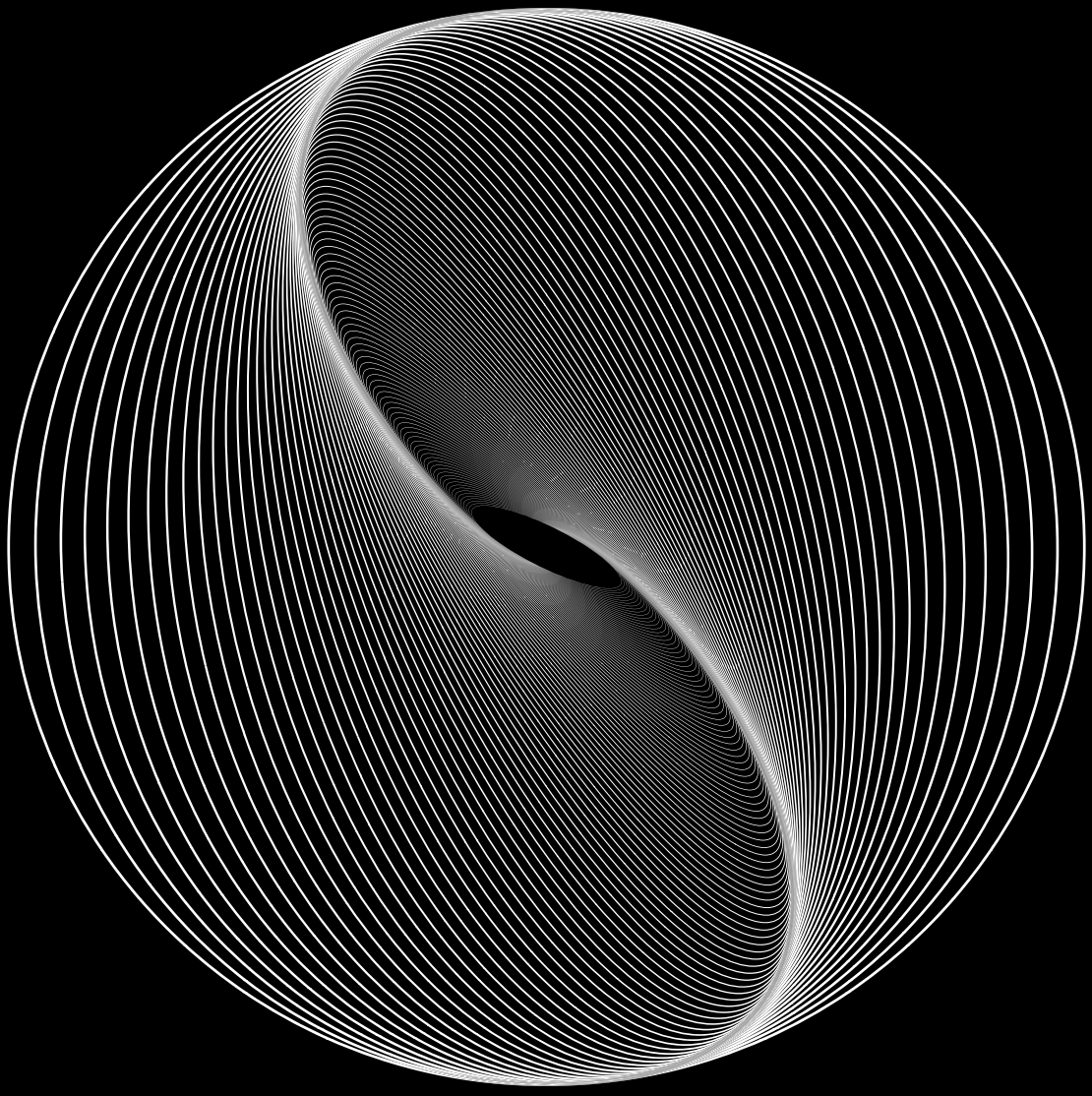
COLLABORATION TOOLKIT

S+T+ARTS

SCIENCE + TECHNOLOGY + ARTS



European Commission

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S+T+ARTS

SCIENCE + TECHNOLOGY + ARTS

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TABLE OF CONTENTS

INTRODUCTION

"We must foster cooperation between the arts and industrial innovation" – Alexander Mankowsky [1]

This toolkit has been developed as a practical resource to support artists, researchers, technology experts, and companies in finding a common ground and language, identifying goals and objectives, offering guidance to plan and execute a collaborative project with the aim to maximise the impact of the outcomes.

Expressing the wish to collaborate with artists is one thing, but actually building a successful cross disciplinary collaboration is something completely different. It takes good preparation, clear objectives, willing participants and a suitable methodology to get off to a good start.

The toolkit focusses primarily on helping artists in how and when to approach researchers or companies to collaborate, based on their artistic interest. In defining the ground for collaboration, it focusses on delivering a sustainable return for both: be it in strengthening the opportunities for innovation or as a source of inspiration and insight while offering the artist the possibility to deepen or extend their artistic practice.

It combines experiences from the EU STARTS initiative, its predecessor's ICT&ART; FET-ART & ICT ART CONNECT, insights from other collaborative practices and is supported by a wide variety of literature to help potential collaborators on this journey. Since this toolkit combines sources from different domains it makes uses of two reference types: numbers refer to the reference list and letters refer to the glossary to explain the context of specific words. Good luck and remember:

"The hardest part of creating is not having an idea but saving it."
– Kevin Ashton[2]

1 Alexander Mankowsky, Human Agency in the Robotic Age, 2018

2 Ashton, Kevin; How to Fly a Horse, 2015

ABOUT SCIENCE, TECHNOLOGY, AND THE ARTS (S+T+ARTS)

"It was artists who envisioned and produced photographic technologies. It was artists who first foresaw a world in which individuals might fly. And it will be artists who continue to shatter the perceived limitations of our own intellectual frameworks" – Rebecca Solnit[3]

More and more (high-tech) companies throughout the world assert that, in addition to scientific and technological skills, one of the critical skills needed for innovation to happen, and to be of value for society, is creativity. Since creativity is rooted in artistic practices, the expertise and practice of artists can directly drive and influence innovation in technology. They offer alternative perspectives, inspire surprising directions, and can act as catalysts for a successful and socially responsible transformation of technologies into products and new social, ecological and economic models. In recognition of this, the European Commission launched the STARTS Initiative - Innovation at the nexus of Science, Technology, and the Arts, in 2015. The main goal of the STARTS initiative is the inclusion of artists in innovation projects.

STARTS projects integrate artistic players in non-artistic domains and put an emphasis on the added value and unexpected results these interdisciplinary encounters can have for both the artists and collaborators involved.

To encourage collaboration of engineers, scientists and artists, STARTS has developed and funded different pillars, representing all the dimensions STARTS works with:

STARTS PRIZE

8 GRAND PRIZES, 38 HONORARY MENTIONS, 72 NOMINATIONS

The annual STARTS Prize, since 2016, gives visibility to collaborations between artists and industry for new pathways to innovation, and artistic exploration of technology altering the use, deployment and perception of technology. | Projects implemented under this Pillar: STARTS PRIZE (2016 – present).

STARTS RESIDENCIES

45 ARTIST RESIDENCIES AT TECHNOLOGY INSTITUTIONS

The STARTS Residencies finance long-term cooperation periods between science or technology projects and artistic proposals, contributing to jumpstart collaborations between artists and technologists as part of interesting use-cases. | Projects

3 Solnit, Rebecca; A Field Guide to Getting Lost, 2006

implemented under this Pillar: VERTIGO (2016 – 2020).

STARTS LIGHTHOUSES

+ 80 INNOVATIVE COLLABORATIONS FUNDED

The STARTS Lighthouses support research seeking radically novel solutions and concrete results to major challenges for industry and society in close collaboration with artists as active members of the project teams. | Projects implemented under this Pillar: WEAR Sustain (2017-2019), RE-FREAM (2018-2021) and Mind Spaces (2019-2021).

STARTS ACADEMIES

+ 1000 PARTICIPANTS

The STARTS Academies strive to bridge the gap between art and technology at all levels of education. They unite technologists and artists to teach digital skills to kids and young adults in a playful way that also helps to raise awareness of the opportunities, limits and potential pitfalls harboured by technology.

REGIONAL CENTERS

+ 200 NETWORKING EVENTS AND ACTIVITIES

The Regional STARTS Centers intend to expand the S+T+ARTS initiative on a local level towards European regions. They work at developing a network of players interested in creating local centres in the spirit of S+T+ARTS and public activities that strengthen collaborative practices between the fields of art, industry, business, and research.

