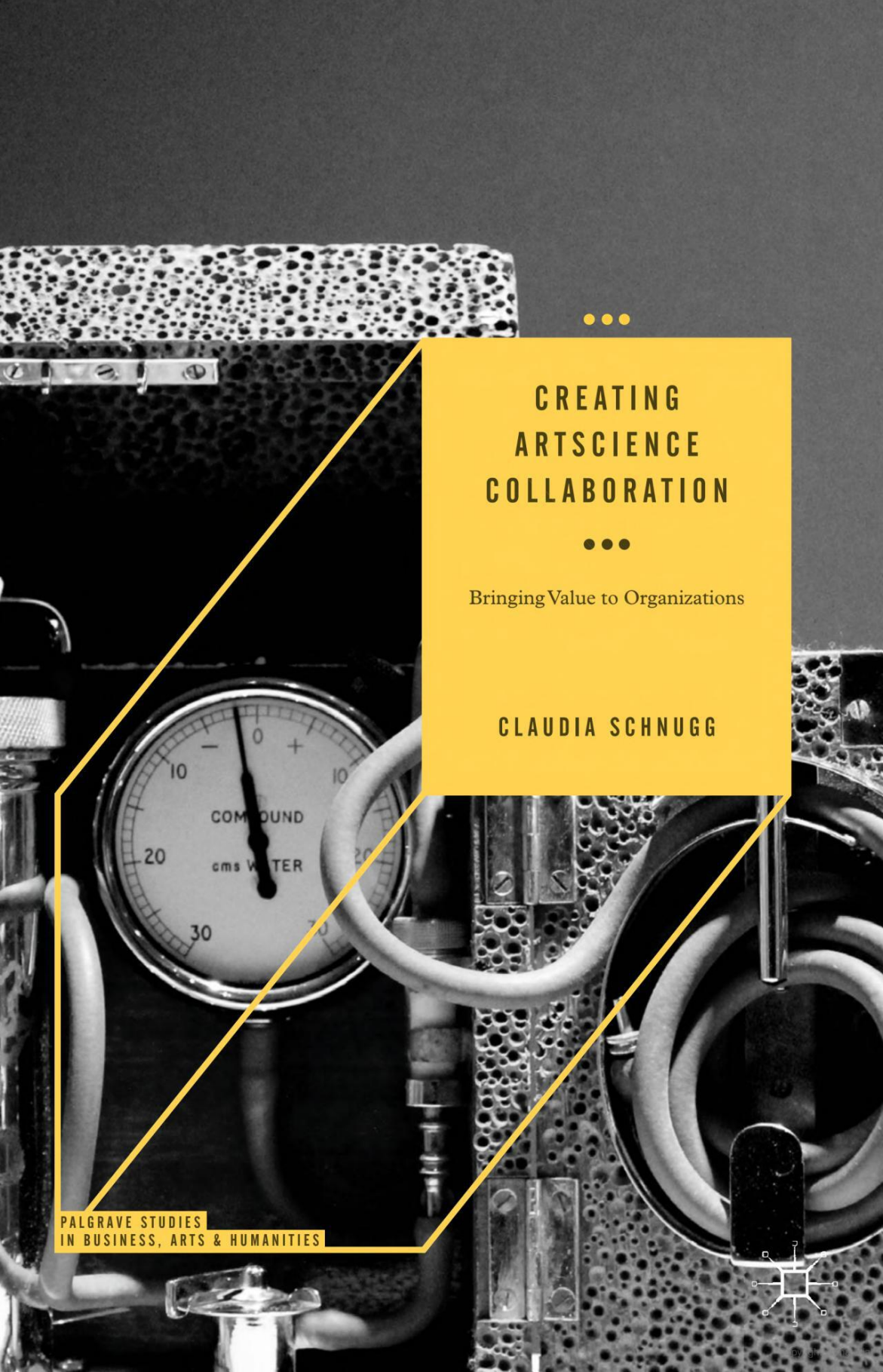
CREATING
ARTSCIENCE
COLLABORATION
Bringing Value to Organizations
CLAUDIA SCHNUGG
PALGRAVE STUDIES
IN BUSINESS, ARTS & HUMANITIES

Claudia Schnugg

Creating ArtScience Collaboration

Bringing Value to Organizations

palgrave
macmillan

Claudia Schnugg
Wels, Austria

ISSN 2662-1266 ISSN 2662-1274 (electronic)
Palgrave Studies in Business, Arts and Humanities
ISBN 978-3-030-04548-7 ISBN 978-3-030-04549-4 (eBook)
https://doi.org/10.1007/978-3-030-04549-4

