, physical structures and language.	To explore how available resources will influence what you do (skills in the team; tools available) and how to act to expand them.
Pathways	To become more aware of what sort of pathways are supported: what future pathways are made while doing concrete projects, and reflect upon the potential plurality of it,to anticipate the impact of the ethical pathways. To recognize the path dependencies, become aware of what one can change with the created pathway and what not.	To become aware of one's own role and the situatedness of the activities carried out: how those impact/influence the environment. By recognizing the various pathways (anticipation), the potential social and ecological impacts can be reflect upon.	To reflect upon whether the developed or imagined pathways maintain existing exclusive structures, do they create new exclusions, new divisions between people? How can they be made more inclusive?	To investigate what kind of support the desired pathways would need in the broader social context (knowledge, funding, policy changes etc.) and/ or whether they may face resistance and to consider how this support can be gained and resistance addressed.

Vertical Axis



4 GIM dimensions

based on Smith et al. 2017

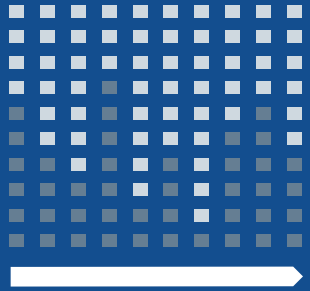
The **context** helps outline the conditions in which the movement is developing. Historical, political, economic, cultural, religious contexts that could be generative or constraining, and other circumstances, issues and situations, including opportunities available within those contexts that had a generative effect on the movement are considered here.

In **framings**, future possibilities are negotiated collectively, including establishment of shared vision(s). Framing is the process of meaning production that helps communities connect to powerful narratives beyond shared grievances which can be expressed in critique towards mainstream practices. Framings are shaped by underlying assumptions, and can include problems, strategies, requirements, theories, knowledge, design criteria, exemplary artefacts, testing procedures and user practices that emerge through social interaction. It can include technological frames (free/open source software, free/open source hardware, peer production, personalized manufacturing, mass customization, the democratizing power of technological citizenship), include or exclude a broader set of framings, such as social, economic, or political questions and can be important factors in designing new practices.

Spaces and strategies crystallize novel strategies and co-operative forms. What actions communities take, and how those actions are influenced by the availability of resources is explored, considering that spaces cannot only be physical, but also social, discursive and institutional (makerspaces are spaces for grassroots digital fabrication, maker movements and grassroots groups, activities include educational outreach, skills provision, etc.). Locations and activities that enable experimentation and innovation are analyzed, actions done by enrolling audiences, alliances and users to improve their own performance (in a user-centered way, creating public engagement) and making alternative spaces of engagement. It is hereby that resources are mobilized while grassroots consider the costs and benefits, risks and rewards of strategies, shaped by conditions attached by resource holders that influence the outcome of activities.

In the **pathways** section, various opportunity pathways are constructed and assessed from multiple perspectives. How does the plurality of pathways contribute to alternative developments over time? Ideas and aims are continuously developed and dismissed; objects and practices and their materiality also contribute to developments in different and changing settings over time, including a future perspective. These alternative pathways and their plurality show that there is not just one self-evidently best pathway, and the political nature of grassroots movements might contribute to new pathways created with greater attention to issues of social inclusion, diversity and difference and social justice, playing a key role in their RRI practices

Horizontal Axis



4 RRI procedural responsibility dimensions

based on Stilgoe et al. 2013

Anticipation refers to systematic thinking which aims to increase resilience of communities and helps to recognize and create opportunities for challenging the existing state of the art with novel social and technical innovations. Anticipation can be fostered with various participatory and deliberative foresight tools including horizon scanning, scenario building and road mapping. The aim is also to make people aware of existing social imaginaries.

Reflexivity refers to deliberate rethinking of how one's activities encounter and reflect the social norms and conventions and potentially challenge or strengthen existing social power relations, division of labor and costs and benefits or whether it causes potential risks for other people or ecological environment. Reflexivity is a process of questioning one's own activities and looking at them from the perspective of other people and natural beings.

Inclusiveness refers to the need to include multiple voices and stakeholders in the innovation and making to bring in legitimacy and to provide an opportunity for stakeholders to express their concerns and opinions about the direction of activities. Several engagement methods to achieve inclusion in research have been introduced including for example citizen juries and panels or more light consultation through surveys and polls. In grassroots innovations the context is different as innovations are driven by citizens. In this case also, there is the need to carefully consider that people with multiple background feel welcome and get their voices heard in making activities and to make sure that also often underrepresented citizens (e.g. elderly people, young people, people with lower socioeconomic status etc.) are invited to participate.

Responsiveness is the ultimate aim of the three previous RRI principles: to increase the capacity of researchers and science and innovation system to be responsive for social challenges related to their research. In institutionalized research this kind of responsiveness is shown for example in the direction of research efforts towards recognized societal challenges. In addition, research actors can actively influence the rules of the game in society by promoting changes in regulation and standards and contributing to ongoing policy debates and programs.

