

# Worldmaking as Techné

PARTICIPATORY

ART, MUSIC, AND ARCHITECTURE

Edited by Mark-David Hosale, Sana Murrani,  
and Alberto de Campo with a Foreword by Roy Ascott





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## **Worldmaking as Techné: Participatory Art, Music, and Architecture**

Editors: Mark-David Hosale, Sana Murrani, and Alberto de Campo  
with a Foreword by Roy Ascott

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*From a pub in Milan...*

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# Foreword

At the midpoint of 20<sup>th</sup> century culture, in the slipstream of the intellectual momentum established most notably by Ross Ashby, Gregory Bateson, and Heinz von Forster, the word *cybernetics* was introduced into the world of art, radically affecting, over the long term, both art theory and art practice. At once a provocation and a prophesy, the word enabled the values of process and system to enter the perception and practice of artists, who were otherwise immersed in the stasis of object and structure. Indeed, the 1943 paper by Rosenblueth, Wiener, and Bigelow, "Behavior, Purpose and Teleology" was prescient in relation to the move in art and architecture towards behaviour concerned that not only what an artwork or building could do, but what the viewer or user can do to make it do it!

This book is essentially about doing, set in the context of technological and ontological becoming ... of new forms, new behaviours, new meanings. It is a book that witnesses the triumph of theory on the move, of worlds in emergence, of the malleability of mind and matter. Such processes of perceptual plurality, the fluctuation of form, the generation of multiple meaning, calls for semantic interplay and physical interaction that have institutional and ontological consequences: institutionally, in that the technology of art demands the revisioning and restructuring of the architecture of encounter, that is the post-gallery, moistmedia museum environment; and ontologically in the reframing of thought and theory, at all levels of human encounter, whether singular and intimate or social and public.

Here we have a book that speaks of the poetry of change in sync with the technology of desire, where computational inspiration meets with the fertility of the creative organism, whether behaviourally performative or structurally adaptive, and always in the frame of advanced ontological engineering. As a consequence of the interactional element in their evolution, art and architecture, like the advanced technology to which they turn, have come to be seen, and above all created, as instruments of the individual user's desire, rather than simply users of common cultural



tropes, as past decades determined. The artwork, as process and system, offers interaction with multiple worlds, new universes of mind and media. Art, as we read here, has become a worldmaking process, architecture has become subtly semiotic and serially transformative.

Worldmaking necessarily involves word making: new terms of technique are required, new phrases of creation are called for, the whole vocabulary of becoming requires critical and theoretical renewal and redescription, a demand that this book celebrates in excelsis - a book about worldmaking by worldmakers exhibiting not only aesthetic innovation but technological sense and social sensibility.

– Roy Ascott.

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# Introduction from the editors

While the three editors of this volume have disparate practices that fall into the domains of art, music, and architecture, the conceptual thinking and the methodology that drives our practices transcends medium or discipline. This commonality can be traced to the foundation of technology in our work. Technology-based work is inherently interdisciplinary. Stemming from the digital, modern technology provides humankind with the ability to encode all information and its representation using the same binary system as a basis. It has a tendency to be algorithmically executed, runtime, and adaptive to change. As a result, technology-based works commonly feature notions of participation, perception, interaction, user experience, and immersion in its outcome.

Beyond the use of technology, we found common-ground in the desire to maintain a close-knit relationship between philosophy and methodology in our practice. In our work, philosophical concepts are manifested in the methods for the creation of work, as much as they are embodied in the content of work itself. In our work we see the process from creation to presentation as part of a continuum. To describe this relationship we found the term *techné* (τέχνη). *Techné* is an ancient philosophical concept that has been debated by philosophers such as Aristotle, Xenophon and Plato, as well as more contemporary philosophers such as Guattari and Heidegger. In simplified terms the concept of *techné* is concerned with the art and craft of making, but the extended meaning implies a discussion of the significance of the work, including *how* and *why* something is made.

For Aristotle, *techné* (which literally means *art* or *skill*[1]) is not simply concerned with the craft of making. Along with *episteme* (knowledge), *phronesis* (judgment), *sophia* (wisdom), and *nous* (intellect), *techné* is one of *the five qualities through which the mind achieves truth in affirmation or denial*[2]. *Techné* is also key in the completion of the *hexis* of a virtuous person[3]. As Aristotle stated, *art is the same thing as a rational quality, concerned with making, that reasons truly*[4].[5] From this definition one can understand *techné* as a mode of rationalization capable of concept forming, and is a form of discourse in its own right.

[1] Merriam-Webster. 2017. "Dictionary and Thesaurus - Merriam-Webster Online." *Encyclopedia Britannica*.

<http://www.merriam-webster.com/dictionary/techne> (accessed June 28, 2017)

[2] Aristotle. *Nicomachean Ethics*. Rev. ed. Edited by H. Rackham. Loeb Classical Library. Cambridge, MA: Harvard University Press, 1934: 1139b

[3] Including "Art or technical skill, Scientific Knowledge, Prudence, Wisdom, and Inteligence." (Ibid.: 1139b)

[4] Ibid. Bekker page 1140a.