Library of Congress Control Number: 2018964911

Cover illustration: 'Pneumothorax Machine' by Anna Dumitriu. © Anna Dumitriu

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

List of Figures

1

Building up the Basics: An Introduction to ArtScience Collaboration

In a time of rediscovery of art and cultures of antiquity, artists started out to employ scientific principles and philosophy in order to experiment with daily processes of perception. Artists no longer see their roles in the depiction of religious motives, but want to contribute to the exploration of nature or even outplay it with their work. Based in this new self-understanding of art and a process of societal change, a curious scene can be observed: in 1412, the well-known Florentine craftsman Filippo Brunelleschi stands in front of the Florentine Dome looking at the Baptistery through a strange wooden construction, inviting passersby to look through and to see a perspectively correct representation of the Baptistery. In this way, Brunelleschi demonstrates his newly developed method of central perspective to his fellow citizens. He developed this method from his architectural and sketching point of view by investigating geometry and ways of seeing with the goal to create the illusion of depth in paintings. This is the environment where crossing borders between disciplines to create advancement in different fields is rediscovered—and the fruitful environment where the often-cited genius of Leonardo da Vinci is born and where he goes through an apprenticeship as painter, in a world where artists start to cross borders and do not want to be part of this reductionist guild of artisans of high professions. Openness and observation of the world are important for these artists to create their progressive artworks, which drives them to employ methods from natural sciences like mathematics and investigations into the body as basic fundamentals of their artistic production. This led not only to artistic development but also to scientific investigations, or to visionary ideas about flying machines, such as those demonstrated by Leonardo da Vinci.

C. Schnugg, *Creating ArtScience Collaboration*, Palgrave Studies in Business, Arts and Humanities, https://doi.org/10.1007/978-3-030-04549-4_1

A yearning for this time seems to be prevalent in our current culture, where the call for "new Leonardos" as figurehead of this fruitful melting pot of art and science is getting louder, as creativity and innovation are major buzzwords that drive economic and social development. Thus, lately, art and science are often named in one sentence: not only as opposite approaches to reality but also as fertile ground for innovation, new perspectives on important questions, deeper understanding of current developments, and exploration of recent technologies to be created. There is an unsatisfied need for this elusive "something new," which is interesting, helps to make the world a better place, helps to redefine societal structures, lowers production costs, or helps to create a more sustainable life. To create this, no new Leonardos as genius individuals are needed; however, opportunities for interdisciplinary exchange that allow for open-ended processes to investigate nature and new technological as well as scientific possibilities are needed. And an exchange that includes artists with their insatiable thirst for investigation, contextualization, and future visions seems to be a productive way to do so. This weird outcome may be ambiguous, like the weird wooden construction by Brunelleschi, but taking it further in scientific, technological, and artistic context can elevate such an outcome to an important innovation that can be understood retrospectively.

Moreover, the artistic or scientific outcome is not always groundbreaking, but the interaction between artists and scientists can be the critical endeavor to change work processes or set the stone for groundbreaking methods. Thus, it is the process of this interdisciplinary investigation that comprises the most interesting aspect, of which the outcome often cannot be foreseen. Individuals who have insights into different areas are often understood as those artists and scientists who are able to create paradigm-shifting ideas: they are either artists or scientists who want to go deep in their field and are able to draw from their extensive experiences in other fields; they understand connections or analogies (Edwards 2008; Root-Bernstein et al. 2017; Kemp 2016).

But it is not only diverse interests that help individuals to create such insights: as art and science are both fields of deep knowledge and imply long learning processes of methodologies and processes, engagement in collaboration can broaden the scope and connect subtle understandings of well-educated individuals from each field. Therefore, it is important to investigate the interdisciplinary process of artscience collaboration to realize the multifaceted implications for the collaborators' knowledge and skills. At the same time, this process can have impressive by-products or lead to enlightening outcomes. This process is thus important, as there is no definite answer as to what the artistic or aesthetic experience does to the recipients, but there are

many processes that can take place and are important to consider for evaluating the impact of the encounters with art and artists (Belfiore and Bennett 2007).

The fragmented understanding of the effects of the engagement with art is based on cognitive, psychological, and sociocultural dynamics. Bringing together a few of them to create a more comprehensive understanding of the artscience collaboration process is the major contribution of this book. First things first though: for starters, a little bit of clarification of terminologies is needed, and, moreover, these recent years are not the first time that these artscience attempts have been made since the Renaissance and on which current collaborations build. Thus, a brief overview of the major developments of the twentieth century will be given in the remainder of this chapter.

1.1 First Things First

Artists and scientists are creative in their work; they produce knowledge and create exciting artworks. They have different workflows, are concerned with different practical issues in their work, and approach bigger problems from their own perspective. However, artists and scientists are often concerned with similar topics: some focus on environmental issues—such as climate change—or societal issues, while others are interested in technologies; secrets of the universe are as fascinating to artists as they are to scientists. Although there is this call for new Leonardos and people who are able to engage across the fields, as we saw in the case of Filippo Brunelleschi, often it is important to take a step outside the own professional field and look into other fields to create something new that is relevant for art, science, and society. In our society, where art and the scientific disciplines create deep knowledge that often relies on previous training in different disciplines or mastering very specific technologies, if an artist or a scientist wants to draw from other disciplines and go beyond superficial knowledge or rough application of methods, the most interesting way to learn and implement new skills is to collaborate.