Example questions from the Critical Making cases

Below, example questions from each of the 3 case actions are presented. The aim is to inspire other practitioners to ask further questions.

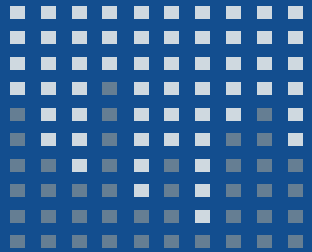
Openness

Gender

Education

In the project, these are used to inspire a self-reflexive process: co-evaluation and facilitation of the self-evaluation for self-reflection at the beginning, mid-term and end of the case action.

Anticipation



Context

Explanation

Anticipation in terms of context is the ability to understand and act upon the ongoing changes in social, historical, political, economic, cultural, religious contexts (including trends & weak signals) and other circumstances.

It also refers to what kind of opportunities, restrictions and requirements these may provide in the future.

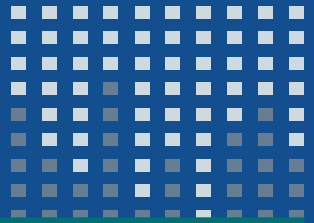
Example

One could explore community-based innovation processes that reflect upcoming societal changes: grassroots innovators being first sensitive to societal change and reacting by kickstarting innovation, because innovative capabilities are based in community.

Viewing trends in making from the industry's point of view, the spread of makerspaces could be a sign of distributed manufacturing becoming more prevalent.

Anticipation

Context



Example questions from the Critical Making cases

Openness

How are different factors that affect the success of open hardware likely to change?

How do our activities potentially change these factors?

How will the future of open hardware to develop (ie. will distributed manufacturing become more common etc.)?

Gender

How do gender inequalities exacerbate in the local specific context?

Which living situations do persons of non-dominant groups face and how do they influence their possibilities to get engaged?

Can Critical Making actions trigger contextual changes, such as political or cultural changes and how would that become instantiated in the future?

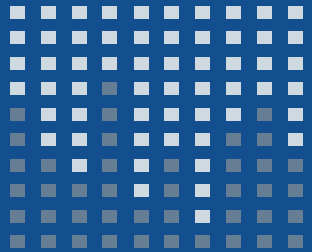
Education

Which societal/ political and cultural factors shape the attractiveness of a critical maker education in schools nowadays and in the future?

How are schools/formal education influenced if schools are left behind in the digitization process, and makerspaces step up?

What will the future of critical maker education look like depending on the funding schools or makerspaces receive?

Reflexivity



Context

Explanation

Reflexivity refers to becoming aware of how social, historical, political, economic, cultural and religious contexts have affected one's activities (including innovations, projects, programs) and what kinds of contexts their reactions and innovations might cause (e.g., vicious circles or hope, and for whom?)

Example

While designing a participatory project, a responsible researcher or maker needs to ensure that visibility does not cause harm to its participants, for example in projects that tackle human rights issues or might generate knowledge uncomfortable for decision makers.

A case of this was the negative, unintended impact in a grassroots innovation project trying to help homeless people by developing water filtration tools, but as newspapers started reporting about them, people in the settlements, who were considered as illegal, got evicted.

Reflexivity

Context

Example questions from the Critical Making cases

Openness

What societal goals do we aim to reach by promoting openness/ how do they relate to surrounding social values atc?

How do these goals impact our approach?

Are there any alternative approaches? Social and societal (context dependent) relevance of produced innovations

Gender

Where is it that gender matters? Where is it that gender does not matter?

How to support situations where gender matters and not to make any differences where it does not matter?

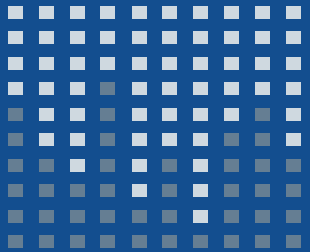
Education

What kind of social values support maker education/ what kind of social values are maintained/ supported by maker education?

When students critique context-relevant issues through making, what comes after the critical thinking process?

Inclusiveness

Context



Explanation

To become aware of exclusive, contextual patterns.

It is necessary to understand these in order to not (even if by “accident”) exclude others. This is especially applicable to women, elderly, and other, traditionally underrepresented groups.

It is crucial to understand how exclusion works and support people based on the contextual patterns of exclusion.

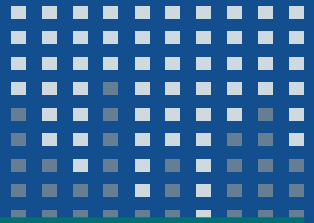
Example

Projects proactively designed to include underrepresented communities and develop frameworks that support their inclusion based on the context.

An example is a capacity building project that develops the self-esteem of minorities and allows them to become part of a "timeshare bank" for participating in incubation programmes, instead of having them pay, thus, building an alternative economy.