[5] *Techné*, *episteme*, *phronesis*, *sophia*, and *nous* are part of a spectrum of reason which can be understood in terms of three qualities: *techné*, having to do with making/action with intent; *episteme* and *nous*, having to do with knowing and intelligence based on rationality; and, *phronesis* and *sophia*, having to do with virtue and conduct (ethics). This ecology of *techné*, knowing, and ethics is what we attempted to articulate in the curation of this book.

One of the most common frames of reference used in contemporary discussions of the concept of *techné* can be found in Heidegger's essay, *The Question Concerning Technology*[6]. Like Aristotle, Heidegger sees *techné* as a form of discourse and concept making. While *techné is the name not only for the activities and skills of the craftsman*, it is also the name *for the arts of the mind and the fine arts*[7]. As an *arts of the mind*, *techné* is a key tool in the exploration of knowing (*episteme*), and key in the process of revealing truth:

[6] Heidegger, Martin. "The question concerning technology, and other essays." 1977

[7] Ibid. p. 12-13.

*Techné* is a mode of *aletheuein* [getting at truth]. It reveals whatever does not bring itself forth and does not yet lie here before us, whatever can look and turn out now one way and now another. Thus what is decisive in *techné* does not lie at all in making and manipulating nor in the using of means, but rather in ... revealing[8].

[8] Ibid.

In Heidegger's essay the need for *techné* is presented with some urgency. In describing our world, Heidegger states that *everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it*[9]. For Heidegger technology has the potential to be out of control, or to benefit humankind. Heidegger does not think we can escape the rise of new technology, therefore in order to make the world a better place we must embrace technology responsibly:

[9] Ibid. p.4

...the frenziedness of technology may entrench itself everywhere to such an extent that someday, throughout everything technological, the essence of technology may come to presence in the coming-to-pass of truth.

Because the essence of technology is nothing technological, essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it.

Such a realm is art. But certainly only if reflection on art, for its part, does not shut its eyes to the constellation of truth after which we are *questioning*[10].

[10] Ibid.

[11] Ibid. p. 35.

It seems that art is considered particularly ideal for questioning technology because it is something fundamentally different from the frenzied nature of technology. This happens particularly when the artwork is not complacent in the trajectory of technology (speeding towards frenzy), but confronts that trajectory through questions and a critical discourse grounded in making[11] (*techné*). While Heidegger never directly states it - it doesn't take much of a leap to assert that technology-based art (a form of art that fully embodies the essence of technology) is an ideal tool for questioning technology.

In bridging the concept of *techné* to worldmaking a useful starting point is the Heideggerian concept of *Ge-stell*, or enframing. *Ge-stell* is a term that is used to describe the organization and assemblage of nature. For Heidegger *Ge-stell* is the mode by which we see the world and how the world becomes known:

But when we consider the essence of technology, then we experience Enframing as a destining of revealing. In this way we are already sojourning within the open space of destining, a destining that in no way confines us to a stultified compulsion to push on blindly with technology or, what comes to the same thing, to rebel helplessly against it and curse it as the work of the devil. Quite to the contrary, when we once open ourselves expressly to the essence of technology, we find ourselves unexpectedly taken into a freeing claim[12].

[12] Ibid. pp. 25-26

[13] Ibid. p. 26

For Heidegger the essence of technology lies in Enframing[13]. *Ge-stell* is the essential function of modern technology. In the construction of an apparatus, an instrument, or a device, we are enframing the world and helping to reveal it[14]. The questioning of technology therefore lies in how the world is Enframed. *Ge-stell* is meant to be an active challenge to the world, because enframing is not only a revealing of the world, but a making of the world as well:

[14] Ibid.

The word *stellen* [to set upon] in the name Ge-stell [Enframing] not only means challenging. At the same time it should preserve the suggestion of another *Stellen* from which it stems, namely, that producing and presenting [Her- und Dar-stellen] which, in the sense of poiesis, lets what presences come forth into unconcealment[15].

[15] Ibid. p. 21.

How does technology Enframe the world? Certainly technology changes the world physically by building roads, growing cities, harvesting energy from the earth, mass farming, and through the entire spectrum of militarization including the polarization of the territories of the earth. But the world is made perceptually as much as it is made physically. New technologies shape what we experience and what we share about our world. As shown in Nelson Goodman's, *Ways of Worldmaking*[16]:

[16] Goodman, Nelson. *Ways of Worldmaking*. Vol. 51. Hackett Publishing, 1978.

...if worlds are as much made as found, so also knowing is as much remaking as reporting. All the processes of worldmaking I have discussed enter into knowing. Perceiving motion, we have seen, often consists in producing it. Discovering laws involves drafting them. Recognizing patterns is very much a matter of inventing and imposing them. Comprehension and creation go on together[17].

[17] Ibid. p.22.