This is where artscience collaboration starts: basically, it refers to a process where artists and scientists work together on a project or relevant research question. These projects can aim to produce a joint outcome, like an interesting artwork, or to work with a scientific idea. Further reasons why artists or scientists or even their employers are interested in doing so can be manifold: artists have their artistic goals and scientists their scientific goals; organizations even have additional goals like human resource development, project development, or cultural change. Nevertheless, the basic idea is that the artist

and the scientist collaborate and bring together their ideas and skills; thereby, they are tackling bigger problems or research questions they are interested in. The duration can be quite variable: some are short-term projects of a few weeks, other are projects that go on over half a year or up to several years. Such long-term collaborations allow the partners to develop project ideas and realize them. Sometimes, based on the experience of specific projects, artists and scientists develop an ongoing working relationship.

The intensity of the collaboration can differ. For example, some corporate and scientific institutions invite artists to stay at their facilities for a certain amount of time to produce an artwork or to get inspired by the scientific work being done there. This does not necessarily imply that one artist and one scientist or a scientific group will work together intensely on a specific project, but it can mean that the artist invites scientists to discuss and contribute to certain phases of their work. All different types of intensities of collaboration can add value to the work of artists, scientists, and organizations, but they can lead to different kinds of outcomes.[1] Intense collaborations are more likely to bring new insights or personal development processes to all participants, whereas less intense processes, for example, can affect motivation and networking opportunities or lead to smaller learning processes. How the interaction affects artists, scientists, and organizations is much dependent on the situation, personalities, and organizational cultures involved. Nevertheless, knowledge about the aspects of the collaboration process can help to frame the interaction in a more detailed way toward the needs of artists, scientists, and organizations.

Artist-in-residence programs are a more formalized opportunity to realize artscience collaboration within organizational structures. These programs provide artists with the opportunity to work at a scientific organization or to stay at an organization where they can work and collaborate with scientists. The formal structure of the "artist-in-residence" program says nothing about the intensity of the artscience collaboration or about the length of the interaction. Nevertheless, residencies are often longer than two months. Most programs that allow for shorter stays call these "visits" instead of residencies. To qualify as a program, these formats offer regular opportunities for artists. These residencies imply that the artists stay at the scientific organization over a certain amount of time for collaboration. Some programs have a clear focus on the collaboration process or artistic intervention in the scientific process; others offer these

[1] For example, Jack Ox (2014) relates different kinds of outcomes like visualization of scientific work or highly interesting artscience projects for different kinds of intensities of the collaboration process.

residencies to create new art pieces that are based on these new experiences and collaboration processes. Some programs include the opportunity for commissioned artworks based on the experience during the residency.

In contrast to the growing number of artist-in-residence programs offered at scientific organizations or by cultural organizations in collaboration with scientific organizations, there are rarely scientist-in-residence opportunities. There are several reasons for this. For scientists of many STEM[2] disciplines it is difficult to work for a few months in an artistic environment without access to scientific facilities. Moreover, within a scientific career path, it is often difficult to spend a sabbatical outside for personal development and learning processes that do not immediately contribute to scientific outcome which can be published and is important for future funding and positions.

Another term that is more and more often used is "arts-based initiatives," sometimes also called "artistic interventions." These terms more generally point to initiatives that bring art into organizational contexts, mainly to reach an organizational aim. The term arts-based initiative is perceived as more neutral than artistic intervention. Artistic intervention rather implies an active role of art or artists to initiate change in the environment in which they are invited. Intervention is sometimes used to indicate a disruptive character of art in scientific or corporate organizations. These terminologies refer to the difference of the fields and the foreign character of artistic processes and perspectives to scientific or corporate ones. Hence, the words "encounter" and "collision" of art and science are often used.

Additionally, "artscientist" is another term that emerged in the last decade. It was introduced to label those individuals who draw from their own experience in art and science for their own professional work (Edwards 2008). The artscientist refers to the importance of getting experience in diverse scientific and artistic fields to gain new perspectives that help to obtain new insights in the own profession. This is strongly connected to ideas of the importance of including art in education, which were made prominent by John Dewey (1934) in the first half of the twentieth century. Moreover, artistic approaches inspire to walk across disciplinary borders or go beyond traditional approaches, as, for example, Thomas Kuhn shows in *The Structure of Scientific Revolutions* (Taylor 2014; Bijvoet 1997). This is an important argument of the "STEM to STEAM[3] movement" pointing to the importance of art in STEM education. Advocates of STEM to STEAM argue

[2] STEM refers to disciplines from Science, Technology, Engineering, and Mathematics.

[3] STEAM refers to Science, Technology, Engineering, Art, and Mathematics.

that the inclusion of art helps STEM professionals to broaden their knowledge and skill base, create the capability of drawing connections between different fields, improve the perception of complex situations, or gain new perspectives on difficult issues. Similar effects are observed in scientists who start to engage in artscience collaboration.