Inclusiveness

Context



Example questions from the Critical Making cases

Openness

For whom are our processes and products open? How do we ensure that?

What societal structures are hindering open hardware practices and which structures exclude certain groups from certain activities?

Gender

How inclusive are the gender-related activities?

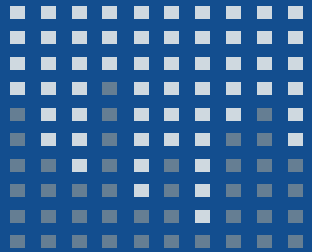
In how far are we exclusive or inclusive? e.g. not only in terms of gender but also in terms of race, disabilities, class or other aspects?

Education

For whom is critical maker education feasible/ open / meaningful?

How do the pedagogical/ organisatory etc. choices impact the inclusiveness of maker education (teachers, facilitators, students)?

Responsiveness



Context

Explanation

To understand the particular societal needs arising from the context and to respond to them through making and other types of innovations.

In addition to this, knowing how to react and whom to contact to address the societal needs and risks related to novel innovations or identified during making.

Example

Responsive makers and grassroots innovators are those who directly address the needs of community.

Responsiveness could also mean having the networks and ability to reach e.g. local politicians to generate influence on higher levels and achieving the goal through policy change or other types of support.

Responsiveness

Context

Example questions from the Critical Making cases

Openness

What can we do to promote openness based on our findings?

How can project activities be adapted to country specific contexts?

Can it encourage participants to adapt their projects to better address local conditions?

Gender

What are the societal needs that gender inclusive making activities address? Who are key actors to address these needs?

What are contextual changes that might affect the gender-inclusiveness in making with critical making activities?

What could that be and how could that be addressed?

Education

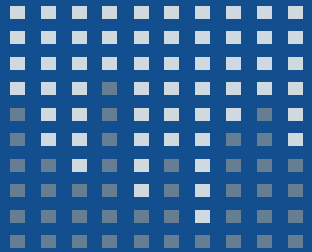
What societal / future workforce needs does critical making education address?

What kind of socio-political changes does teacher training in critical making require?

What socio-political changes does the cooperation between schools and maker spaces require?

What can be done to promote these changes?

Anticipation



Framings

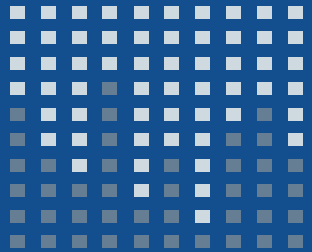
Explanation

Not applicable.

Anticipation relates to forward-looking activities and deliberate actions aiming to affect future pathways whereas framing as an academic term refers to existing shared meanings and cultural structures that shape these meanings. A small group of actors often only has an impact on broader cultural discourses and assumptions once the community has grown into a movement. In addition, it is also difficult to anticipate the changes in these structures within which they need to carry out their work.

Although originally deemed “not applicable”, the gender case action team proposed the following questions in this category: How might existing values of gender inclusive making change and evolve? Which social, economic and technical concerns might come into play here in future?

Reflexivity



Framings

Explanation

To become aware of how the language and terminology used shapes the actions taken, and what kinds of values and interests are mobilized, maintained or challenged with the language used.

Shared framings can help and hinder dialogues. Once this is recognized, a learning process can begin and change might occur.

Example

Reflecting upon the framings we work with might reveal how different people understand the terms free, open source, open innovation and how different community members' experiences might clash in these wordings.

Framings of different concepts, e.g. nationalist, leftist or capitalist framings of social innovation are influenced by the country where it takes place and its history.

Framings of beneficiaries in fundraising processes: they are often described as passive, "in need of help", downplaying their abilities to contrast with the abilities of those who will be funded to deliver that necessary help.

Example questions from the Critical Making cases

Openness

How do we talk about openness? What kind of understanding of the means and goals of openness does it maintain and constitute?

Reflecting on the language used and narratives told around subjects of openness, are they supporting open hardware practices?

Gender

What are key issues when it comes to communicating gender inclusive making and speak in a gender inclusive manner?

What may be changes in the terminology used?
Which terms are used to refer to members, communities? Are these terms (perceived) gender-neutral? How do community members call themselves?

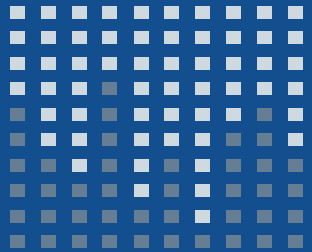
Education

How is making and maker training introduced to teachers and students, and by whom?

What kind of language is used, what kind of assumptions of the skills, orientation etc. of participants do these visual, technical and linguistic choices imply?

Inclusiveness

Framings



Explanation

To reflect upon and become aware of the wordings that are used in verbal or written communication, or the setup of the space one creates for the community. Does a specific set-up lead to inclusion or exclusion? Does the shared umbrella of interpretation within the existing community lead to missing any perspectives?