Comprehension as creation parallels the Heideggerian description of *poietic unconcealment*. To make a (different) world is to know (differently). Shifting perception then is the means by which to critique and question the world. We change the frame, change the perspective, and thereby change our understanding of it:

The physical and perceptual world-versions ... are but two of the vast variety in the several sciences, in the arts, in perception, and in daily discourse. Worlds are made by making such versions with words, numerals, pictures, sounds, or other symbols of any kind in any medium; and the comparative study of these versions and visions and of their making is what I call a critique of worldmaking[18].

[18] Ibid. p.94.

Goodman's questioning, or critique lies in *how* worlds are made. According to Goodman worlds are made through processes of eversion that includes *composition and decomposition; weighting; ordering; dele-*

[19] Ibid. pp. 7 - 17

*tion and supplementation; and deformation*[19]. All these processes could be considered a confrontation to the world, and a means whereby to produce alternatives to it.

The domain of worldmaking is that of possibility. When we make worlds, we conjoin the Other. In doing so we also help shape the world and its trajectory. One of the leading thinkers in the domain of speculative worldmaking is researcher, artist, theorist, and *transarchitect* Marcos Novak. Novak is probably best known for his essay, *Liquid Architectures in Cyberspace*[20] (LAC), a timely and provocative text about the poetics of cyberspace. Among other things, LAC describes a fluidity between the virtual and the real, made possible by the domain of the digital, as extending to all aspects of data, information, and form. This fluidity even includes our minds and bodies as having a potential to be represented in cyberspace as a liquid form[21].

[20] Novak, Marcos, *Liquid Architectures in Cyberspace*, first appearing in "Cyberspace: First Steps." Michael Benedikt. ed. 1991. pp. 225-254.

[21] Ibid. pp. 226-227.

According to Novak, the extreme changes brought forth by technology create unprecedented new opportunities to conceive of new kinds of spaces[22] (or worlds). The characteristics of these spaces transformed conventional modalities of expression from a familiar medium to a new and unfamiliar form, what Novak calls an *extreme intermedium*[23]. The extreme intermedium is *the medium between two media, equally far from both, [and] precisely neither one nor the other*[24]:

[22] Novak, Marcos. "Trans-TerraForm: Liquid Architectures and the Loss of Inscription." KR Knowbotic Research (1997). <http://www.krcf.org/krcfhome/PRINT/nonlocated/nlonline/nonMarcos.html> (last accessed July 13, 2017).

[23] Ibid.

[24] Ibid.

Architecture becomes liquid, music becomes navigable, cinema becomes habitable, dance becomes disembodied. As distant as these new options seem from their origins and from each other, they are related to one another by what can only be called 'worldmaking.' Worldmaking is, in my estimation, the key metaphor of the new arts[25].

[25] Novak 1997.

We can see the extreme intermedium as questioning the world, as it is a form of enframing, or worldmaking. An important concept related to the *extreme intermedium* is that of *transvergence*[26]. For Novak transvergence is a framework that is used for critical thinking, questioning, rhetoric in general, as well as a methodology in making[27]. Transvergence is an expansion of the *extreme intermedium* into domains beyond the digital, such as *the spaces of nanotechnology and biotechnology and the spaces of consciousness, always considered bidirectionally and on several parallel*

[26] Novak, Marcos. 2002. "Speciation, Transvergence, Allogenesis: Notes on the Production of the Alien." *Architectural Design* 72 (Part 3): 64-71.

[27] Ibid. pp. 69-71.

*registers: as arts and architectures, as transarchitectures, as formations as yet unnamed, trans~, reflexive, and allo~.*[28] These new domains represent potential new forms of knowledge and information that are *alien* to our current understanding of the world. Therefore, Transvergence is a process whereby to predict, and even try to shape future domains.

[28] Ibid. p. 68.

The emergence of new domains is happening at a frenzied, exponential pace. This is evident in the rise of digital technologies and the internet, and is present in newer domains such as nanotechnology, biotechnology, robotics, and artificial intelligence. In this rising tide we are faced with two options: we can wait and see how these domains take shape, then respond; or we can try to anticipate, even *derail* the course of these domains and help create them, thereby creating the world.

The discussion above has left us with many questions regarding the implications of worldmaking as *techné* in participatory art, music, and architecture. We see worldmaking as having the potential of being an emerging field. However, at the moment there lacks a synergy and common language for it to be so. The book project, therefore, is seen by us as a way to help build a more rounded and formalized language around the concept of worldmaking as *techné*. We believe that by forming a common language it would be helpful to other theorists and practitioners who work in a similar territory. The book also gives us an opportunity to try and reach a broader community. We wanted to learn about the parallels and the differences between various practices that may fall under the moniker of worldmaking, compare the outcomes in these works, and look for future directions.

A precursor to this book was a panel discussion held at *Inter Society of Electronic Arts (ISEA)* conference in Istanbul in 2011 called, *The Volatility and Stability of Worldmaking as Techné*. From early on we wanted to have a critical approach to this endeavour. The discussion focused on the involvement of the technology of worldmaking in participatory art practice, exploring threads that related to the concepts surrounding worldmaking as *techné* as found in all areas of technology-based art, such as interactive, generative, prosthetic art, architecture and music practices that depend on the participation of observers for their vitality and development. We invited to the panel discussion, Roy Ascott

(electronic arts pioneer and founder of the *Planetary Collegium*), Jerome Decock (member of the art-collective *Lab-AU*) and Marcos Novak (philosopher, pioneer in virtual reality and interactive architecture). The panel's enquiries evolved around:

the aesthetic and historical context for the techné of worldmaking in relation to practice in art technology;  
the role of generative and/or cybernetics-inspired approaches (as compared to traditional notions of making) in one's own practice/research;  
the implications of worldmaking practice in the real world;  
and, the implications of pitfalls and their role in shaping a theoretical and/or practical approach to worldmaking.