1.2 Tracking ArtScience Collaboration

The idea to see an equivalence between artists and scientists exploring the edges of knowledge in an interdisciplinary no-man's-land and the power of the creative capacities of artists, inventors, and scientists of the Renaissance is not emerging for the first time now at the beginning of the twenty-first century. The idea to break the boundaries between these two distinct fields of creation and interrogation of reality has been explored several times to date. Most prominently, the creative explorations of artists, engineers, and computer scientists in the mid-twentieth century have already been compared to those of influential artists and inventors like Leonardo da Vinci (Taylor 2014). Ideas of conceptual art and the art and technology movement (Shanken 2002), groups of artists connected to the Fluxus circles or kinetic art, and the origins of computer art as important in the 1950s and 1960s are exemplary for this time. In these exciting years of an artistic, scientific, and technological sense of "get-up-and-go," the time was ripe to explore new ways of working with new technologies and artistic production. Connected to many of these experiments, various interdisciplinary and transdisciplinary scientific fields evolved, such as computer graphics, computer visualization, and diverse streams within media art (Van Dijck 2003).

Although many of these ideas were developed around the same time, exploring possibilities of art, technology, and science was—like today—not a movement with a uniform set of ideas on how and why to create interdisciplinary collaboration (Taylor 2014). Philosophers, practitioners, and theorists at this time started to point to the possible effects of interdisciplinary collaboration in arts and sciences. Starting from the influential writings of Norbert Wiener, Herbert Marshall McLuhan and R. Buckminster Fuller's thoughts on general system theory and cybernetics reached the art world. Especially McLuhan's work *Understanding Media* (1964) was well received by artists who were interested in new technologies (Bijvoet 1997) and inspired art theorists to include system theory and cybernetics in their ideas about art (see a selection of publications collected in Topper and Holloway 1980, 1985). As an important contribution to the discussion, Susan Sontag introduced a

discussion about possible congruencies and differences between art and sciences and technology. In *One Culture and New Sensibility* (1967) and *Against Interpretation* (1967), she explained the artistic experimentation in other fields as a transformation of the function of art through a new cultural and social sensibility. She pointed to the exploration of the boundaries of art as reflection of a change in social life and culture, where fields like art and technology start to move closer and change each other.

In the mid-twentieth century, scientific and technological laboratories started to see opportunities in opening up their ways of working in order to create exchange and explore possibilities with the tools and the ideas they created. For example, after the success of the Radar Laboratory's interdisciplinary research group activities, the first interdisciplinary research laboratory at the Massachusetts Institute of Technology (MIT), the Research Laboratory of Electronics, was founded in 1952. Finally, in 1967, the Center for Advanced Visual Studies (CAVS) was founded at MIT that included artistic perspectives. MIT has remained an important player in this field up until today and strengthened its position with the foundation of the MIT Media Lab in 1985 (Bijvoet 1997), which is today still leading in the field of artscience.

From this fruitful environment sprang many different initiatives, and influential artists and scientists developed ideas that laid the foundation for growing interdisciplinary fields like computer graphics, and ideas were developed which are now reflected in the growing field of artscience. For example, influenced by the ideas of Bauhaus and Constructivism, György Kepes started to integrate visual arts with the visual idioms of the daily environment and to connect the languages of different disciplines and distinct ways of visual communication, like photography, motion pictures, and television, in his book *The Language of Vision* (1944). In the late 1960s, artist and physicist Bern Porter coined the term SciArt, referring to a field that includes artistic and scientific approaches (Porter 1971 as in Sleigh and Craske 2017).

Artists sought new content and media and had a desire to participate in this emerging outside the realm of the arts. Artists exploring the boundaries of traditional media and approaches went in different directions: for example, Jasia Reichardt, who organized the path-breaking exhibition *Cybernetic Serendipity* in 1970[4] in London, an exhibition about works on cybernetics—the control and communication in the animal and machine in order to explore the relationships between technology and creativity; or Jack Burnham, who

[4] *Cybernetic Serendipity. The Computer and the Arts.* (1968) Edited by Jasia Reichardt. London: Institute of Contemporary Art, New York/Washington/London: Praeger Publishers.

created the exhibition *Software* in 1970[5] in New York with a focus on information processes and showing creative possibilities of computer-based art. Individuals on the edge of computer science and graphics explored computer art with a more exploratory approach instead of the ideological and societal goals that the Fluxus circles had in mind in their ways to cross disciplinary boundaries (Taylor 2014). These prevalent ideas of crossing discipinary boundaries and the growing accessibility of computers, technologies, and software in the 1960s allowed a movement to develop where artists started to explore these new media.