Example

Creating shared interpretations is necessarily a collective, discussion-based process. When a member of the community argues for a particular idea, other perspectives are automatically downplayed. This collective production of ideas and meanings creates bonds but might also exclude others. Does the term "maker" exclude "makeuses" and vice versa?

Inclusiveness

Framings

Example questions from the Critical Making cases

Openness

How do we talk about openness, does it exclude some groups of people?

How can a reflection upon the narratives around open hardware and making take place, e.g. by screening them for exclusiveness?

Gender

Who is invited to the place?

Who is visible in the place?

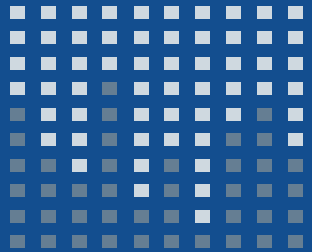
Which communication culture is in place?

Education

What skills, background, resources etc. are expected from the participants of training course?

How to support the inclusiveness during training (language, material support, topics of workshops etc.)?

Responsiveness



Framings

Explanation

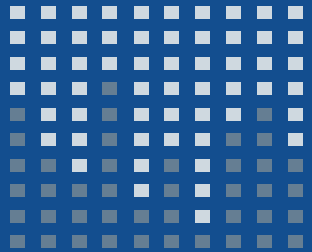
Not applicable.

Similarly to the Anticipation x Framings, we find that the intersection of Framings x Responsiveness is not an applicable category.

The reason is that framings cannot be influenced through policies, standards and public action but are rather changed slowly over time, through collective reflection.

Anticipation

Spaces/
Strategies



Explanation

To become aware of one's own strategies to act, to learn to deliberately build strategies towards desired futures and to be able to anticipate what kinds of futures (and future spaces of action) the applied strategies create.

Example

Strategies are always forward-looking in themselves, with an explicitly or automatically embedded idea of which directions to take and why. By asking the participants what their goal is for the next years, or what kind of world do they want to see then and how does their project help them reach this, such strategies of anticipation can be mapped.

Example questions from the Critical Making cases

Openness

How is the financial viability of open hardware projects created (financial sustainability; e.g. fitting social / alternative business models)?

How are the ecological and social sustainability of produced innovations considered?

Gender

How do actions in makerspaces affect existing gender inequalities? Are they potentially reinforced or counteracted?

How are intersecting inequalities considered?

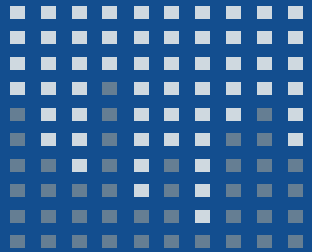
Education

How does the introduction of critical maker activities in schools trigger changes in the curriculum?

What resources will be needed for implementing critical making in school curriculums and set-up (e.g. teacher training, material costs, equipment, etc.)?

Reflexivity

Spaces/
Strategies



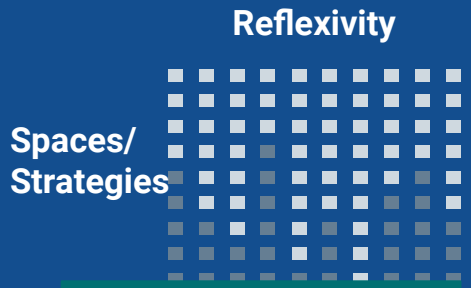
Explanation

To become aware of how chosen spaces and strategies influence other people, including what the risks and rewards for the surrounding community and environment of the chosen strategies are. After deliberating the strategy itself (as it might be something that was not consciously planned), one might ask themselves: What are then the “side effects” of the strategies communities have chosen?

Example

By saying no to taking money from a big company, an already underfunded community remains low on financial resources, however, their practice stays uninfluenced. Instead, they decide to use limited but non-attached resources to avoid outside powers impact their values and practices in ways they deem as negative.

Another example is when a community receives particular machines free of charge. If this is a 3D printer, they might move away from paper prototyping and create more plastic waste than previously in the process, which becomes an unintended impact caused by the resources they have.



Example questions from the Critical Making cases

Openness

How do the spaces used and activities arranged support or hinder open hardware practices?

What degrees of openness can be measured in the produced hardware designs?

Gender

How do strategies/new design of spaces influence others? Is there an exchange with other communities? Are there consequences (intended and unintended)?

Do make spaces have gender-segregated places? (e.g. sewing corner vs. CNC mill or not-unisex toilets). How does this gender segregation exacerbate and is it possible to change spatial features to make the space more inclusive and prevent segregation without hindering from the creation of safe spaces?

Education

Critical making in schools (formal setting): how does that challenge teachers?

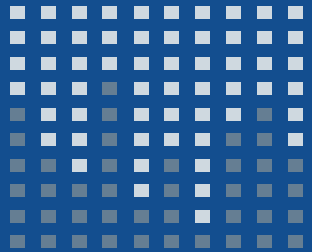
Can/should external people be allowed to teach critical making?