The questions led to a lively discussion, which explored the aesthetics, systems, methods, and ontological underpinnings of a worldmaking-based practice. The presentations by the panelists indicated that there was a parallel trajectory that could be understood as worldmaking as techné, but only highlighted the need to find a meeting point for the concepts and language in order to pursue the dialog further. From this impetus the book project launched shortly after, in early 2012. We sought chapter submissions (which were peer-reviewed in a double blind process) and curated reprints to complement the submissions and to round out the discussion. The texts were carefully chosen to highlight the integration of theory and practice in their approach to highlight the continuum of concept to making. Each section contains historical texts alongside new texts to show a line of thought that spans more than 60 years, as well as to provide a historical foundation to the discourse.

Structurally, the book is organized into three sections: *po(i)etic*, *machinic*, and *cybernetic*. The intent in creating sections in this book was not an attempt isolate the discourse between the works, rather we see them as plateaus in a rhizome of concepts that intersect each other fluidly. In selecting works to fill these sections, we sought to break the frame at the same time we built it by choosing unconventional texts by familiar authors, and by including texts in sections that fall outside of their normal categorization.



## Po(i)etic

The title for the first section of this book is a portmanteau between the terms *poiesis* and *poetry*. *Poiesis* is an ancient Greek term (ποιέω) meaning to bring into existence something which did not exist before[29]. There are two forms of poiesis: autopoiesis (self-creation) and allopoiesis (the creation of the other), which work in tandem to as a meta-description of the processes of nature, readily encapsulating systems of evolution, homeostasis, emergence, and similar processes that are the foundation of the living world. Fundamentally the defining of poiesis is an attempt to define how living things come into being through the organization of nature as a system. If one can understand the system, then one can understand the workings of nature itself.

[29] <https://en.wikipedia.org/wiki/Poiesis>

Poetry, which means making, is derived from poiesis[30]. Poetry is traditionally considered a literary form, but if we look closely at its etymological origins it becomes clear that poetry has deeper implications of any kind of making, especially any human made work that brings forth aesthetic results. Aristotle's *Poetics*, for example, was not just a treatise on literature, but a treatise on the theory of art and making in general, focusing in particular on themes of catharsis, and the social and ethical utility of art[31].

[30] Ibid.

The po(i)etic is the domain of *techné*, representing the aesthetics and methods of *what* kinds of worlds we are making, as well as *why* we make them. The bringing together of these two related terms is meant to describe the drive to make living artworks. These works are poietic (unexpected/emergent), but are shaped by the artist (poetic) in order to express a particular idea, or experience that is either a reflection of the known world (autopo(i)etically), or a view into one that is alien and unfamiliar (allopo(i)etically). The balancing of these concepts is foundational in the aesthetics of worldmaking and computational art. Therefore, the po(i)etic and making is highlighted in this section as examples of how the poiesis and poetry come together in various practices in the production of work.

[31] Halliwell, Stephen. *Aristotle's poetics*. University of Chicago Press, 1986.

This section begins with the work of Nicolas Schöffer (1912-1992), a pioneer in the domains of cybernetic, robotic, and computational arts. Written late in Schöffer's career, *Sonic and Visual Structures: Theory and*

*Experiment* (1985) provides a succinct and compelling overview of the motivations and organization of his work, and the framework in which he works through his experimentations in sound and music. Schöffer's practice in what he called cybernetic art began in 1948 and focussed on several themes, including *spatiodynamisme* (1948-1958), *luminodynamisme* (1956-1977), and *chronodynamisme* (1959, on). While his works are often primarily considered kinetic sculptures, his primary focus as an artist was on engaging the senses, including space, light, time, and, new at the writing of his text, sound. The scale of Schöffer's work extended from the object to architectural, and even urban scale. His work often contained motors, sensors, and responded to the world around them using cybernetic principles as a basis for behaviour. He was deeply motivated by the role of art and aesthetics in everyday life and sought to engage humans interactively in the experience of his work, what he called, *activated humans*. Schöffer's aesthetic and methodical contribution is a highly adaptable system of thinking that deeply considers the impact that art has on the world.

In the second article, *Inventing Causalities and Networks of Influence*, Alberto de Campo explores a key notion in worldmaking: Creating mechanisms by which artificial worlds function is inventing causalities, and their possibilities for diverging from conventional cause-and-effect are essential artistic choices that deeply influence the experience of these worlds. A tour of common and unusual notions of causality, its limits, and skepticism toward it touches a multitude of historical and current perspectives, including philosophy, sociology, psychology, and behavioral economics, concluding with circular causality as postulated by cybernetics, and radical constructivism. To show the applicability of these conceptual perspectives for both analysis and creation, de Campo discusses a number of his own works and the works they relate to. Finally, the concepts underlying his current approach for improvising music with nontrivial processes directly forgo linear causality, in effect giving up causal control in favor of networks of influence which can only be understood intuitively through the experience of playing with them.