Most important for the development of formats for artists, engineers, and scientists to collaborate were the foundation of the Experiments in Art and Technology (E.A.T.) at the AT&T Bell Telephone Laboratories, initiated by Billy Klüver, and the artist-in-residence program at the Los Angeles County Museum of Art, called the Art and Technology Program, initiated by Maurice Tuchman in 1967. Both programs had a major impact on bringing artists into the new environment of scientific, technological, and corporate organizations and explored the potential of collaborations. "The idea was that a one to one collaboration could produce something that neither of the two could individually foresee. And that was the basis for the whole thing, and the system developed from there," as Klüver states about E.A.T. (Candy and Edmonds 2002: 8). The outcomes ranged from artworks based on the most recent technologies, to artistic exploration of the use of such technologies, to reflections of aspects prevalent in the organizations or the organizational sites. Both programs were recognized within the artistic and the scientific community, also because important artists, scientists, and well-known organizations like AT&T Bell Telephone Laboratories and the Los Angeles County Museum of Art were involved. At E.A.T., personalities like Billy Klüver, Fred Waldhauer, Robert Rauschenberg, and Robert Whitman were involved (Patterson 2015). The Art and Technology Program in Los Angeles invited artists like Victor Vasarely, Roy Lichtenstein, and Andy Warhol to be hosted in organizations like IBM, Universal Film Studios, and Hewlett Packard. The program invited Richard Feynman as consultant, who was working at CalTech at this time.

Prominently positioned in the journal *IEEE Spectrum*, Nilo Lindgren contributed two articles on art and technology as a "call for collaboration" (1969a, b). Based on experiences and the work coming out of the newly funded initiatives, he asks about the roles of artists and engineers in the collaboration process and how engineers could profit from such a collaboration.

[5] *Software, Information Technology: Its Meaning for Art.* (1970) Curated by Jack Burnham. New York: Jewish Museum.

He sees potential in changing traditional ways of working in art, technology, and science to create new forms of projects. This is interesting because at that time the artistic profession was not so open for collaboration.

Another initiative that focused more on the changing power of the arts was the Artist Placement Group (APG), founded in London in 1966. Influenced by the ideas of the Fluxus movement, the artists John Latham and Barbara Steveni created an artist-in-residence program in industrial and governmental organizations. These placements of artists in organizational settings aimed at triggering change in workflows and organizational culture, or creating new ideas. Although the idea is close to the initiatives in the USA, the lack of regulation of the collaboration and the often-missing artistic output led to questioning of the program's effectiveness and the funding ceased.

In the 1970s, many of these initiatives started to disappear from a broader discussion, sometimes because of the lack of funding, sometimes because it was still difficult for scientific fields, the artistic community, and corporate organizations to understand and evaluate the outcomes of these collaborations. These experimental settings led to many developments in computer arts, new streams of media art, and new forms of hybrid scientific fields like computer graphics and visualization. Nevertheless, outcomes based on, for example, the exploration of upcoming technologies like plotters, cameras, or audio recordings were difficult to evaluate at the time of their first presentation (Van Dijck 2003; Taylor 2014; Patterson 2015). Only retrospectively in the last few decades have the value and possible utilization of these developments been more broadly understood.

One medium that went on connecting the discussions and developments in the fields of art, science, and technology was the journal *Leonardo*. In 1968, Frank J. Malina founded *Leonardo* with a focus on contemporary art as a platform for communication between artists. From the beginning, Malina, himself a pioneer in light and motion art, thought it was important to display a wide range of topics that might be interesting for artists, and thus the journal would give space for insights from fields like physics and psychology, but also from philosophy, aesthetics, and artistic fields like theater, cinema, and architecture. He was convinced that artists need to communicate about the use of new scientific developments, techniques, and technologies. This created a platform for interdisciplinary fields that otherwise often operated in no-man's-land, where neither artistic nor scientific or technological outcome was difficult to publish and reflect upon in its respective field. In 1981 Roger F. Malina became executive editor and has been an important agent in pushing the field of art and science ever since. He pushed

toward widening the scope of influence with fields like language, performance, music, media, and environmental and conceptual art. Moreover, he wanted to open up the journal to legal, political, and economic aspects. In his later editorials, Malina identifies how media arts could at the time address contemporary needs of society and problems of contemporary scientific practice (Malina 2012). He is arguing for art and science collaboration and interdisciplinary exchange through a shared language, which is important to build a common ground (Malina 2011). The International Society for the Arts, Sciences and Technology (ISAST) was founded with the support of the two founding board members Frank Oppenheimer and Robert Maxwell in 1982 as a network of artists, scientists, and engineers. *Leonardo* became the official publication platform and the journal changed its subtitle, now being called *Leonardo: Journal for the International Society for the Arts, Sciences and Technology.*

The second early founded platform for exchange of ideas that opens the discussion to a wider audience is Ars Electronica, a new media art festival focusing on the nexus of art and technology and including its societal impact. Based in Linz, Austria, the festival was established in 1979. After most of the initial programs had already ceased, this festival provided a place to meet, to present work, and to exchange new ideas.