Critical making in informal settings: do we exclude young people if we offer critical making outside formal education (extra-curricular) as only the already interested appear?

How much value do we give the “criticality” in critical making?

Inclusiveness

Spaces/
Strategies



Explanation

To become aware of the norms and conventions that "made the space" in terms of making or grassroots innovations. What has contributed to it including particular people, and if someone is excluded, there is a need to become aware of those norms and conventions, physical structures and language that contributed to the exclusion. There is a need to become aware of what capabilities and skills are expected from people to be allowed to participate.

Example

In addition to physical inclusiveness (accessibility or safety of space, tools, website), cultural, and other influences might also play a role. In some countries, cultural issues might play a role, such as it being inappropriate for women to leave their homes in the evening. This has led to only men meeting in the spaces created for the whole community in a project. The issue was reflected upon, and additional activities were planned from then on during the daytime hours.

Inclusiveness

Spaces/
Strategies

Example questions from the Critical Making cases

Openness

How to make sure that spaces, tools, websites etc. are accessible for a diverse target group?

Which capabilities are needed to allow participation in the critical making activities?

Gender

Which strategies do makerspaces have in place to reach new and marginalised target groups?

What might be particular barriers (also physical ones) for marginalised groups?

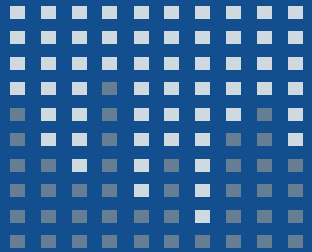
Education

How inclusive are informal critical making offers? Does it engage beyond the “interested crowd”?

What are strategies to reach marginalised groups?

What might be particular barriers (e.g. time, and also physical ones) for marginalised groups?

Responsiveness



Spaces/
Strategies

Explanation

To explore how available resources will influence what you do and if the resources or chosen strategies limit the scope of social goals you address? How to act to expand the resources and whom to engage in commenting and reflecting the chosen strategies?

Example

It might be explored what skills are available within the team and which tools they have access to. Was there a case when they wanted to do something but their skills, tools, space, resources didn't let them, so they pivoted and did it differently? Did this modification still develop a suitable solution? How was this possible?

Responsiveness

Spaces/
Strategies

Example questions from the Critical Making cases

Openness

How can critical making projects work around any resource scarcity issues - especially considering the physical tools and resources available to remote mentoring program participants?

Gender

How can available resources (guidelines, training etc.) be adapted from time to time?

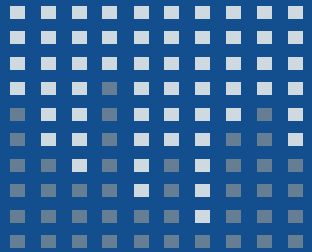
Who does the adaptation and why?

Education

How can available resources (guidelines, trainings etc.) be adapted to the local settings, in terms of availability and local contexts? Who does that adaptation and why?

How important is teacher training for adaption and responsive use of critical making resources?

Anticipation



Pathways

Explanation

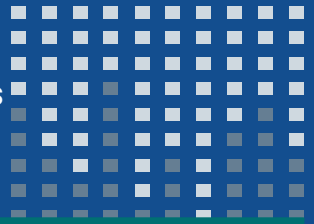
To become more aware of what sort of pathways are supported. What future pathways are consciously or subconsciously made while doing concrete projects? These need to be reflected upon, including their potential plurality to anticipate the impact of the ethical pathways. The goal is to recognize the path dependencies, become aware of what one can change with the created pathway and what not, for example through envisioning: what is the future the project is aiming at, and what are the different pathways to get there?

Example

Acknowledging that prerequisites need to be achieved before efficient change is done is crucial. While change might be blocked by existing structures, but with long-term planning of a pathway, one can have an impact. An example of such long-term planning of hidden agendas includes community network projects that at first glance are about physical infrastructures, however, their ultimate goal is empowering and protection of the rights of indigenous communities.

Anticipation

Pathways



Example questions from the Critical Making cases

Openness

How can the shift towards open source hardware production be supported - e.g. through reflecting upon the pathways supported in the project's open hardware mentoring program?

Gender

How does the action that you implement in the Critical Making context offer new opportunities and unforeseen alternatives for gender inclusion in making?

Will approaches be able to scale out?

Education

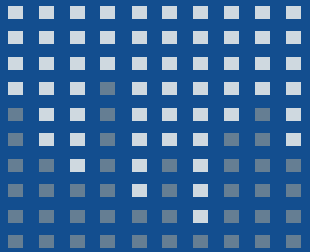
How are critical making results dealt with in educational settings?

Is there a need for specific rules, guidelines, process to allow for real take-up of critical making practices and not just see it as an exercise?

How to deal with expectations management?

Reflexivity

Pathways



Explanation

To become aware of one's own role and the situatedness of the activities carried out, including how those impact/influence the environment.

By recognizing the various pathways (anticipation), the potential social and ecological impacts can be reflected upon.