[32] <http://ciat-lonbarde.net/plumbutter/>

A reprint from his blog[32], the intent in formatting Peter Blasser's, *An Essay on Worldmaking in Plumbutter* was to remain as true to the

original style of writing as much as possible. On first impression, Blasser's text is a description of a drum machine, but it is so much more. The poetic and reflective narrative provides an inside look into the inner workings of his artistic approach and process. In an unrelenting fashion, Blasser's text embodies the spirit of the work by guiding you through a psycho-geographical exploration of *Plumbutter* that is at once tangible and surreal. Told from the perspective of *Plumbutter*, the text describes the development process of creating a drum machine developed as a result of a convergence of technical and philosophical considerations that equally feed into the details of the layout and design of the unit. *Plumbutter* is the embodiment of techné. Within the text one gains the sense that within his development of this multidimensional instrument no aspect is left to chance, no possibility unconsidered, and its creation is deeply personal and meaningful.

The survey of work that artist James Coupe provides in his text *Art, Surveillance and Metadata* reveals the potential of worldmaking as a critical discourse. One of the fascinating things about working with technology as a medium means that, as a critical discourse, *artists can make work that uses the same tools deployed by governments – not painting pictures of these scenarios but operating in the same reality, with the same methods recast*[33]. In Coupe's case he uses metadata. Metadata is a set of information that provides a descriptor of other data that is too large to analyze quickly[34]. Metadata is stored with the data and is usually hidden during normal viewing. The use of metadata is quite useful in summarizing otherwise unmanageably large data sets, but ethical issues arise when the data is used to summarize us. Coupe's work provides an exploration of the potential uses of an otherwise unseen metadata to identify and categorize us, and exposes it to the audience. He constructs generative narratives using the audience's metadata, exposing how we are in profiled by various entities in the process. This includes voluntary services like Facebook and Twitter, as well as in surveillance programs, such as with the National Security Agency (NSA) of the United States. The result is a chilling look at a the dystopian reality of our own world and the pervasive cataloging and surveillance we are subjected to on a daily basis, exposing the world as it is in order to shape what it could be.

[33] Coupe, p. 88.

[34] For images this might include the *image's size, resolution, and date of creation*; for an audio file, it might include the *file format, the author, title, etc.* Coupe, p. 69.

Dan Overholt and Esben Bala Skouboe's *Perceptual Ecologies: Mine* discusses the technical and conceptual implementation of the *Perceptual Ecologies* art installation in the Thingbæk Kalkmine, an abandoned limestone mine near Aalborg, Denmark. A multidisciplinary work between programmers, engineers, musicians and architects, *Perceptual Ecologies* shows how technology can be used to create novel experiences of alternate worlds as art. Motivated by the creation of affect, Overholt and Skouboe use *the term atmosphere as an abstract machine with which to establish a common ground, uniting the disciplines of music and architecture into a world of 'living' perceptual compositions*[35]. With this in mind Overholt and Skouboe use an expanded notion of ecology to produce an environment of cybernetic social interaction between observers and the physical work, the virtual work, and each other. In the spirit of experimentation, *Perceptual Ecologies* provides a glimpse into the challenges and considerations of producing large-scale immersive environments as interactive worlds.

[35] Overholt Skouboe, p. 91

In *Towards Probabilistic Worldmaking: Xenakis, n-Polytope and the Cybernetic Path to Chaos*, Chris Salter and Sofian Audry provide a detailed discussion of their work, *n-Polytope*. *n-Polytope* uses a series of works by architect and composer Iannis Xenakis (1922-2001) known as the *Polytopes* as a point of departure[36]. Created between 1967 and 1979, the *Polytopes* were remarkable, forward thinking immersive light, sound and architectural installations that influenced and anticipated computational art thinking today. As described by the authors *n-Polytope is based on the attempt to both re-imagine Xenakis' work in probabilistic/stochastic systems for composition with new techniques as well as to explore how these techniques can exemplify our own historical moment of extreme instability*[37]. Through this endeavour the artists not only help to share the influence Xenakis had on contemporary art and music, but discover new methods and approaches to making art today. These include aesthetics and techniques in art-science and worldmaking with the goal of generating new *artistic forms or morphologies*, and through new forms of knowing.

[36] Salter and Audry, pp. 115-116

[37] Ibid. p. 116.