OVERVIEW OF STARTS METHODOLOGIES

WEAR SUSTAIN (2016 – 2018)	Duration of residencies | 6-8 months
Selection process	46 teams of artists and technologists through two calls were selected through a rigorous selection matrix, and then an external selection committee made the final decision after online presentations and interviews. Teams worked on their prototype/ solution / innovation to develop it sustainably and ethically further along TRL and/or further towards marketability.
Monitoring	Consortium partners and carefully matched mentors and hubs supported teams throughout each project term. Mentors and hubs were matched to the teams depending on the needs of each team (Legal/IP/ Marketing/Design etc.). Teams provided monthly update reports as well as mid-term and end of term reports. Mentors also produced reports. The external monitoring committee assessed teams mid-term and end of term using the reports and online demonstrations / presentations and interviews. Teams were categorised depending on how they performed against the criteria into Red (fail), Orange (needs improvement) and Green (Pass, an exemplary project) at both mid and end of term. If a team was orange at the end of term they were required to make improvements before receiving the final project money. If a team was Red at the end of the term they did not receive the final money or any further support.
Results	**Were presented at mid-term and end of team, through public and private reports, public videos, exhibitions and symposia and other events.**

VERTIGO - STARTS RESIDENCIES (2016 – 2020)	Duration of residencies | short-term (3 – 6 months) and long-term (9 – 12 months
Selection process	Yearly short term 2-steps call 6-9 months before the residency. First ICT companies and research centres are selected through a call for "Tech Projects". Once selected, they call artists to integrate an artistic view in the application of their prototype / solution. Than an external international jury made the final decision. The Project awarded 45 residencies through 3 calls.
Monitoring	Consortium partners accompany teams at starting point, mid-term and closure, regarding the contractual and administrative questions. They follow-up the work plan established and collect feedbacks from the residencies regarding their collaboration and the programme.
Results	**are presented at presented mid- term and closure and post-residency, through public and private reports, public videos, symposia, exhibitions and presentation at events.**

RE-FREAM (2019 – 2021)	Duration of residencies	9 months (minimum 30% presence time at the hub)
Selection process	Online application of artistic approach to 3 challenges.	
Monitoring	Facilitation during all steps of the collaboration.	
Results	**are presented mid- term and closure and post-residency through exhibitions and presentation at events, public videos, private and public reports and promotion via social media channels.**	

MindSpaces (2019 – 2021)	Duration of residencies	First round of open call (18 months), second round of open call (12 months)
Selection process	MindSpaces launched the open call. Artists were invited to propose an original artwork based on MindSpaces platform and technologies. Applications were cross-read by an internal jury made up of 4 consortium members. Following cross-reading, applications were ranked by overall score and the top ten were shared with external jurors engaged for their expertise in the arts.	
Monitoring	At the beginning, a consortium partner (MU) monitors the contractual and administrative questions. Consortium partners collaborate with artists throughout their residency. MU follows-up the work plan established and gets feedback from the residencies regarding their collaboration. CERTH as a coordinator of the project supervises the whole procedure.	
Results	**are presented at mid-term review and closure, through private and public reports, public videos, symposia, exhibitions and presentations at events.**	

OVERVIEW OF THE TOOLKIT

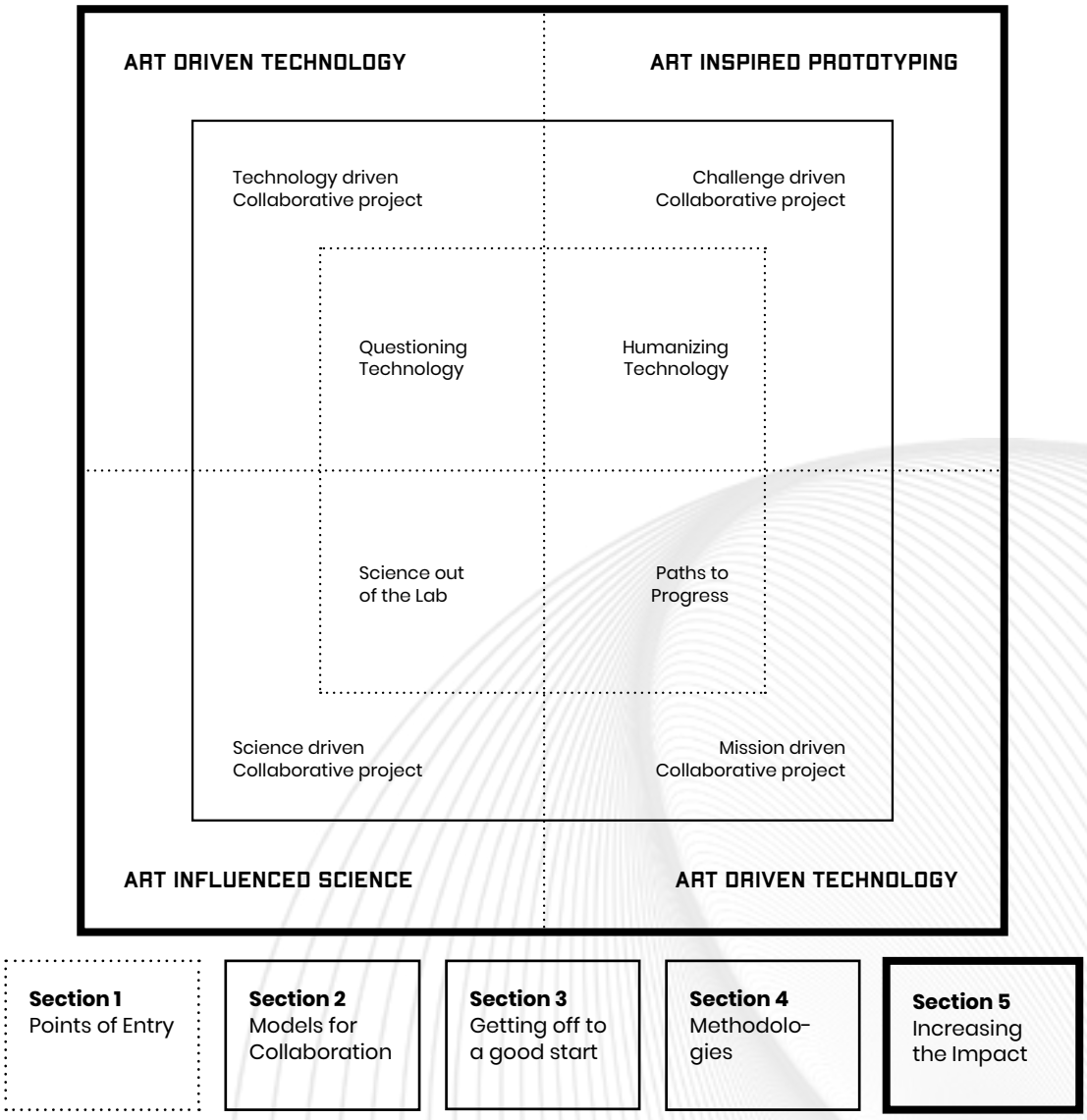


FIGURE 1: Overview of the collaboration toolkit.

Section 1

POINTS OF ENTRY

In her keynote delivered in the Art-Science Resiencies symposium organised at the end of the VERTIGO/STARTS Residencies project, Ariane Berthoin-Antal[4] addressed the potential of artistic interventions in organisations (from different sectors – arts, health, research, etc. –, types and sizes), and pointed out what would be the significance of artists' interventions in science.

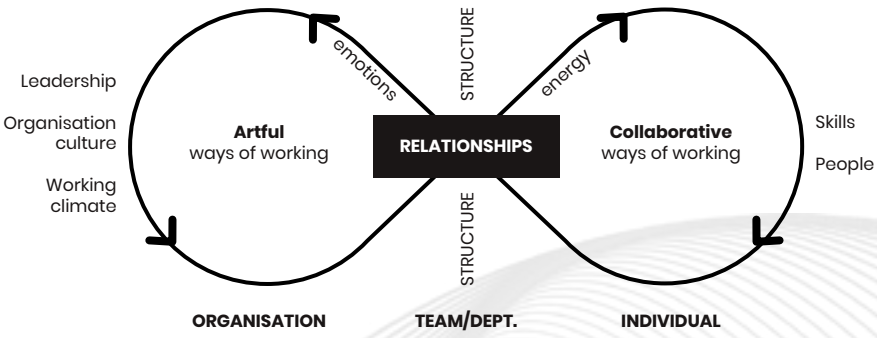


FIGURE 2: Outcomes of artistic interventions in organisations, by Ariane Berthoin-Antal.

Collaborative practices between science, technology and art/design are interdisciplinary, aimed at exploring and pushing the boundaries of the possible. By merging different perspectives, knowledge and expertise, the points of entry for collaborations are about the questions, shared values and the intended outcomes which underlie the collaboration.

When scientists, technologists work together with artists and designers, they need to find a common language to succeed. Artists don't necessarily need to bring with them technical skills, and scientists and technologists do not necessarily have to bring with them an interest in the arts. However, in order to make the collaboration meaningful, both need to be curious and open to finding a common ground on which the project can be developed.

In the publication *Creating Artscience Collaboration*, Claudia Schnugg discusses the importance of contextualisation and how the artist at the start of a collaboration can help to create a narrative (through a story, an artwork, etc.) to help the scientists and technologists to understand the context of the work and visualise the possible benefits and outcomes. According to Schnugg: "Contextualization can help to understand the questions scientific and technological work implies; it can point to both opportunities and downsides. These opportunities and downsides only become tangible when the newest research outcome

4 Ariane Berthoin-Antal, Unleashing the radical potential of artistic interventions residencies, keynote presentation at the Art-Science Residencies symposium held at IRCAM Centre Pompidou on 2-3 March 20202, in the framework of STARTS Residencies Days. From https://youtu.be/HWyN6lW95bg, last visited 24 June 2020

is applied in real-life situations. Artists can ask these questions and invent scenarios—utopian, dystopian, and neutral ones—based on the information about scientific work and cutting-edge technologies. Thus, contextualization and implications of this work can be discussed before they become reality."[5]

To develop a shared understanding, it helps to make explicit the kind of collaboration the both are looking for by making interest(s) explicit. Four categories of artistic interest could help:

QUESTIONING TECHNOLOGY An interest in exposing what goes on inside technology, who has access to it, and which intentions it serves	**HUMANIZING TECHNOLOGY** An interest in contributing to the reinvention of technology or the use thereof under an ethical paradigm of fairness
TAKING SCIENCE OUT OF THE LAB An interest in transmitting scientific information to inform the populace or to advance science by bringing research to the scale of human senses or experiences	**EXPLORE NEW PATHS TO PROGRESS** An interest in investigating speculative or hypothetical future scenarios for progress to explore new paths to battle societal and technological grand challenges

FIGURE 3: Artistic interests – points of entry, by In4Art.

QUESTIONING TECHNOLOGY

Are you interested in addressing the growing set of concerns about what goes on inside technology, who has access to it, and which intentions it serves?

Then your goal would be to set up a technology driven collaborative project aimed at analysing, diagnosing and highlighting (overlooked) issues.

Technology driven collaborative projects

The aim of responsible innovation[A] is to connect the practice of research and innovation in the present to the futures that it promises and helps bring about.[6] Technology driven collaborative projects in this context of bring together art and technology to search side-effects of technological innovation and treat them as problems to solve.