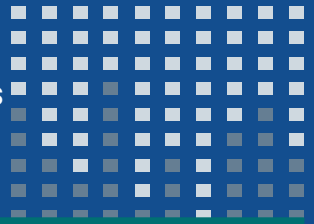
Example

If a maker community decides to opt for distributed manufacturing, they ought to recognize their own role in making various pathways happen.

These pathways can be based on business and start-up culture, or can be more environmentally or socially just, representing changes the maker movement significantly contributed/can significantly contribute to.

Reflexivity

Pathways



Example questions from the Critical Making cases

Openness

How could the project be arranged in a way that recognizes and supports pathways towards more open maker practices?

How can it support reflection upon the sustainability of the actions supported (e.g. making sure not to encourage the culture of excessive 3D printing)?

Gender

[Potentially for participants from marginalised groups]

What has helped me?

How did I start to get engaged in the first place?

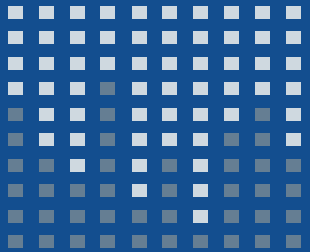
Education

How do you make sure that you stress the “critical” aspects of critical making while not taking out the fun?

For example not making things just for the sake of making things, but stressing the fact of environmental impact and unfair mining practices?

Inclusiveness

Pathways



Explanation

To reflect upon whether the developed or imagined pathways maintain existing exclusive structures, do they create new exclusions, new divisions between people? How can they be made more inclusive?

Example

The long-term work of a social innovator and activist lobbying for internet laws to be more open in the late 1990's to turn his country into a knowledge-based society combined with the completely separate work of another social innovator bringing micro-hydro plants for sustainable electricity to remote areas combined enable remote communities today to have their own community-maintained electricity and internet without being hindered to do so by the market or complicated laws.

Example questions from the Critical Making cases

Openness

Which processes of promoting openness might exclude people, e.g. if open means a lack of financial sustainability, who can contribute to an open hardware project?

How can such concerns be addressed and inclusive pathways promoted?

Gender

Is gender-inclusive making driven top-down (from make space organisers) or bottom-up (from individual members)?

Which measures are in place to institutionalise inclusiveness?

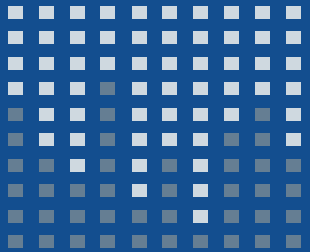
Education

Are measures in place to institutionalise inclusiveness or does it rather depend from individual engagement of specific group members?

Are there specific activities that address young people with specific needs and include them?

Responsiveness

Pathways



Explanation

To investigate which societal actors and resources need to be engaged to support the realization of desired future pathways and whether there is a need of policy or regulatory changes.

Example

For open hardware in healthcare, a project has explored pathways which, depending on the cultural context, needed legal changes, e.g. in the medical device legislation, to be adapted in order to become available. Makers might strategically engage with academia to receive new ideas, collaborate in projects, or gain visibility through scientific articles, leading to more impact to change future pathways. Some engage with governments on different levels, or the UN, not only to receive funding, but also to influence e.g. the political support of creative economy, shaping a desired future pathway.

Responsiveness

Pathways

Example questions from the Critical Making cases

Openness

How can policies be designed, and policy-makers engaged so that the importance of open source is recognized and more support / incentives are created, as opposed to closed source and IP rights?

Gender

How can gender-inclusive critical making practices scale out?

Which mechanisms can be established to reflect and review gender-inclusive measures from time to time?

Education

How to move from making to critical making in education?

How to convince educational policy makers that critical making offers important skills and competencies, but needs to be further supported and widely implemented?

06

Outlook

Next steps for the individual tools

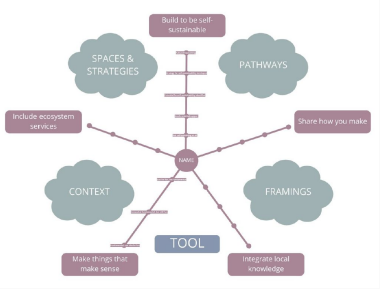
- the tools are being iteratively developed together with the practitioners in the cases
- “best practice” cases will be extended with hands-on examples of workshops, which can be reproduced by critical makers
- on the next slides, other potential tools are shared which are being developed

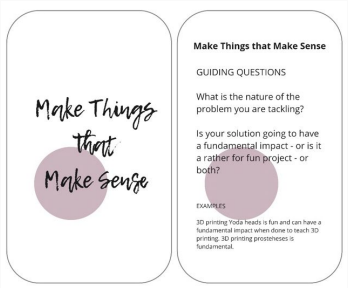
Critical Making Reflection Tool

This interactive and gamified tool is based on the Sustainable Making Principles, which was originally co-created by a community of makers.