## Machinic

This section explores notions of the machinic through the discourse of practitioners who use abstract assemblages and frameworks to describe and implement their work. We derived the term *machinic* from the first chapter in this section, *Machinic Heterogenesis*, by renowned philosopher Felix Guattari (1930-1992). In the simplest terms the machinic describes the relationship between human and machine. The machinic resides in the same rhetorical space as *techné*, but where *techné* focuses on *why* the machinic emphasizes *how*. As Guattari noted, for Aristotle the goal of *techné* is *to create what nature finds it impossible to achieve, so that techné sets itself up between nature and humanity as a creative mediation*. [38] Guattari's description also includes notions of the machinic that go beyond creative mediation. For example, there is the inclusion of the world of living beings, which have similar qualities to machines (or are even considered machines in their own right) but without an anthropocentric purpose (or any "purpose" at all). Guattari also includes the Heideggerian notion that *entrusts techné, in its opposition to modern technicity, with the mission of "unveiling the truth*[39],*" as was discussed above. When we look at the systems that make up our world there are many processes beyond the technical that can be described as machines. Among these possibilities Guattari includes the technical, social, semiotic, and axiological, making up what he refers to as a* *machinic ordering*[40].

[38] Guattari, Felix, *Machinic Heterogenesis*, p.145

[39] Ibid.

[40] Ibid. p.146.

*Machinic Heterogenesis* provides a description of the high-level processes that govern a machine and its modality of production. There are two aspects to the machinic: the diagrammatic and the materialized machine. The diagrammatic machine exists virtually, as a *protomachine*[41]. The materialized machine exists as an instance of the diagrammatic. The diagrammatic is capable of producing many materialized machines and, unlike the materialized machine, is unfixed and always in flux.

[41] Ibid. p.146.

While not cited directly in Guattari's text, the domain of the computational is an exemplar of the machinic. Computational processes are not limited to digital computation and can include mathematical, biological, and other systems as their basis. What is unique in the digital domain is that the diagrammatic computational system (model) and the materialized result of that system (instance), are created using the same tools. As a

result the machinic processes of abstraction and implementation are often blurred. For instance the materialized form of the computational machine has the ability to evolve, *dematerialize*, and produce other machines *auto-* and *allo-poietically*. The diagrammatic can even produce materialized machines that recursively rewrite the diagram and re-instantiate themselves as they run.

Computational methodologies are key in artist Mark-David Hosale's description of the conceptual framework, the *Worldmaker Universe*. Hosale's framework is based on an epistemological model that includes a representation of both perceivable (known) and imperceivable (unknown) aspects of our world. The framework is separated into three parts: operations (all information before it is perceived and the imperceivable), transforms (the interpretation of perceivable information into our sensorium), and personae (the perception/experience of that information). While primarily conceptual, the framework is used to create software and hardware tools that result in concrete implementations of computational artworks. The framework is also used in the description and analysis of existing works, as a theoretical tool. There is perhaps a paradox in Hosale's approach in developing a framework that is used in production of software and hardware applications that are primarily quantitative; and adapting it for the analysis of work, a domain that is primarily qualitative. However, the ability of his framework to be used bi-directionally in the creation and analysis of work facilitates a feedback loop between concept, making, and reflection that is highly adaptable to various kinds of work.

As an exploration of *Techné and Dispositif of Architecture*, Sang Lee looks at the role of architecture as a dispositif in the face of new technologies. Commonly translated in to apparatus[42], the dispositif draws parallels to concepts in the machinic. For example, there is a synonymous relationship between what Guattari describes as the *diagrammatic* and the *material* with what Lee refers to as *codification* and the *apparatus*. According to Lee, architectural practice is one of codification, in that the role of the architect is to produce the schemata that describe in great detail what is to be built, but are disconnected from the building process itself. In contrast, digital architecture has given rise to a *new rationality*, facilitated by generative and parametric processes that allow for a *dynamic disposi-*

[42] Lee, Sang *Techné and Dispositif of Architecture*, p. 196

tif. One example of this is the trend towards the development of what is known as *biomimetic* architecture. *Biomimetic* architecture proposes to create buildings that are analogous to a biological organism in its organization and function. For Lee these trends represent a potential benefit or a detriment to humankind, depending on the approach of the designer. In architecture, where aesthetics often take precedence, Lee offers a biting argument for the need to create a better balance with utility in this new domain: *The substance of our relationship to natural organisms and environments is at stake, not the usefulness or affectation of such technological organs installed in order to satisfy our excesses and to reinforce our dysfunctional so-called lifestyle*[43].

[43] *Ibid.* p. 215.

Laura Beloff's *Experiencing the World: Wearable Technology and the Umwelt* is a compelling survey of a series of her works and how they have evolved since the mid-2000's. As suggested in the title, the point of departure in Laura Beloff's work is Jakob von Uexküll's concept of the *Umwelt*. Beloff uses wearable technology to explore how we can alter our *Umwelt* through the augmentation of the body using wearable devices. The goal in Beloff's work is to explore how a human can connect to a wearable augmentation that is affected by elements humans are normally not aware of, such as the technological *umwelt*, the *umwelt* of other organisms, and the processes of the environment. According to Beloff *the world is full of interconnecting and overlapping spheres— like a conglomeration of bubbles forming multiple perspectives in which each organism has its own umwelt*[44]. The joining of these *umwelten* creates what she calls a *techno-organic constellation*[45]. By following the trends of contemporary technology, she suggests that this kind of modification is becoming a necessity as we may need to enhance our bodies in order to be able to survive our changing techno-scientific relationship to the world. The result is a condition where humans are not just mediated by machines, humans become the machines themselves.