Project Alias is an example of a technology driven collaborative project supported by STARTS as the winner of the STARTS Grand Prize for Artistic Exploration 2019 and is presented as Case Study 1 at the end of this toolkit (page 34).

EXPLORING NEW PATHS TO PROGRESS

Are you interested in investigating speculative or hypothetical future scenarios for progress?

5 Schnugg, Claudia, Creating Artscience Collaboration, 2019
6 Owen, Richard; Responsible Innovation, 2013

Then your goal would be to set up a mission driven collaborative project aimed at exploring new paths that respond to societal and technological grand challenges.

Mission driven collaborative projects

Economist and advisor to the European Commission Mariana Mazzucato describes missions for progress as follows: "missions should be broad enough to engage the public and attract cross-sectoral investment; while remaining focussed enough to involve industry and achieve measurable success. By setting the direction for a solution, missions do not specify how to achieve success."[7]

Mission driven collaborative projects in this context involve artists in research or open innovation projects to explore new paths to progress that respond to the direction set by a mission in order to fuel innovation-led, sustainable growth.

Constructing Connectivity is an example of a mission driven collaborative project supported by STARTS under the WEAR Sustain Lighthouse program and is presented as Case Study 2 at the end of this toolkit (page 35). Also NTNU ARTEK, the Art and Technology Task Force of the Norwegian University of Science and Technology, could serve as an example of organisations stimulating mission driven residency programs for artists.[8]

TAKING SCIENCE OUT OF THE LAB

Are you interested in using research as I: a source of inspiration or II: an influencer of your work?

Then your goal would be to set up a science driven collaborative project aimed at being a go-between; transmitting scientific information to inform the public or advancing science by, for example, bringing science to the scale of human senses or experiences.

Science driven collaborative projects

Science is changing our world and lives. Today's artists are taking science out of the laboratory. Scientific theories are not invented but discovered through exploration, intuition and experimentation.[9]

Science driven collaborative projects bring together art and science to widen the horizon of both scientists and artists by taking scientific information out of the lab and into the world.

Atom Chasm is an example of a science driven collaborative project supported by STARTS under the VERTIGO Residencies program and is presented as Case Study 3 at the end of this toolkit (page 36).

HUMANISING TECHNOLOGY BY OFFERING SOLUTIONS

Are you interested in contributing to the reinvention of technology or the use thereof under an ethical paradigm of fairness?

7 Mazzucato, Mariana; Mission-Oriented Research & Innovation in the European Union, 2018

8 Alexandra Murray-Lesley and Andrew Perkis, The arts as enabling technology, keynote presentation at the the Art-Science Residencies symposium held at IRCAM Centre Pompidou on 2-3 March 20202, in the framework of STARTS Residencies Days. From https://youtu.be/4P4RtOLB_4A

9 Miller, Arthur I; Colliding Worlds, 2014

Then your goal would be to set up a challenge driven collaborative project aimed at directly responding to a specific industrial or societal challenge or goal.

Challenge driven collaborative projects

The Open Innovation[B] paradigm assumes that there is a bountiful supply of potentially useful ideas outside the company. [10]

Challenge driven collaborative projects involve artists directly in addressing industrial and societal challenges to prototype possible solutions to the problem(s) defined.

Pollution Explorers is an example of a mission driven collaborative project supported by STARTS under the VERTIGO Residencies program and is presented as Case Study 4 at the end of this toolkit (page 37).

10 Chesbrough, Henry; Open Innovation, 2006

Section 2

MODELS FOR COLLABORATION

When a point of entry for collaboration has been identified, the next step is to shape to the cross disciplinary collaboration project. This involves developing a model (in this section) and drawing up a collaboration agreement (in the next section). The model involves deciding on the aim, approach and intended outcome from the start. Each point of entry corresponds to a collaboration model. The standardized models can help to provide clarity on required contributions and responsibilities and will be elaborated upon as methodologies in section 4.

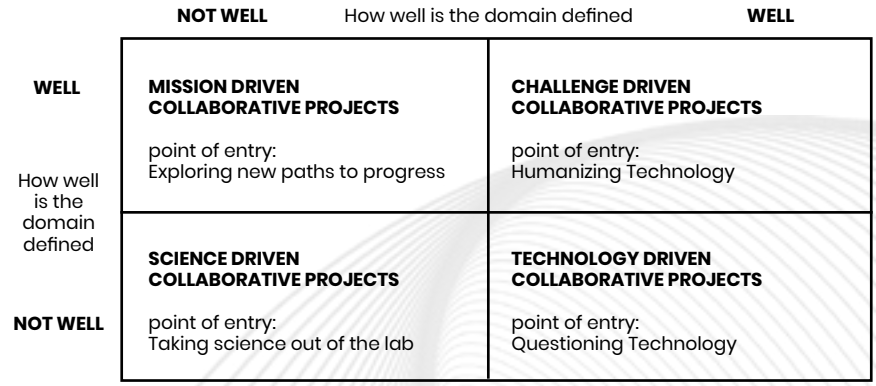


FIGURE 4: Models for collaborative projects between scientists, technologist and artists. Developed by In4Art in collaboration with STARTS Ecosystem

The models for collaboration are proposals for different strategies that can be followed to accomplish a project's objectives. The matrix for collaborative models in figure 6 is inspired by the Innovation Matrix developed by Gregg Satell[11].

It distinguishes standardised models by asking two questions: How well can we define the problem? and How well can we define the skill domain(s) needed to solve it?

HOW WELL CAN WE DEFINE THE PROBLEM?

To define the problem, the challenges addressed in the Sustainable Development Goals (SDG)[12], as defined by the United Nations in 2012, are taken as a starting point. The SDG distinguish 17 global goals which serve as the basis for defining progress. Additionally, the Stockholm Resilience Centre[13] has proposed a systematic hierarchy of the SDG, identifying three levels: societal progress, economic development and biosphere

11 Satell, Greg; The 4 Types of Innovation and the Problems They Solve, HBR, 2017
12 From https://www.un.org/sustainabledevelopment/sustainable-development-goals/
13 From https://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html, last visited 27 02 2020

restoration and protection. On top of that, Mariana Mazzucato has proposed to identify two main paths to sustainable innovation (Green or Care[14]).

The green path proposes to remake the way we have made things in either one of two categories: products for consumption (biological cycle) or products as a service (technical cycle)[15].

The care path proposes to include important activities into the realm of the productive economy[c] which are currently left out: this includes education, healthcare and biodiversity amongst others.

When combined, the different levels of insight lead to specific drivers for societal and economic value. The drivers can be translated into measurable targets and objectives, while providing a scope for responsible innovation.

Figure 5[16] presents a framework which can help in determining how well (or: specified) the problem can be defined.

HOW WELL CAN WE DEFINE THE SKILL DOMAIN(S) NEEDED TO SOLVE IT?

This question refers to whether it is known within which domain (arts, science, technology or otherwise) the intended outcome can have value. If this is known, then the skills (artistic, scientific, technological or otherwise) needed to bring the collaborative project to a success should also be known.

A simplified rule of thumb to get a sense of the degree to which the skill domain(s) needed in a project are known is to determine whether the project is explorative in nature or applied in nature. In explorative projects, the problem defined is hard to solve and unconventional skill domains are needed to do so.

As Thomas Kuhn explains in *The Structure of Scientific Revolutions*[17] we advance in specific fields by creating paradigms, which sometimes can make it very difficult to solve a problem within the domain in which it arose — but the problem may be resolved fairly easily within the paradigm of an adjacent domain.

14 Mazzucato, Mariana; The Value of Everything, 2018
15 McDonough, William and Braungart, Michael; Cradle to Cradle – Re-making the Way We Make Things, 2002
16 Groenewoud van Vliet, Rodolfo & Lija; Art Driven Innovation White Paper, 2020
17 Kuhn, Thomas; The Structure of Scientific Revolutions, 1962

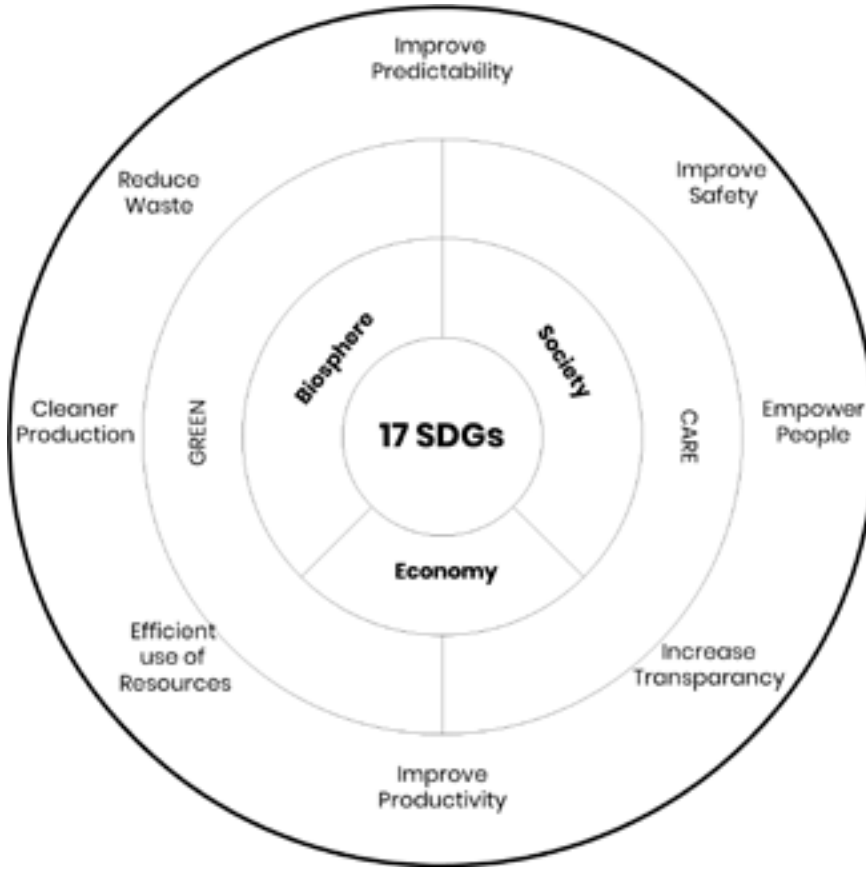


FIGURE 5: Art Driven Innovation Goals, by In4Art.