An important reference point for recent artscience programs in organizations is Xerox PARC's (Palo Alto Research Center) Artist-in-Residence Program (PAIR). The program was initiated by Rich Gold in 1993, supported by John Seely Brown, chief scientist at Xerox and responsible for PARC (Harris 1999). The idea of PAIR was a step in applying the founding idea of the laboratory. The initial idea of the research laboratory Xerox PARC was to connect people from interdisciplinary backgrounds in order to create a conglomerate that is able to build new technologies including hardware and software from the basic idea up to the final product. The open culture of this research laboratory invited future users and possible customers into the lab to collaborate with the employees on questions concerning usability and basic needs, and give feedback to existing products and prototypes. Through PAIR, artists could be included in this community and work collaboratively with scientists, researchers, and engineers on new ideas. The idea behind that was to use this shared knowledge between artists and scientists (on media, methods, or specific questions) as a starting point for collaborative exploration and creation of ideas. In recent years, this program has become a role model for many programs at corporations and scientific organizations because the organization, scientists, and contributing artists saw a lot of value in these collaborations, which were extensively published.

The interest in such initiatives came back in the last decade, and the potential to push borders in art, science, and corporate situations has been rediscovered. Lately, corporate programs, artist-in-residence programs in scientific organizations or within publicly funded scientific projects, and academic opportunities for artists and scientists to cross the borders of their fields have been growing rapidly. The interest in artscience collaboration and its possible effects—like the game-changing experiments at Bell Labs in the 1960s, the development of computer graphics that started out as an exploration in a no-man's-land, or the seminal residencies at Xerox PARC—is growing rapidly. The Swiss Artists-in-Labs program was started in 2003 to bring artists into scientific laboratories. A growing number of scientific and cultural organizations like laboratories, galleries, and departments at universities support artscience centers and provide opportunities for exchange between students from artistic and scientific faculties. Influential role models for these centers are SymbioticA at the University of Western Australia and the Art|Sci Center at the University of California, Los Angeles (UCLA) for universities all over the world. These centers bring together scientists, artists, and students from artistic and scientific faculties. An important outreach and communication role is played by Science Gallery, which started out at Trinity College Dublin. It is now a constantly growing worldwide network of Science Galleries connected to universities. What these centers have in to common is their focus on the process and the idea that right where art and science collide, the lust for exploration and groundbreaking twists in thinking can be ignited.

But what makes the artscience collaboration process so special? And what are the necessary preconditions to create a fertile ground for this extraordinary exchange? As it is important to understand the process first, the next few chapters will focus on artscience collaboration. Based on this knowledge, the last part will discuss practical issues of bringing artscience collaboration to life.

References

Belfiore, E., & Bennett, O. (2007). Determinants of Impact: Towards a Better Understanding of Encounters with the Arts. *Cultural Trends, 16*(3), 225–275.

Bijvoet, M. (1997). *Art as Inquiry. Toward New Collaborations Between Art, Science, and Technology*. New York: Peter Lang.

Candy, L., & Edmonds, E. (2002). *Explorations in Art and Technology*. Berlin: Springer.

Dewey, J. (1934). *Art as Experience*. New York: Minton, Balch & Company.

Edwards, D. (2008). *Artscience: Creativity in the Post-Google Generation*. Cambridge: Harvard University Press.

Harris, C. (1999). *Art and Innovation. The Xerox PARC Artist-in-Residence Program*. Cambridge: MIT Press.

Kemp, M. (2016). *Structural Intuitions. Seeing Shapes in Art and Science*. Charlottesville/London: University of Virginia Press.

Lindgren, N. (1969a). Art and Technology I – Steps Toward a New Synergism. *IEEE Spectrum, 6*, 59–68.

Lindgren, N. (1969b). Art and Technology II – A Call for Collaborations. *IEEE Spectrum, 6*, 46–56.

Malina, R. (2011). Non-Euclidian Translation: Crossing the River Delta from the Arts to the Sciences and Back Again. *Leonardo Reviews Quarterly, 1*(3), 6–8.

Malina, R. (2012). Is Art-Science Hogwash?: A Rebuttal to Jean-Marc Levy Leblond. *Leonardo, 39*(1), 66–67.

Ox, J. (2014). Art-Science Is a Conceptual Blend. *Leonardo, 47*(5), 424.

Patterson, Z. (2015). *Peripheral Vision: Bell Labs, the S-C 4020, and the Origins of Computer Art*. Cambridge, MA: MIT Press.

Root-Bernstein, R., Pathak, A., & Root-Bernstein, M. (2017). Review of Studies Demonstrating the Effectiveness of Integrating Arts, Music, Performing, Crafts and Design into Science, Technology, Engineering, Mathematics and Medical Education. Part 1, Part 2, Part 3. *White Paper.*

Shanken, E. A. (2002). Art in the Information Age: Technology and Conceptual Art. *Leonardo, 35*(4), 433–438.

Sleigh, C., & Craske, S. (2017). Art and Science in the UK: A Brief History and Critical Reflection. *Interdisciplinary Science Reviews, 42*(2), 313–330.

Sontag, S. (1967). *Against Interpretation*. New York: Farrar, Straus, & Giroux.

Taylor, G. D. (2014). *When the Machine Made Art. The Troubled History of Computer Art*. New York: Bloomsbury.