[44] Beloff, Laura, *Experiencing the World: Wearable Technology and the Umwelt*, p. 220.

[45] *Ibid.*

We conclude this section with Graham Wakefield's *Open Worlds: Bergson And Computational Ontology*. Wakefield's chapter provides a thought provoking discussion on computational aesthetics and world-making that attempts to address the challenge of making worlds *that approach the open-endedness of the natural reality we inhabit*[46]. As

[46] Wakefield, Graham, *Open Worlds: Bergson And Computational Ontology*, p. 243



Wakefield identifies a tendency in computational creativity to rely on static models of nature that are too deterministic, and based on the *world-as-we-know-it*. In Wakefield's view, the reason for this tendency towards determinism is not because of any limitation of computation, or of programming languages themselves. Determinism is more symptomatic of *our natural habit to abstract discrete static snapshots of continuously flowing reality through the selective actions of perception*[47]. To counter this tendency Wakefield turns to Bergsonism, in particular concepts, such as the *durée*, that emphasize a *conception of reality as a whole that is continuous and creative, predicated not on a static notion of being, but rather on an enduring notion of becoming*[48]. The remaining chapter gives an intriguing description of how computational systems can be developed that are free of linguistic constraints, self-executing, and evolving, which he describes as a *strongly constructive inhomogeneity*[49].

[47] Ibid. p. 248.

[48] Ibid. p. 249.

[49] Ibid. p. 257.

Wakefield's use of the term inhomogeneous is interesting as it is synonymous with heterogenesis, which brings us full circle to Guattari's text. In the end, Guattari's concern with the machinic has *nothing to do with their materiality*, but within the diagrammatic processes whereby machines evolve over scale, form, and time[50]. The relationship between the materialized and the diagrammatic is analogous to that of the genotype and the phenotype in biology. The diagrammatic is like the genotype (high-level evolving form of the machine)[51], and the materialized the phenotype (an individualized form of the machine). Heterogenesis in Guattari's machinic therefore exists in the diagrammatic form describing how machines produce other machines that are of a different kind than themselves (allopoiesis). What is important here is to consider how the machinic can lead to worldmaking. If we want to make meaningful worlds then we need to consider how to make worlds that are open-ended and, as Wakefield describes, *more inherently creative*.

[50] Guattari. p.151. and throughout.

[51] For Guattari the diagrammatic form of the machine exists at the *phylum* level, which could be understood a genotype by interpretation.

## Cybernetic

Cybernetics is a meta-discipline that aims to describe and understand systems and processes from very different domains with the same set of fundamental concepts. It was constituted as a field in the Macy conferences organized by Warren McCulloch from 1946 to 1953, who invited the



leading scientists of the times from fields like anthropology, mathematics, neurology, psychiatry, biophysics and others. The term *circular causality* in biological and technical systems refers to phenomena that occur when parts of a system influence each other such that linear causal chains form loops, requiring the new concept of feedback. At the time, this idea was in the air in many fields. The name cybernetics was adopted from the eponymous book by Norbert Wiener, when Heinz von Foerster proposed it as the ideal name for the conference series, and it later became the common label for this meta-discipline.

In the first phase of cybernetics (later called first order cybernetics), one assumed that observers can study the causal pathways in systems from the outside, deduce how to influence the system in question, and then control it such that it reaches the desired state. Typical states are stable dynamic balance (homeostasis), cyclic balance (periodic oscillation), and aperiodic behaviour (chaos). This concept was quickly adopted by military, political and economic leadership, as it seemed to promise technocratic control of societies worldwide.

Second order cybernetics (or cybernetics of cybernetics, as Margaret Mead put it) emerged from 1965 on, and here cyberneticians consider the observer an essential part of the system who always influences the system from the inside. This view foregoes classical notions of scientific objectivity (which were criticized from other perspectives at the time as well, e.g. as constructions of power and control), and replaces it with the now common-sense idea that one understands a system much better by interacting with it, and thus encountering its behavioural repertoire actively.

Both waves of cybernetics were adopted quickly in many disciplines, and over time got absorbed into the invisibility of standard practice in each field. After a phase of buzzword fatigue, its history has been studied more deeply again since the 1990s by the Heinz von Förster archive in Vienna, in particular by Albert Müller and Karl Müller, and Andrew Pickering. Andrew Pickering, the author of the first selection in this section[52], is a historian of science and a pre-eminent scholar responsible for the rediscovery of the early British cyberneticians, and reinterpreting their complex worldview, which was the subject of his influential book, *The Cybernetic Brain*[53].

[52] See pp. 266-295.

[53] Pickering, Andrew. *The cybernetic brain: Sketches of another future*. University of Chicago Press, 2010.