PICTURE 1: Overview UN SDGs.

CHALLENGE DRIVEN COLLABORATIVE PROJECTS

How well is the problem defined? WELL
How well is the domain defined? WELL

Aim
This model for collaborative projects is inspired by the essay Broken Nature by Paola Antonelli from 2019.[18]

Focussing on analysis and repair, this model aims to propose solutions to well defined industrial and/or societal challenges. Artists often work from afar on ideas that directly respond to the one posing the question, be that a challenge, goal or company mission, knowing that the goal is to turn their input into applicable solutions for responsible innovation led growth.

Approach
The point of entry best suited to pursue *Challenge driven collaborative projects* is 'humanizing technology'. To increase the chances of finding collaborators, it is good to make explicit what the collaborator(s) can expect. This might be:

- Analysing the true costs[D] of a product or service to illuminate areas where conflicts arise under a paradigm of ethics and responsibility
- Repairing existing systems, processes or products
- Rebooting value chains by developing new approaches and solutions to challenges

Intended outcome
The collaboration intends to take what is already there and explore its outer edges, resulting in prototypes and pilots for new use cases.

SCIENCE DRIVEN COLLABORATIVE PROJECTS

How well is the problem defined? NOT WELL
How well is the domain defined? NOT WELL

Aim
Providing lenses that help to see prospects more clearly, make richer judgments and enable sensitivity to uncertainties is the aim of this model for collaborative projects. Collaborations between scientists and artists stimulate new ways of looking at and dealing with life in the future. This model is inspired by the research on art-science collaborations by Arthur I. Miller published under the name Colliding Worlds in 2014. [19]

Approach
The point of entry best suited to pursue *Science driven collaborative projects* is 'taking science out of the lab'. To increase the chances of finding collaborators, it is good to make explicit what the collaborator(s) can expect. This might be:

- Stimulating new ways of looking at technology
- Making something visible which has been invisible before
- Taking science out of the lab and applying it in the real world

18 Antonelli, Paola; Broken Nature XXII Triennale di Milano, 2019
19 Miller, Arthur I; Colliding Worlds, 2014

Intended outcome
A successful Art Influenced Science project results in a proof of idea[E] where the possibility of a future is proven rather than the probability.

MISSION DRIVEN COLLABORATIVE PROJECTS

How well is the problem defined? WELL
How well is the domain defined? NOT WELL

Aim
Involving artists in research or open innovation projects to respond to a mission is the aim of this model. Since missions are designed to steer the direction of development but not the rate, mission driven collaborative projects are very suitable to explore new paths to progress involving artistic exploration and experimentation.

Approach
The points of entry best suited to pursue *Mission driven collaborative projects* are an interest in 'exploring new paths to progress'. To increase the chances of finding collaborators, it is good to make explicit what the collaborator(s) can expect. This might be:

- Exploring new applications for existing technologies
- Collaborating on an iterative process of prototyping of new ideas

Intended outcome
The collaborations which follow this model produce a wide variety of ideas or prototypes that span over many domains while having in common that they respond to a mission for progress and become part of a wider strategy of analysis and repair.

TECHNOLOGY DRIVEN COLLABORATIVE PROJECTS

How well is the problem defined? NOT WELL
How well is the domain defined? WELL

Aim
Cross-pollination between artists and technologists at companies or within the walls of (academic) institutions is the aim of this model. Artists work directly with research and development teams with the goal of shaping the development of new technological products and services through the artistic process. This model is inspired by the artistic residency programs at Microsoft, Adobe and Nokia Bell Labs.

Approach
The points of entry best suited to pursue *Technology driven collaborative projects* are an interest in 'questioning technology'. To increase the chances of finding collaborators, it is good to make explicit what the collaborator(s) can expect. This might be:

- Critical investigation of the implications of (new) technology manifested in works of art, exhibitions, performances, interventions or otherwise
- Knowledge and perspective sharing from an ethical framework
  Intended outcome

The result is a project whereby artists' practices are deepened, technology companies or institutions products are critically refined, and the desire for innovative solutions without undesired societal implications is respected.

CONVINCING COLLABORATORS: ADDED-VALUES OF ART-TECH-SCIENCE COLLABORATIONS

What are the reasons/motivations for both sides of the collaboration? How can artists, scientists and technologists either within or outside of companies benefit from collaborative practices?
One can take insights from the Stakeholder Investigation by the EU National Institutes of Culture, summarised below. [20]

Motivation for technologists and scientists:
Emotionality – the artistic process can help push companies and institutions towards developing products and services that emphasise our shared societal bonds.
Exploration – engaging artists is not about discovering solutions but discovering needs as they add thinking about the consequences of technology to the process.

Motivation for artists:
Role – these sorts of collaborations allow artists to not just comment on the changing world around us but directly shape its continued reconstruction, deepening their role in public and private life.
Bridge – integrating artists into collaborative projects with scientists and technologists challenges them to develop skills to constructively integrate their thinking into developments, thereby benefitting their personal artistic practices and augmenting their potential for continued work with collaborators.

20 Hochman, Nadav and Reben, Alex; Art+Tech Report 2019

Section 3

GETTING OFF TO A GOOD START

Converting a positive relationship into an actual partnership is about preparing the ground, ensuring you are aligned in the right ways.

Ariane Berthoin-Antal[21], identified five main "Barriers to generating value(s)":

1. Instrumentalization of art, artists, employees (artists are partners, not "suppliers"!)
2. Unrealistic expectations
3. Narrow definition of "value" and insufficient time invested into the collaboration
4. Lack of follow-up
5. Attitude of knowing rather than curiosity and humility

Additionally, we would say that in a true partnership, complementary interests exist even where the outcomes for everyone may differ. An effective working relationship exists where both parties exchange knowledge resources in order to progress the work and resolve difficulties of both a technical and artistic nature. The sharing of knowledge is an important facilitator of creative collaboration. [22]

Where to focus?
It is important to embed the following practices into the heart of your collaboration and keep them top of mind while going along. Losing focus with any of them could hamper the collaboration impact. When all parties are ready to commit on how they will work together, a partnership agreement will typically be drawn up (see Further Resources section for links to example agreements). Here we present a checklist of the most essential elements within such an agreement.

The collaboration agreement checklist consists of:

- Shared purpose and aim
- Explicit objectives
- Outline working process and mutual expectations
- Required resources and contributions
- IP (Intellectual Property) agreement

ARTICULATE A CLEAR SHARED PURPOSE AND AIM

Functioning as an anchor, an articulated and written purpose and aim of the collaboration will provide the resilience to overcome issues and keep the project on track. It might be very short, but it will serve as a guide, inform collective decision-making, and make life easier in multi-disciplinary collaboration practices. [23]

MAKE THE OBJECTIVES OF THE COLLABORATION EXPLICIT

As discussed in section 1; to develop a shared understanding, it can help

21 Video playlist Art--Science Symposium https://www.youtube.com/playlist?list=PLEV-4JNNrV8ldhpzzJYsKg-8q4diLMFpqNR
22 Candy, Linda and Edmonds, Ernest; Modeling Co-Creativity in Art and Technology, 2002
23 NESTA, Partnership toolkit, 2019

to specify the kind of collaboration each party is looking for by making interests explicit.

This really is about shared understanding, as collaborations on the nexus of art, science and technology often fail due to a lack of shared understanding[24]. Being open and transparent about what each party expects to achieve builds trust.

OUTLINE THE WORKING PROCESS AND MUTUAL EXPECTATIONS (MONITORING)

Depending on the chosen collaboration model from section 2, project leadership is shared between the collaborators.

By outlining the working process, the frequency of meetings and visits to the collaborator's organisation are set. Also determine whom should be informed on progress and status and when (communication schedule).

Finally, since the collaboration is bound to be of a flexible nature, it is advisable to articulate mutual expectations in terms of presence, committed time, decision making, communication and presentation. The working process gives insight in the planning; hence, it helps in monitoring the progress of the collaboration.

Claudia Schnugg[25] identifies these important questions to be asked right at the beginning of the collaborative process:

- What is the funding structure?
- Is the project supported by the most important individuals and departments in the organization?
- How much time is available and how much time can employees or scientists spare to talk to the artists, have regular conversations, or engage in a collaborative project?
- How much time can employees or scientists spend to work with the artists without neglecting other projects? Are there routines where the artists can be integrated?
- How open is the process or are there specific organizational or individual goals?
- Is there a focus on the process or is there a certain result that is required?

Once the answers to these crucial questions are answered, Schnugg then identifies that the structure of the collaboration can then be shaped along these lines:

- **Positioning of the ArtScience project in the organizational structure** Positioning within the organizational structure defines access, possible collaborating partners, interaction structures, and perceived value of the project or program for nonparticipating colleagues.
- **Selection process** This often depends on the situation and funding scheme.
- **Design of the open call and application details** Essential information to be provided in the open call comprises main ideas

24 Zhang, Yun; Weakly, Alastair and Edmonds, Ernest; Resolving Assumptions in Art-Technology Collaboration as a Means of Extending Shared Understanding, 2007

25 Schnugg, Claudia, Creating Artscience Collaboration, 2019 ; page 231-232

of the program, goals, description of the format and facilities, application and selection process, timeline, funding situation, expectations, and responsibilities.
• **Payments and funding**
• **Allocation of resources** Based on the funding structure, it is important to think of how much time employees can invest in collaboration.
• **Contractual arrangements and intellectual property (IP) rights**
• **Duration of the project or residency**
• **Interaction structures** Placing a scientist and an artist in the same building does not necessarily lead to a collaboration process. There need to be structures that can be used for exchange and interaction, like the integration of the artist in weekly lab meetings, official presentations, or after-work mingling for artists and scientists to meet and talk about their work.
• **Internal communication** Mailing lists and internal communication opportunities should be used to announce the program or project and the incoming artists.
• **External communication** Even if outreach is not the issue of artscience collaboration, the projects are interesting for a wider public and stakeholders.
• **Presentation and evaluation** Although a focus on the process can create the most interesting outcomes, there are needs in the scientific and artistic community to present the work, experiences, and insights. Additionally, organizations love to have evaluations in order to make sense of what happened.