Topper, D. R., & Holloway, J. H. (1980). Interrelationships Between the Visual Arts, Science and Technology: A Bibliography. *Leonardo, 13*, 29–33.

Topper, D. R., & Holloway, J. H. (1985). Interrelationships of the Arts, Sciences and Technology: A Bibliographic Update. *Leonardo, 18*(3), 197–200.

Van Dijck, J. (2003). After the "Two Cultures": Toward a "(Multi)cultural" Practice of Science Communication. *Science Communication, 25*(2), 177–190.

Part I

Perspectives on the ArtScience Collaboration Process

It is important to give space and time to the artscience collaboration process. Only through deep engagement in this extraordinary interdisciplinary process that is demanding for artists, scientists, and organizations can truly groundbreaking ideas follow. These are based on personal development, creation of new knowledge, game-changing experiences, or new connections that are made, connections with other people, or connections between different fields. The theoretical perspectives on artscience collaboration and the cases presented aim at creating awareness of the intensity of the process and the importance of seriously engaging in the process in order to allow all these desired effects to emerge. By understanding the process, it is easier for artists and scientists to get involved in artscience collaboration, and it helps managers and curators to create enough space for the projects to happen and to guide artists and scientists through the process.

The theoretical perspectives presented in the following chapters are as follows: interdisciplinary collaboration and development, contextualization, liminality, social network theory, sensemaking, aesthetics, communication, and creativity theory. The chapter on interdisciplinary collaboration creates a basic understanding of such collaboration, its goals and processes, for example, specific ways to raise questions and trigger learning. The theory of contextualization presents how artscience collaboration helps artists and scientists to gain a broader perspective on their work and relate it to stakeholder groups or the work of other scientific disciplines. This additionally points to two ideas: first, how artscience projects can support ethical reflections and, second, how

they can help the actors to find meaning in their work again. The theory of liminality deals with the idea of artscience collaboration as creating space for exploration, experimentation, and play and enabling changes. Next, with the theory of social networks, the potential of the new connections initiated by artscience projects within organizations and between different fields is explored. Going on to a more cognitive change, the chapter on sensemaking explores how the collision of art and science affects sensemaking processes and potentially leads to new ways of understanding. The chapter on aesthetics is closely connected to this idea: aesthetic knowledge, embodied processes, and sensory perception in the experience of artscience collaboration are explored as potential for new insights and learning processes. The chapter on communication explores how artscience projects can affect communication skills and add new ways of communication, and how artscience projects are intertwined with outreach and public engagement. Finally, creativity theory is explored. This chapter shows how all the other aspects of the artscience collaboration process influence the emergence of creativity and how intense and multilayered the process of fostering creativity is.

2

Interdisciplinary Collaboration

Laying down the theoretical foundations of artscience collaboration, it is first necessary to define collaboration. Most scholars agree that collaboration is a well-defined relationship between two or more parties (organizations or individuals) that is mutually beneficial. The involved parties co-develop structures and strategies, are committed to a common goal, share responsibility, have mutual authority and accountability for success, and thus share outcomes and rewards (Mattessich and Monsey 1992). Interdisciplinary collaboration can be understood as the coordinated relationship between two or more parties who are trained in different disciplines to reach a shared goal. These collaborations can be designed more instrumentally and aim at solving a shared goal by contributing different skills and knowledge sets, but they can be more conceptual and aim at the development of a joint field that involves practices and knowledge from the respective fields of the partners.

Complexity of tasks calls for collaboration to reach goals and to solve problems because obviously the professions and scientific disciplines have reached a certain amount of knowledge and depth that is difficult to understand without extensive education and experience. Interdisciplinary and transdisciplinary collaboration between academics and practitioners has been advocated and researched by social scientists for a few decades (e.g., Klein 1990, 2008). The most prominent examples of problems that need to be tackled collaboratively are sustainability, climate change, changes in society driven by new technologies, and the threat of evolving diseases. Approaching these issues needs expert knowledge from many different fields and experimental approaches to find possible solutions (Falk-Krzesinski et al. 2011; Popescu 2014). The contribution to a specific problem or the development of an

C. Schnugg, *Creating ArtScience Collaboration*, Palgrave Studies in Business, Arts and Humanities, https://doi.org/10.1007/978-3-030-04549-4_2

interdisciplinary field can include different kinds of expert knowledge, methods, ways to work (e.g., analytical approaches vs. synthetic approaches), new perspectives on an issue, diverging interpretations of the issue, and awareness of the weak areas of one's field (Amey and Brown 2004).

Although collaborations, especially interdisciplinary collaboration, are intense, take time to establish structures, and thus take time to deliver, they have to be seen as an investment: beyond completion of the set goal, each collaborator can develop new competencies. A reflection of different paradigms in the fields and contradictions can help to understand the blind spot in the own discipline or methods, which helps to focus on these areas to build up new competencies. At the same time this reflection helps to better understand the strengths of the own disciplinary perspectives and to acknowledge the importance of interdisciplinary exchange (Amey and Brown 2004). Interdisciplinary collaborations can be confrontational, as issues appear different seen from diverse disciplinary perspectives. This is important to understand and explore in a common procedure. A successful collaboration can be reached through trust and mutual respect, a shared vision, flexibility, and enough time allocated to the interaction, as well as open, honest, and respectful communication (Mattessich and Monsey 1992).