It consists of 2 parts: the **Critical Making Slider Tool** and the **Critical Making Guiding Cards**, which are meant to be used by reflexive makers to generate discussions.

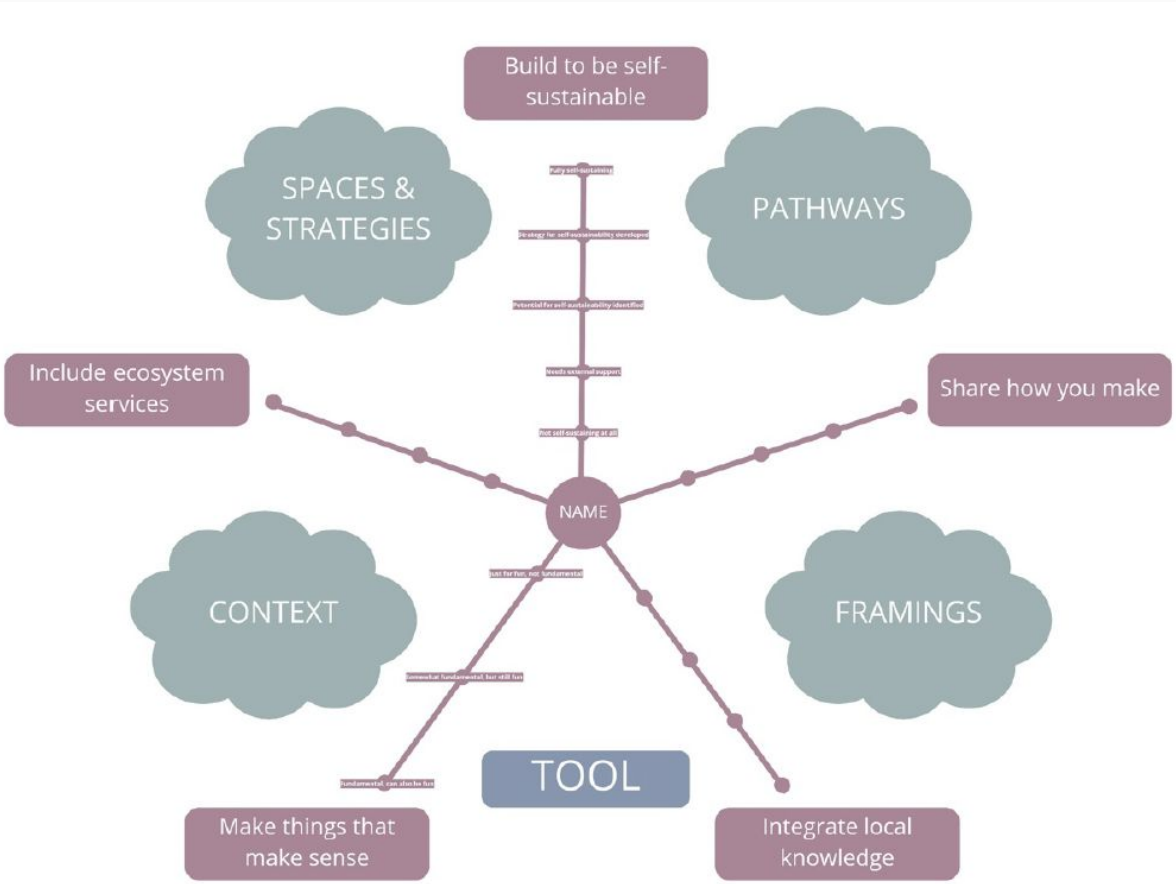
The tool is “work in progress” - it was tested in an internal workshop with the Education Case Action and will be further developed with practitioners.