REQUIRED RESOURCES AND CONTRIBUTIONS

In almost any case, the artist is the smaller and more fragile partner in the collaboration. Especially, when the collaboration involves an institution or company.

Therefore, it is very important that all collaborators understand the contributions they are expected to bring to the collaboration and perceive them as fair. Areas where partners can add value should be discussed, drawing out what is and isn't on the table. This might include:
• Expertise brought into the collaboration
• Relationships / Network the artist gets access to
• Accommodation & Travelling
• (Access to) Facilities
• Renumeration for the time investment
• Investment budget for the capital investments [F]

AGREE ON THE DISTRIBUTION OF IP ON THE OUTCOME

There are three different categories of Intellectual Property (IP) that can be a result of a collaborative project on the nexus of science, technology and the arts: Background IP, Foreground IP, and Joint IP[26]. Intellectual Property includes inventions, copyrights and design rights.

26 Sandback, Dave; WEAR Sustain Webinar Legal IP, 2017

Background IP
Includes IP that was not created as part of the collaboration. This can be brought in by any of the collaborators on terms of a (non) exclusive use licence or on a permission to use basis. It is important to have this clearly stated in the beginning.

Foreground IP
Includes IP created as part of the collaboration, but owned by one of the collaborators. For example, in a challenge driven collaborative project the artist acts as the primary developer of the solution, therefore, the artist should retain the right on the foreground IP and can provide an exclusive use license to the challenge owner.

Joint IP
Includes IP created as result of the collaboration in which case all collaborators contributed to the development. This is the likely result of technology driven or science driven collaborative projects. In this case, it makes sense to agree upon a 'free for each party to use' option.

In general, it is important for all collaborators to understand the types of rights that can be licensed and to plan ahead as formal costs for IP protection will increase over time.

Who will own the jointly created IP is a question you want to have answered before starting a collaborative project.

The role of intermediaries: brokering in collaborative projects

Intermediaries that broker in art -science - technology projects are organisations or individuals that enable collaboration. They do so either directly through seeking artists, scientists, institutions or companies that share a mutual interest, or indirectly by enabling or facilitating the collaborative capacity of regions, nations or sectors. They do so by creating and nurturing networks, but also by conducting and supporting activities that close the gap between art, science and industry.[27]

There are different types of brokers in collaborative projects. Some work from a concrete challenge or question, for instance seeking new sustainable applications for a technology. Others focus on overarching themes and create collaborations around those themes (for example: energy transition or plastic waste reduction). A final major category of brokers departs from the artistic practice (for example: artistic explorations around sensor technology) and seek collaborators from there.[28]

Claudia Schnugg describes intermediaries as bridge-builders and says they "often have the abilities of a cultural producer, curator, mediator, translator between the fields, and facilitator who guides the project and helps to communicate the project to the microcosmos of the organization in which it is embedded....This person has to be able to grasp the artistic and scientific value and impacts of the work, and to contextualize it within the organization and the disciplinary fields." [29]

Schnugg also categorises the roles that intermediary organisations and individuals can take[30]:

- Seeking out artists and organizations, matching them, and making contractual arrangements
- Designing and executing open calls and jury meetings (if part of the project)
- Helping to specify the focus of the project or program
- Assisting in arguing the value-added and finding funding
- Connecting the focus of the program to the organization's vision and keeping it on track
- Providing a framework to structure the process, management, and facilitation
- Curating and guiding the project, and seeing opportunities and articulating them
- Providing mediation and translation between the fields, and finding a common language
- Keeping conversations going, as communication is key to a successful collaboration
- Guiding the progress

27 Berthoin Antal, Ariane; Artistic Intervention residencies and their intermediaries: a comparative analysis, Organizational Aesthetics, 2012
28 Dalziel, Margaret; Why do Innovation Intermediaries exist?, 2010
29 Schnugg, Claudia, Creating Artscience Collaboration, 2019
30 Antal, Ariane Berthoin and Strauss, Anke; Artistic Interventions in Organisations: Finding Evidence of Values-Added, 2013

- Building up trust and relationships with and between core actors
- Addressing conflicts that may emerge before or during the collaboration process
- Dealing with concerns among artists, scientists, and employees, and providing introductory information
- Providing space for conversations, engagement, and exchange
- Communicating with authorities and the media locally and beyond
- Externally communicating the residencies and providing space for outreach about the project
- Evaluating results for communication or feedback to the management of the organization
- Stimulating cross-fertilization between projects and artscience projects and the organization
- Implementing results and guiding in integrating new knowledge and processes
- Setting up presentation moments, contextualizing, and staging the outcome

Schnugg also identifies the importance of the intermediary being part of the process from the start in order to display the value of the project and to facilitate the relationships with the organisation and opening up communication between all the relevant parties.

WHO ARE THEY?

Brokering intermediaries exist in many forms. They could be cultural institutions with a focus on network facilitation. They could be social impact driven organisations, or they could be (platform) organisations with a focus on research and innovation. A comprehensive list of international organisations from and beyond the STARTS community can be found in the section “Further Resources” of this publication.

Section 4

METHODOLOGIES: A STEP-BY-STEP GUIDE

"Artists don't solve the problem of painting a picture or writing a sonata. Rather, they keep in mind the whole picture throughout, and while they surely solve problems along the way, problem solving is not their goal" – Simon Colton [31]

In the previous sections of this toolkit the focus lay on preparing a common ground based on mutual interest. The aim was to reach a valuable outcome for both artists and their collaborators, be they scientists, technologists or companies. In this section, we discuss three supporting methodologies to execute collaborative projects on the nexus of science, technology and the arts, once the collaboration is formalised and the project starts.

It is embedded in the very nature of innovation to focus on solving problems, be they of technical, societal or economical nature. However, artistic practices don't put such problem solving at the heart of their process. Therefore, well-known methodologies for creative problem solving, ranging from Design Thinking[32] to Business Model Ideation[33] are unsuitable to use for these kinds of collaborations.

The three methodologies presented here intend to help artists and their collaborators in setting up and following a process of collaboration and knowledge sharing, where the point of departure is not a specific problem that needs solving but rather a creative process that allows for moments of chaos and serendipity. Problems are being solved along the way through experimentation, a proven gateway to innovation.

Firstly, a short summary of the methodological approach per model is given and afterwards, each model is explained in a figure with clarifying text to enable the execution.

METHODOLOGY FOR ART ENABLED PROTOTYPING

Drawing inspiration from Sensemaking[34] and Bauhaus methodologies, this methodology can help artists to reframe a specific societal or industrial challenge or issue as a phenomenon. By doing this, a non-linear process of problem solving can be applied to the challenge, resulting in prototypes for specific applications. The methodology consists of four steps which are by no means a linear process.

31 Colton, Simon; Refactorable Numbers: A Machine Invention, 1999
32 IDEO, Design Thinking, 2008
33 Osterwalder, Alexander; Business Model Generation, 2010
34 Madsbjerg, Christian; Sensemaking, 2017

METHODOLOGY FOR ART INFLUENCED SCIENCE

"It is by logic that we prove, but by intuition that we discover" – Henri Poincaré [35]

When artistic intuition is combined with technical and scientific expertise and results in collaborative experimentation, new possibilities arise. In this methodology, technologists and scientists are responding to the intuition of the artist to stimulate new ways of looking at science and technology and dealing with life in the future.

METHODOLOGY FOR ART DRIVEN TECHNOLOGY

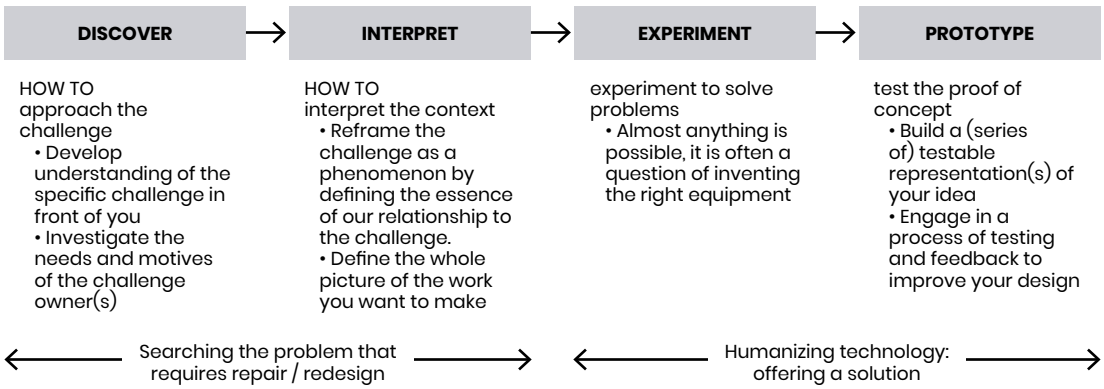
Inspired by the Experiments in Art and Technology (E.A.T)[36] projects and Art/Science collaborations at places such as CERN, MIT and ZKM, this methodology can help remove barriers between art, science and technology in order to push the boundaries of technology and science. keep the project on track. It might be very short, but it will serve as a guide, inform collective decision-making, and make life easier in multi-disciplinary collaboration practices.

35 Poincaré, Henri; The Foundations of Science, 1946
36 Klüver, Billy and Rauschenberg, Robert; the purpose of Experiments in Art and Technology, 1967

Methodology
Art Enabled Prototyping

"The arts offer the best opportunities to explore worlds other than our own, thus collaborating with artists is a way to create a competitive advantage" - Christian Madsbjerg [37]

Art Enabled Prototyping puts the challenge at the heart of the creative process and experiments with different technologies, materials or constructs from different domains to develop a response.