Such successful collaboration between two or more interdisciplinary collaborating partners who have shared goals or interests can be short term and focus on one project, or it can develop into a long-term relationship of fruitful exchange. In the case of artscience collaboration the professional education is probably farther apart than between different academic disciplines. This makes artscience collaboration difficult to manage because artistic goals and scientific goals are bound to different paradigms: a good artwork that contributes to the artistic realm is not the same as an impactful scientific outcome. Nevertheless, artists and scientists are often interested in the same issues, materials, and media, and thus such collaboration has huge transformative potential: there is great potential for gaining new insights, applying new methods and perspectives, and creating new research and artistic agendas.

The following case shows the possible impact of the collaboration of artists and scientists at the intersection of their interests by employing the same media and methods. In this case, artists can learn from laboratory practices to develop an understanding of the scientific process and, at the same time, they can ask important questions that lead to new interpretations of methods or media. Moreover, artistic interest in the scientific work and media can open up new opportunities for scientists to explore new projects. Sometimes, just as in the following case, the artistic and scientific questions asked can even trigger entrepreneurial interest. It is important to note that the original

artscience collaboration did not have any instrumental character to create an economically valuable outcome, but the openness of the process and the highly important questions asked by artists and scientists inspired entrepreneurial ideas.

Case: The Tissue Culture & Art Experiment—About Art and a Laboratory Fridge Equaling Artificially Grown Meat and Leather

The artists Oron Catts and Ionat Zurr started the "The Tissue Culture & Art Project" (TC&A) in 1996 as an ongoing research and development project on the use of tissue technologies as a medium for artistic expression. The artworks they realized throughout the last few decades revolve around important questions from the ethical exploration of artificially produced meat to misconceptions in the public that the genetic code equals life and that life is information. These big topics that the TC&A raises are connected to a fundamental mechanism of art: art generates questions, poses ideas, and leads to reflections instead of giving answers and reaching solutions (which the task of design is, e.g., industrial design).

Early in his thesis on speculative design within the study of design, Oron Catts realized for himself that he is much more interested in posing these important questions than in finding solutions to given problems—which can never be final solutions. In this way he approached tissue engineering, which was in art as well as in science still an open field to explore, as there were only few artists and scientists working on the topic. After initial research in the field, artists and scientists started to point the duo (Cats and Zurr) to scientists who were already interested in the topic of tissue engineering, and finally, there was an opportunity for funding where they could work collaboratively in the lab. It was important for them to be funded in order to have an equal and justified position in the lab without being dependent on the goodwill of individuals. Finally, in 1999, they were able to receive funding for their artscience research laboratory SymbioticA at the University of Western Australia, which was founded in 2000. In the same year they had the opportunity to move to the Harvard Medical School for a year as research fellows. As research fellows they were full members of the team and were included in all obligatory activities like lab meetings. A scientific colleague of theirs was doing tissue engineering using muscles, growing them from fetal cells, where she looked at satellite cells. Although she needed a limited number of cells, she could not throw away the excess muscle cells, which were filling up all fridges. For the two artists it seemed to be an obvious next step to take these cells and grow meat. Presenting their research in the lab meeting, the head of

Fig. 2.2 *Disembodied Cuisine* installation by The Tissue Culture & Art (Oron Catts, Ionat Zurr & Guy Ben-Ary) 2003, mixed media, photography by Axel Heise. (Image courtesy: TC&A, hosted at SymbioticA, School of Human Sciences, University of Western Australia)

growing in-vitro meat. Since then, many research initiatives have been started in the field, where scientists try to find their approach to the topic. In the meantime, the artists go on posing new questions, raising ethical issues and questioning processes in the production of in-vitro meat and leather, like in *Victimless Leather* (2004). The artists do not want to take credit for the invention of in-vitro meat or leather, but in collaboration with scientists, by learning scientific techniques and through their exploration of the scientific work, they were able to push scientific and artistic boundaries—using tissue engineering in art and creating awareness of the possibilities in science, raising ethical questions, and even inspiring corporate startup ideas—and they offer this as a starting point for cultural discussion of important topics (Fig. 2.3).

Some argue that artistic processes and scientific processes are fundamentally different. Although artists and scientists are creative in their work, and each scientist and each artist has their individual work process, they do have different audiences in mind and are trained differently in approaching their ideas. Scientists and engineers are trained to efficiently solve a specific problem by first asking a big question, then dividing it into different parts or fields,

Index[1]

[1] Note: Page numbers followed by 'n' refer to notes.

C. Schnugg, *Creating ArtScience Collaboration*, Palgrave Studies in Business, Arts and Humanities, https://doi.org/10.1007/978-3-030-04549-4