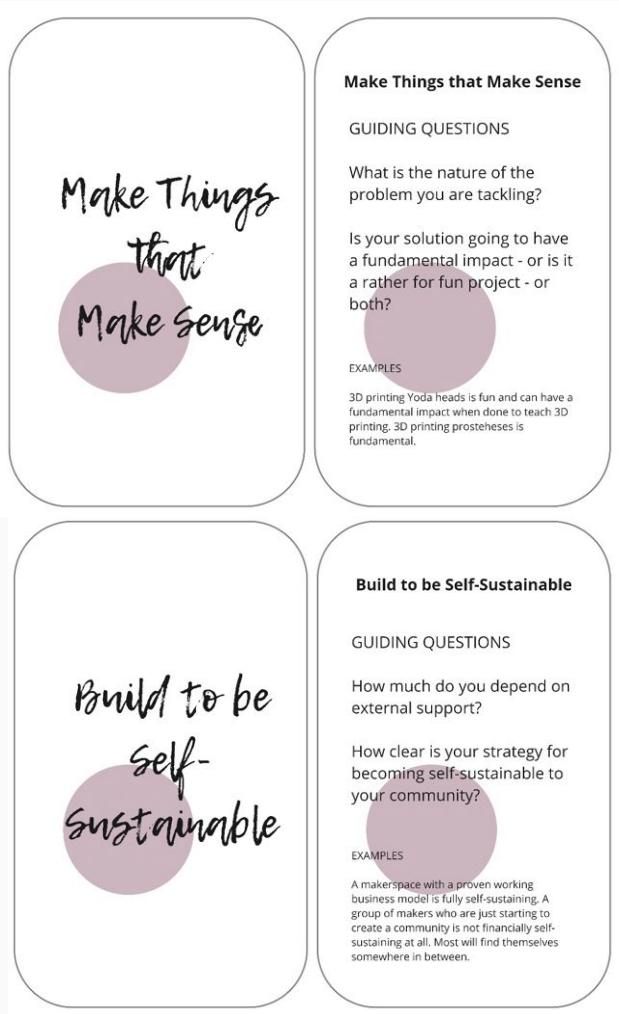
Critical Making Slider Tool

A tool for self-reflection: the maker community itself is prompted to decide how they deliver on each branch of the scale. Some principles might not apply to them, but the ultimate goal is reflection about which aspects of their practice they want to improve:



Critical Making Guiding Cards

The reflexive discussion is supported by guiding cards, which contain questions and examples designed to prompt the discussion. The front of the cards contains the overarching topic, the back details guiding questions and a hands-on example:



SDG Evaluation Tool

Practitioners wished for an SDG evaluation tool that helps to evaluate one's own project according to the SDGs

Next steps

- facilitate workshop for needs assessment and sharing what different grassroots innovators are currently using for this purpose
- research available solutions
- create blogpost, tool or webinar

Useful Tools Template

Existing tools developed by other projects found in the future could be added in this template

Name of tool

Picture

Who is it for?

What does it do?

When to use it?

How does it support the process of making critically?

URL

Next steps towards finalizing the toolkit

- creating a uniform design with a designer
- the toolkit might be published as a zine (http://www.conceptlab.com/criticalmaking/), where one side will be reserved for makers, and turned around, the other side contains tools for researchers
- when printed (on demand), it could include stickers and a manifesto poster
- other “alternative publishing methods” are being considered

Timeline

Collection of Tools and Cases

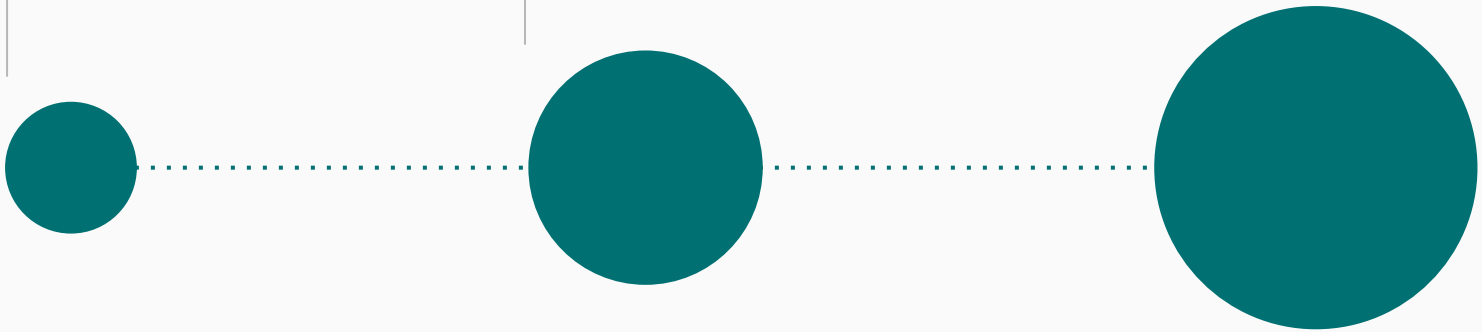
January 2021- December 2021

“Translation” into Templates and Website

July 2021 – December 2021

Open Call and Iterations

January 2022 – June 2023



Resources

Brien F. O. & Meadows M. (2007). Developing a visioning methodology: Visioning Choices for the future of operational research. Journal of the Operational Research Society, 58, 557 - 575.

Ratto, Matt (2011): Critical Making: Conceptual and Material Studies in Technology and Social Life, The Information Society: An International Journal, 27:4, 252-260

Smith, Adrian, Juan Mariano Fressoli, Dinesh Abrol, Elisa Arond, and Adrian Ely (2016): Grassroots Innovation Movements. Routledge, Earthscan.

Stilgoe, Jack, Owen, Richard and Macnaghten, Phil (2013): Developing a Framework for Responsible Innovation. Research Policy 42 (9): 1568–80.

Wiek A. & Iwaniec D. (2014) Quality criteria for visions and visioning in sustainability science. Sustainability Science 9:497–512.

Zamenopoulos, Theodore and Alexiou, Katerina (2018). Co-design As Collaborative Research. Connected Communities Foundation Series. Bristol: Bristol University/AHRC Connected Communities Programme.