DISCOVER

• Develop understanding of the specific challenge

Whatever the challenge is, to develop a deep understanding requires "seeking patterns in a vast ocean of data, impressions, facts, experiences, opinions, and observations and to then connect these patterns into a single unifying insight"[38]

• Investigate the needs and motives of the challenge owner(s)

To do this, it could help to ask the following questions:
What is it like to be this person? How does this person/ environment experience the world? What is the 'job to be done[39] of this person? Why would this person be interested to collaborate? What guides this person's curiosity?

INTERPRET

• Reframe the challenge as a phenomenon by defining the essence of our relationship to the challenge.

Often, challenges are framed in such ways that symptoms are prioritized over causes. But to come up with a meaningful solution to the challenge, it is the causes and context you wish to understand.

37 Madsbjerg, Christian; Sensemaking, 2017
38 Berlin, Isaiah; The Sense of Reality, 1996
39 Christensen, Clayton; Know your Customers "Jobs to be Done", Harvard Business Review, 2016

The philosophical concept of phenomenology as described by German philosopher Edmund Husserl can help: "*describe things as they actually appear and not as we think they should or could appear*"[40].

- ***Define the whole picture of the work you want to make***

  Artist, scientist and technologist Joe Davis once said: "*Artists should create things that hold and idea, no matter what it is*"[41]. It is this central idea that drives the process of exploration and experimentation, allowing unforeseeable twists and turns to shape the creative process.

EXPERIMENT

- ***Almost anything is possible, it is often a question of inventing the right equipment***

  When it comes to humanizing technology through experimentation, it can help to view artistic experimentation as a way to describe yet-to-be-defined progress.

PROTOTYPE

- ***Build a (series of) testable representation(s) of your idea***

  Where other methodologies in this toolkit are positioned further away from applications, this methodology is most suitable for collaborative practices where the goal is to deliver a piloted prototype. Therefore, it is important to realise that the art created in a collaborative practice focused on art enabled prototypes should have the potential to develop into an application.

- ***Engage in a process of testing and feedback to improve your design***

  The Dutch media art institution V2_ created the 3x3 live experimentation program to combine artistic development, prototyping and user testing all in one presentation moment. Also, the French institution Cent Quatre #104 in Paris could serve as inspiration to create space for testing and feedback at the end of the collaboration.

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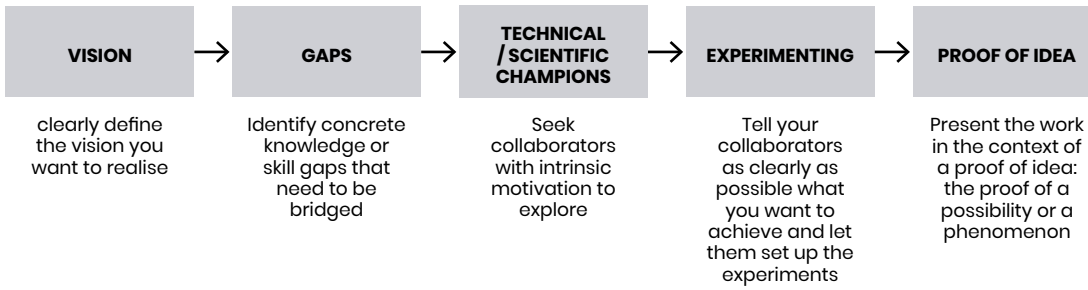
40 Bakewell, Sarah; At the Existentialist Café: Freedom, Being, and Apricot Cocktails
41 Miller, Arthur I; Colliding Worlds, 2014

Methodology
Art Influenced Science

Ideas that offer opportunities for scientific imagination and are based on artistic intuition could follow the Art Influenced Science methodology for collaborative projects. As a creative process led through experimentation, this methodology offers the possibility to produce new objects of scientific study in and of themselves by overcoming technological and practical challenges imposed in this approach. Thereby pushing technological and scientific boundaries through art.



VISION

• ***Clearly define the vision you want to realise***

Art gives scientists permission to play[42]. The problem is however that scientists need a reason to free up time to play. Therefore, it is needed to clearly define the vision of the artistic proposal to realise in order to gain commitment. This vision should specify why it is interesting for the scientific collaborator to work on this project.

GAPS

• ***Identify concrete knowledge or skill gaps that need to be bridged***

In science driven collaborative projects it is important to specify a vision and identify the gaps as concrete as possible since the outcome is highly uncertain. To do this, answering the following questions can help:

What is it exactly you expect from your scientific or technological collaborators? What knowledge are you lacking to realise your vision? Which skills do you need to achieve this? Which technologies or machines do you require access to?

42 Miller, Arthur I; Colliding Worlds, 2014

CHAMPIONS

• Seek collaborators with intrinsic motivation to explore

The collaboration in this approach is based upon sheer curiosity. And although the intent is not to advance science, the possibility that is will do, nonetheless, is what can be the foundation below the scientific commitment to participate.

EXPERIMENTING

• Tell your collaborators as clearly as possible what you want to achieve and let them set up the experiments

Experimentation in these collaborative projects occurs in close collaboration between artists and scientists. There are many ways in which collaborative experiments are different from scientific experiments, including changing the scale of an experiment, seeking ways to illuminate something which has remained invisible until now and bringing science out of the laboratory. In all these occasions, it is the scientific collaborator who plays a big role in setting up the experiments.

Another approach to this is to intentionally conduct an experiment that an artist might think of but not a scientist. It is in this way that artist Mark Dion discovered new species of flies in 2007[43].

PROOF OF IDEA

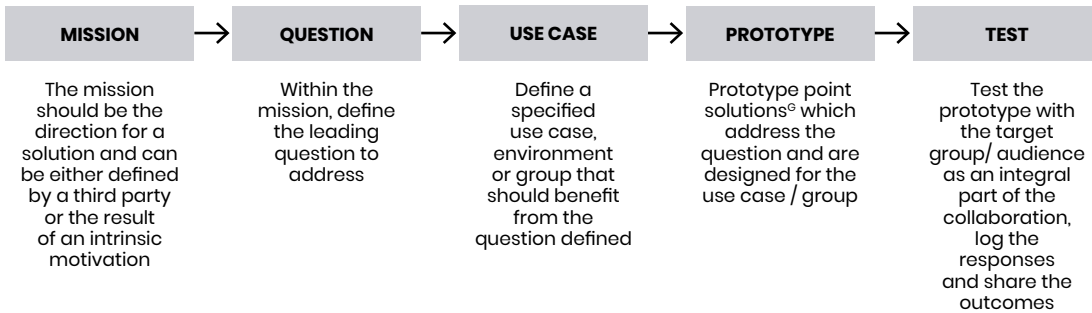
• Present the work in the context of a proof of idea

The experiment resulting from an Art Influenced Science project methodology functions within certain controlled environments only. It is not the goal to show application potential, the goal is to proof the possibility of existence of the idea beyond the artists imagination.

43 Dion, Mark; Systema Metropolis, 2007

Methodology
Art Driven Technology

What technology is observed to do should be the sole basis to evaluate[44]. Simply put, in order to innovate responsibly, we must proactively seek out the unintended consequences of our actions and welcome them as new problems to be solved. A time of radical technologies requires a generation of radical technologists, a multidisciplinary breed of explorers[45] working at the intersection of science, technology and art to push the boundaries of our senses and understanding. The Art Driven Technology methodology focusses on a mission for progress as a leading theme and responds through proof of concepts.



MISSION

• The mission should be the direction for a solution and can be either defined by a third party or the result of an intrinsic motivation

"The ability of innovation to spur economic growth has long been recognised. Less recognised is the fact that innovation has not only a rate but also a direction" – Mariana Mazzucato[46]

Missions should be broad enough to engage the public and facilitate cross-disciplinary collaboration; and remain focussed enough to involve industry and achieve measurable success. By setting the direction for a solution, missions do not specify how to achieve success. Rather, they stimulate the development of a range of different solutions to achieve the objective. As such, a mission can make a significant and concrete contribution to meeting the SDGs.

QUESTION

• Within the mission, define the leading question you want to address

Since missions set a direction but are broad enough to stimulate a range of different solutions, defining a leading question you want

44 Greenfield, Adam; Radical Technologies: The Design of Everyday Life, 2017
45 Jacobs, Ruben; Artonauten: op expeditie in het Antropoceen (Dutch), 2018
46 Mazzucato, Mariana; Mission-Oriented Research & Innovation in the European Union, 2018 (report)

to address within the context of the mission, is necessary. Whether the aim is to reflect on that question (logical when the point of entry for the collaboration was questioning technology) or come up with an answer (logical when the point of entry for the collaboration was explore new paths to progress) is up to the collaborators in the project.

USE CASE

• Define a specified use case or group that should benefit from the question defined

A use case is a specific situation in which a product or service could potentially be used, and it describes the interactions with whomever could benefit from the use.

When the project questions technology it might want to highlight a negative effect, which occurs through usage in a specific case and can be embraced as a problem to solve.

PROTOTYPE

• Prototype point solutions which address the question and are designed for the specified use case / group

With the term 'point solution' we mean prototypes which are focussing on solving one specific problem. This is something different than so called 'integrated solutions' which are meant to present solutions dealing with an entire chain of activities.

For example: The Fairphone, originally developed within the walls of WAAG in Amsterdam, is an integrated solution where a smartphone is created, which is sustainable and fair to all involved people. On the contrary, *Project Alias* (case 1) is a point solution that adds a layer to an existing technology in order to solve a specific problem that occurs with this technology; namely the lack of privacy when using smart assistants.

TEST

• Test the prototype with the target group as an integral part of the collaboration, log the responses and share the outcomes

A good example for this is the VERTIGO/STARTS Residencies project *Soundshirt 2.0* from Cutecircuit. Their interactive garment translates soundwaves into vibrations to allow the deaf to experience music. It was tested with the Jungen Symphoniker Hamburg. The idea of testing is to witness the reactions of the audience and explore to what extent the prototype works or should be adjusted.

CASE STUDIES
CASE EXAMPLES ON COLLABORATION

Case 1: Technology Driven Collaborative Project

PROJECT ALIAS

STARTS Prize winner edition 2019

Created in 2018 by interaction designer Bjørn Karmann in collaboration with UX designer Tore Knudsen. *Project Alias* is a 3D printed smart assistant shell equipped with a microphone and speakers that can be placed over a smart assistant to gain control over the device.

POINT OF ENTRY: QUESTIONING TECHNOLOGY

The exciting future that "smart" technologies can give us often comes with conditions that diminish our privacy. With Alias we want to challenge this condition and ask what kind of "smart" we actually want in the future. [47]

MODEL: TECHNOLOGY DRIVEN COLLABORATIVE PROJECT

Our interaction patterns are highly determined by the designers of these products, and with Alias we are interested in how this power relation can be redefined, especially when it comes to privacy. [48]

METHOD: ART DRIVEN TECHNOLOGY

Project Alias is the result of a collaboration between two designers working multidisciplinary with the intend to explore a new use case (middle-man device for privacy) based around an existing technology (smart home assistants). They use the knowledge from a completely different domain (nature: fungus and viruses) to solve the problem of privacy and control, which they identified in the domain of smart tech.

IMPACT

The innovation has been realised and made available open source.

PICTURE 2: Project Alias. Bjørn Karmann, Tore Knudsen. Tokyo Midtown Exhibition 2020.

47 From http://bjoernkarmann.dk/project_alias, last visited 02 03 2020

48 Idem

Case 2: Mission Driven Collaborative Project

CONSTRUCTING CONNECTIVITY

WEAR Sustain 2017-2018[49]

Developed by artist Jessica Smarsh in partnership with technology firm Vention Technologies and neuroscientist Raymond van Ee. The *Constructing Connectivity* project creates an interactive rehabilitation platform around a person-centred stroke rehabilitation method.

POINT OF ENTRY: EXPLORING NEW PATHS TO INNOVATE

Based on the scientific insight that multisensory stimulation appears more beneficial in stroke rehabilitation than single sensory stimulation, the artist explores a new path to innovate by asking the question: Could the benefits of textile making (a multisensory activity) help patients to recover from stroke more effectively?

MODEL: MISSION DRIVEN COLLABORATIVE PROJECT

Although the mission is broad enough to allow for a variety of experiments and developments within the project, the mission is narrow enough to engage both a technology firm and a scientist[50]. Although the direction for a solution is set on improving the quality of life for stroke patients, there are many solution areas to explore.

METHOD: ART DRIVEN TECHNOLOGY

Through testing the prototype has been improved and further developed, both as garment and as a connected platform for training and feedback.

IMPACT

A prototype shirt was piloted as a follow up under the name Connextyle[51] with the support of the WORTH Partnership project.

PICTURE 3: Project Constructing Connectivity. Jessica Smarsch.

49 From https://legacy.wearsustain.eu/awardees/opencall1-2/, last visited 29 06 2020
50 From https://www.jessicasmarsch.com/Constructing-Connectivity, last visited 02 03 2020
51 From https://www.jessicasmarsch.com/Connextyle, last visited 02 03 2020

Case 3: Science Driven Collaborative Project

ATOM CHASM

VERTIGO/STARTS Residencies 2018 – 2020[52]

Phenomenological artists Evelina Domnitch & Dmitry Gelfand collaborated with the 5th Institute of Physics from Stuttgart University to realize an artwork on atomic scale- answering the question: might it be possible to witness single atoms floating in space?[53]

POINT OF ENTRY: TAKING SCIENCE OUT OF THE LAB

The artists have built a career around the interest of extending the reach of human sensory capacities by taking phenomena out of the lab and making them visible to the public. Their quest in this project is no different.

MODEL: SCIENCE DRIVEN COLLABORATIVE PROJECT

Single trapped atoms can only be admired in research labs today. However, the light a charged atom emits is so strong that it should be possible to witness in free space. Atom Chasm brings together scientists, technology and artists to solve a multidisciplinary challenge: creating the world's first work of art presented on the atomic scale.

METHOD: ART INFLUENCED SCIENCE

Through experimentation the collaboration is set to realise something never done before: develop a new technology (free-ranging imaging system) that allows audiences to observe trapped ions in a safe way, thereby expanding scientific horizons (experiments on a larger scale).

IMPACT

New technology (imaging system) and improving public understanding of quantum reality through observation.

PICTURE 4: Gelfand, ArtAtom. STARTS Residencies Days 2020. Photo: Quentin Chevrier

52 From https://vertigo.starts.eu/calls/2017-2/residencies/atom--chasm/detail/

53 From https://www.youtube.com/watch?v=89xbR02YO6s, last visited 21 01 2020

Case 4: Challenge Driven Collaborative Project

POLLUTION EXPLORERS

STARTS Residencies 2017 - 2018[54]

A participatory project co-created between maker/designer Ling Tan, the hackAIR community and FutureEverything, *Pollution Explorers* answers to the challenge what we can do as a community to tackle air quality issues.

POINT OF ENTRY: HUMANIZING TECHNOLOGY

We have enough data telling us the air is bad, therefor investing in more air quality measurement technologies seems unneeded. What we need is the next step: what can we do? Asking ourselves as citizens what we can do and what our responsibility is. The project uses wearable technologies and machine learning to create awareness and inspire behaviour change.

MODEL: CHALLENGE DRIVEN COLLABORATIVE PROJE

Can we assess the quality of air without the need for air quality sensors, and what can we do as a community to tackle air quality issues? Grounded in these two questions, the project develops technologies that focus on empowering citizens and local communities to take action.

METHOD: ART ENABLED PROTOTYPING

The project identified a problem that needs repair: we know the air quality is bad but more abstract data will not lead to action. Consequently, they went through a process of experimentation and prototyping to develop and test wearable technologies incorporating machine learning.

IMPACT

After two years and numerous performances where citizens, children and council members participated, the project has led to a movement.

Picture 5: Residency Pollution Explorers. Ling Tan, HACKAIR.

54 From https://vertigo.starts.eu/calls/2017-2/residencies/atom--chasm/detail/

Section5

INCREASING THE IMPACT: CHECKLIST

Art can be described as the act of making something visible, creating something which previously wasn't there. It could be an idea, a possibility, a combination or a future.

Artistic imagination can be seen as the delivery room for technological innovation and to enhance society as a whole, artists should take their place alongside scientists and technologists.

When entrepreneurs, technologists or scientists allow themselves to be inspired by the arts, they will be able to realise improved visualisations, designs and better communication. When they allow themselves to be influenced by the arts they will be rewarded with new insights and innovations.

Depending on the outcome of a collaborative project the impact of the learnings and results can be distinguished on three levels: inspiration, insights and/or opportunities for innovation. This section presents a checklist to help identify the impact a project could have on each of the three levels. The checklist consists of questions to help translate the outcome of the collaborative project into impact.

Additionally, the checklist can also be used in the beginning to explore the interest of the collaborators – what end result would be desirable?

Inspiration

- Could the outcome inspire strategic decision making?
- Could the outcome lead to renewed scientific communication?
- Could the outcome lead to improved visualisations or design?
- Could the outcome lead to public awareness?

Insights

- Does the artistic research add to our knowledge?
- Does the used data reveal new patterns?
- Does the conducted creative process offer insights for new research methodologies?
- Does the scale of the artistic experiments provide an object of research by itself?

Innovation

- Could the prototype replace an existing product or service?
- Could the prototype add value to an existing product or service?
- Could the prototype be a modular part of a larger innovation?
- Could the prototype combine values currently separated?

Moreover, the collaborations might envision to have impact at individual, organisations and societal level, depending on the questions and kind of partnership addressed. According to Ariane Berthoin-Antal[55], collaborations will take the maximum impact at:

55 Ariane Berthoin-Antal, Unleashing the radical potential of artistic interventions residencies, keynote presentation at the Art-Science Residencies symposium held at IRCAM Centre Pompidou on 2-3 March 20202, in the framework of STARTS Residencies Days. From https://youtu.be/HWyN6lW95bg, last visited 24 June 2020

- individual level, if “people experience value themselves and feel safe”;
- organisational level, “if senior management has the courage to trust the process, visibly supporting it, thereby enabling/legitimizing sense-making conversations and follow-up activities”;
- societal level, if “bigger questions are addressed, wider impacts are considered, and other actors are involved”.

CONCLUSION

This toolkit intends to bring artists in a position to find, structure, formalise and deliver collaborative projects which are mutually beneficial, equitable, and sustainable.

Whether the intent is to expand horizons, deepen knowledge or find new paths to progress, the toolkit contains tools and methods to help in this journey by reaching a common language. It crosses the borders of art, science and business, uniting the fields in a mutual goal to create sustainable, responsible, innovation-led growth and possibilities.

GLOSSARY

Certain terms and words have been used in a specific context throughout the toolkit. Here the context is described:

A **Responsible Innovation**

Responsible innovation compels us to reflect on what sort of future(s) we want science and technology to bring into the world, what futures we care about, what challenges we want these to meet, what values these are anchored in, and whether the negotiations of such technologically- enabled futures are democratic. It asks how the targets for innovation can be identified in an ethical, inclusive, and equitable manner. – From Owen et al; Developing a Framework for Responsible Innovation, 2013

B **Open Innovation**

Open innovation, a term coined by Henry Chesbrough in 2003, consists of two elements: using external knowledge and combining that with internal innovation development (outside-in) and increasing the efficiency of internal knowledge and innovation by sharing with third parties (inside-out)

C **Productive Economy**

Economists have for a long-time divided activity into either productive economic activities or non-productive economic activities. The divide between the two is what is called the production boundaries. Over time, those activities which are placed inside and outside the production boundaries change, leading Mariana Mazzucato to propose we think anew what we place inside the productive economy.

D **True costs**

Also often called 'true pricing', includes natural and social costs of production, transport, consumption and disposal into the actual pricing of a product. These costs, which include unsafe working environments and unequal pay but also water use and air pollution are often discarded in pricing leading to incomplete pictures of the actual price for products.

E **Proof of Idea**

Proofs of ideas verify the working of the experiment but do not include the potential for application (unlike proofs of concept).

F **Capital Investment**

This is a sum of money provided to purchase equipment, rent property or otherwise buy or rent assets necessary to complete the project. This does not include expenses for day-to-day operations (working capital) or other expenses (such as travelling).

G **Point Solution**

Solving one particular problem for a particular case without regard to related issues.

I **Transdisciplinary**

Transdisciplinarity connotes a research strategy that crosses many disciplinary boundaries to create a holistic approach. It applies to research efforts focused on problems that cross the boundaries of two or more disciplines, such as research on effective information systems for biomedical research (see bioinformatics), and can refer to concepts or methods that were originally developed by one discipline, but are now used by several others, such as ethnography, a field research method originally developed in anthropology but now widely used by other disciplines. The Belmont Forum [1] elaborated that a transdisciplinary approach is enabling inputs and scoping across scientific and non-scientific stakeholder communities and facilitating a systemic way of addressing a challenge. This includes initiatives that support the capacity building required for the successful transdisciplinary formulation and implementation of research actions. (From: https://en.wikipedia.org/wiki/Transdisciplinarity)

J **Interdisciplinary**

Interdisciplinarity or interdisciplinary studies involves the combining of two or more academic disciplines into one activity (e.g., a research project). It draws knowledge from several other fields like sociology, anthropology, psychology, economics etc. It is about creating something by thinking across boundaries. It is related to an interdiscipline or an interdisciplinary field, which is an organizational unit that crosses traditional boundaries between academic disciplines or schools of thought, as new needs and professions emerge. Large engineering teams are usually interdisciplinary, as a power station or mobile phone or other project requires the melding of several specialties. However, the term "interdisciplinary" is sometimes confined to academic settings. The term interdisciplinary is applied within education and training pedagogies to describe studies that use methods and insights of several established disciplines or traditional fields of study. Interdisciplinarity involves researchers, students, and teachers in the goals of connecting and integrating several academic schools of thought, professions, or technologies—along with their specific perspectives—in the pursuit of a common task. The epidemiology of HIV/AIDS or global warming requires understanding of diverse disciplines to solve complex problems. Interdisciplinary may be applied where the subject is felt to have been neglected or even misrepresented in the traditional disciplinary structure of research institutions, for example, women's studies or ethnic area studies. Interdisciplinarity can likewise be applied to complex subjects that can only be understood by combining the perspectives of two or more fields. (From: https://en.wikipedia.org/wiki/Interdisciplinarity)

FURTHER RESOURCES

For anyone interested to deepen their knowledge on collaborative practices, these resources can be interesting to explore:

• Video playlist Art-Science residencies symposium (2-3 March 2020, Centre Pompidou – Ircam, Paris, France)
https://www.youtube.com/playlist?list=PLEV4JNNrV8IdhpzzJYsKg8q4diLMFpqNR
• STARTS Residencies brochure 2019, by VERTIGO STARTS
https://vertigo.starts.eu/media/uploads/brochure-starts-residencies.pdf
• STARTS resources page
https://www.starts.eu/resources/
• Leonardo ISAST
https://www.leonardo.info/publications
• ART + TECH REPORT, Nadav Hochman and Alex Reben (2019)
6 current models for collaboration between artists and tech/nologists in the United States
• Co-Creation Navigator by WAAG
Guiding you through the co-creative landscape
• ICT ART CONNECT 2013
Activities linking ICT and Art: Past Experience – Future Activities
• Working Together Toolkit 2013 by NESTA
Collaborative Practices and Partnership Toolkit
• Collaborative Creativity, Linda Candy, 2014
Learning from Art and Technology Experience and Research
• The Good Collaboration Toolkit, The Good Project, 2013
An Approach to building, sustaining, and carrying out successful collaboration
• Artists' Collaboration Agreement, 2006 by CARFAC Ontario, Canada
A model for a negotiated agreement between two artists
• Art Driven Innovation Whitepaper, In4Art, 2020
Introducing a new path to responsible innovation
• Artistic Interventions in Organisations: Finding Evidence of Values-Added, Ariane Berthoin Antal and Anke Strauss, 2013
An overview of the impacts of artistic interventions in organisations in Europe
• Training artists for Innovation, Joost Heinsius and Kai Lehikoinen, 2013
Training artists for innovation is a contribution to the societal and business challenges of today
• From Creativity to Innovation, Worldbank report, 2007
Innovation has two essential ingredients: artistic or scientific creativity and the stock of knowledge`
• What do Artists Know?, Whitehead, F. (2006)
Elaborating upon the unique skills, processes and methodologies artists are trained to udr

• Collective Wisdom: Co-Creating Media within Communities, across Disciplines and with Algorithms, Katerina Cizek and William Uricchio, 2019
This first-of-its-kind field study of the media industry highlights trends, opportunities, and challenges to help advance the understanding and recognition of co-created works and practices — efforts that live outside the limits of singular authorship.
https://cmsw.mit.edu/collective-wisdom-co-creating-media-within-communities-across-disciplines-and-with-algorithms/
• Online access to publications by Ariane Bethoin-Antal
https://www.econstor.eu/handle/10419/43893/browse?type=author&value=Berthoin+Antal%2C+Ariane&sort_by=1&order=DESC&rpp=50&submit_browse=Update

For anyone interested in intermediaries, these organisations/programs can be interesting to explore:

STARTS Pillars partner organisations

• STARTS Ecosystem
- Ars Electronica, https://ars.electronica.art/news/
- INOVA+, https://inova.business/
- IRCAM Centre Pompidou, https://www.ircam.fr/
- La French Tech Grande Provence, https://lafrenchtech-grandeprovence.fr/
- Gluon, www.gluon.be
- University for The Creative Arts, https://www.uca.ac.uk/

• STARTS Prize
- Ars Electronica, https://ars.electronica.art/news/
- BOZAR, www.bozar.be
- Waag Society, https://waag.org/nl/home

• VERTIGO/STARTS Residencies
- IRCAM Centre Pompidou, https://www.ircam.fr/
- INOVA+, https://inova.business/
- Ecole Polytechnique Fédérale de Lausanne, https://www.epfl.ch/en/
- La French Tech Grande Provence, https://lafrenchtech-grandeprovence.fr/
- Libelium, http://www.libelium.com/
- Fraunhofer, https://www.fraunhofer.de/en.html
- Artshare, https://www.artshare.pt/

• STARTS Lighthouses (Re-Fream)
- Creative Region Linz & Upper Austria GmbH, https://creativeregion.org/
- Wear It Berlin, https://www.wearit-berlin.com/
- Creative Region Linz
- Aitex, https://www.aitex.es/
- Care Applications, https://careapplications.com/en/home/
- Consorzio Arca, http://www.consorzioarca.it/index.php/en/

- EMPA, https://www.empa.ch/web/empa
- Fraunhofer, https://www.fraunhofer.de/en.html
- Haratech, https://www.haratech.at/
- Instituto Europeo Di Design, https://www.ied.edu/
- Profactor, https://www.profactor.at/
- Stratasys, https://www.stratasys.com/
- University of Art and Design Linz, https://www.ufg.at/

- **STARTS Lighthouses (Mindspaces)**
  - CERTH, Information Technologies Institute, https://www.certh.gr/root.en.aspx
  - Maastricht University, https://www.maastrichtuniversity.nl/nl
  - Universitat Pompeu Fabra, https://www.upf.edu/
  - Aristotle University of Thessaloniki, https://www.auth.gr/en
  - Mc Neel, http://www.mcneel.com/
  - Up2Metric, www.up2metric.gr
  - Nurogames, https://www.nuromedia.com/
  - Zaha Hadid Architects, https://www.zaha-hadid.com/
  - Moben, https://benayoun.com/moben/
  - Analog Native, http://www.analognative.net/
  - Espronceda, https://www.espronceda.net/
  - Eseniors, http://www.eseniors.eu/
  - Ajuntament de l´hospitalet, http://www.l-h.cat/
  - City University of Hong Kong, http://www.scm.cityu.edu.hk/

- **STARTS Regional Centres**
  - BOZAR, https://www.bozar.be/en
  - Ars Electronica, https://ars.electronica.art/news/
  - French Tech Grande Provence, https://lafrenchtech-grandeprovence.fr/
  - MEET, https://www.meetcenter.it/en/home/
  - Made Group, https://madegroup.co/
  - Film University Babelsberg Konrad Wolf, https://www.filmuniversitaet.de/en/
  - Gluon, http://gluon.be/

Other organisations that participated at the Art-Science Symposium (2-3 March 2020) at IRCAM Centre Pompidou

- Science Gallery Dublin, https://dublin.sciencegallery.com/
- WZB Berlin Social Science Center https://wzb.eu/en
- Melbourne Science Gallery, https://melbourne.sciencegallery.com/
- Artists in Residence Television, http://artistsinresidencetv.com/
- Institute of Unnecessary Research, https://unnecessaryresearch.tumblr.com/
- Polyhedra, https://klas.polyhedra.eu/
- Swissnex San Francisco, https://www.swissnexsanfrancisco.org/what-we-do/pier-17-science-studio/
- The MIT Center For Arts, Science & Tachnology, https://arts.mit.edu/cast/

about/
• Code / Art Research Program, https://codedigitalart.ch/
• Norwegian University of Science and Technology (NTNU), Artek, https://www.ntnu.edu/artec
• Art Partner, https://www.art-partner.nl/en/
• Kersnikova Institute, https://kersnikova.org/
• Université de Bordeaux, Chaire arts & sciences https://idex.u-bordeaux.fr/fr/n/Connexion-avec-la-societe/Arts-et-sciences/r3043.html
• Leonardo/ISAST, https://www.leonardo.info/
• Museum of Applied Arts and Sciences
• University City Science Cente
• Physics and Astronomy, Queen Mary University of London
• École Nationale Supérieure des Arts Décoratifs
• Griffith University

LIST OF FIGURES

LIST OF IMAGES

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