One of the early advocates and educators of second order cybernetics in the field of interactive arts is media pioneer Roy Ascott. His artwork *Change-Paintings* first exhibited in Molton Gallery in London in 1961 was one of the early pieces of art that demonstrated the need for participatory interaction from the audience for what is ultimately an open-ended piece of work.[54] Ascott's focus on creativity of art practice as a process of becoming influenced by making and participation had shaped his future theoretical and art work. He laid out the foundations for examining the concept of art as a behavioural problem in his 1963 text *The Construction of Change*. [55] For Ascott, behavioural art production and art education were inseparable. Following on from *The Groundcourse* pedagogic framework devised in 1963 for his students in Ealing School of Art in London, and Ipswich School of Art, which embraced a syncretic approach to creativity that combined in its making analogue and digital elements and systems, Ascott operated among other British cyberneticists on the shift in focus from the brain and into performative art forms where the spectators interacted in a system of control and communication through the construction of structures in physical and cyberspace. He introduced theoretical concepts such as *Moistmedia* and *Telematic Art*. In 2003 he defines networking in the arts to be "a shared activity of mind and a form of behaviour that is both a dance and an embrace." [56] He opposes the need for the centrality of the existence of the body in the system of perception going on to suggest that networking takes the physicality of the body out of the system by linking the mind to a kind of timeless sea [57] and by doing so, the focus moves onto the transformation of the artwork, or as Ascott calls it, *creative data*, which appears in a constant process of becoming and perceptual motion:

In this sense, art itself becomes, not a discrete set of entities, but rather a web of relationships between ideas and images in constant flux, to which no single authorship is attributable, and whose meanings depend on the active participation of whoever enters the network. In a sense, there is one wholeness, the flow of the network in which every idea is a part of every other idea, in which every participant reflects every other participant in the whole... The observer of the 'artwork' is a participator who, in accessing the system, transforms it. [58]

[54] Ascott, Roy, (1961) *Change-paintings* [Online]. London: Facebook. Available: <http://www.facebook.com/album.php?aid=18986&id=554994561&l=2bd59f766d>

[55] Ascott, Roy ,(1964), 2003) 'The Construction of Change' (1964), in *The New Media Reader*, ed. by Noah Wardrip-Fruin and Nick Montfort (Cambridge, Mass.: MIT Press, 2003), pp. 128-132.

[56] Ascott, Roy, (2003) *Telematic Embrace: Visionary Theories of Art, Technology and Consciousness*, Berkeley, CA: University of California Press. p. 200.

[57] *Ibid*, p.187.

[58] *Ibid*, p.199.

The *Cybernetic* section explores the world as a system (as manifested in First Order Cybernetics) and leaps into the new cybernetics of participatory environments where systems are in fact actor, agent, and observer dependent (as seen in Second Order Cybernetics). This connection is based on a feedback loop, where the participant and the environment are just as much a part of the system as the algorithm (and interface to the algorithm) itself. As with the machinic cybernetic systems can be seen as having diagrammatic and the materialized forms. Because of this cybernetics could be seen as a branch of the machinic[59]. One of the key differences between cybernetics and other machinic systems is one of approach. While other systems tend to approach the *question of technology* by seeking to shape the frame, re-enframing the world, cybernetics attempts to change the manner in which we associate with technology altogether by engaging the processes of nature as part of a system.

[59] Guattari considered the cybernetic as fit for his description of the machinic. see Guattari, p. 144.

In *Beyond Design: Cybernetics, Biological Computers and Hylozoism*, the selection for this volume, Andrew Pickering focuses on the work of Gordon Pask and Stafford Beer in the field of biological computing. The presentation of this history is used to show how cybernetics can be used as a means of questioning technology. Pickering posits the importance of the distinction between two different paradigms in the history of science and technology: *Modern* and *nonModern*. While Modernity aims at the eventual domination and consumption of nature, the cybernetics of Pask and Beer represents a *nonModern* approach which embraces the processes of nature to achieve its goals. For example, Pask and Beer's approach to biological computing is to treat biological units as black boxes with performative elements, catalyzing their actions for use as computational machines without really knowing *how* they work. By contrast, the Modern technoscientific approach is to attempt to unwrap these boxes, and mimic and redefine their inter-workings in order to build cognitive machines from the bottom up. In short, Pask and Beer's attempt to work with nature, rather than redesign or control it. While the major examples provided in the article are biological, Pickering describes how concepts in cybernetic computing are applicable in any natural system. Hence the use of the term *hylozoism*, an ancient Greek word that described the belief that all matter has life, and therefore is able to func-

[60] Pickering, Andrew, *Beyond Design: Cybernetics, Biological Computers and Hylozoism*, p. 294.

tion as an actor in a human created cybernetic system. But in order to achieve this kind of collaboration with nature we need a major shift in our thinking. What Pickering is arguing for is a paradigm shift in our worldview that moves away from the destructive path of Modernism to a paradigm of collaboration with nature. As Pickering states: *...if Modernity is defined by projects of domination, then cybernetics is marked by a symmetric accommodation to the ultimately uncontrollable*[60]. In Pickering's view, the ability to give in to the uncontrollable quality of nature would lead to a holistic connection to our world. The implications of this paradigm shift would not only be present in our technology, but in our social interactions, our political systems, and in our minds as well.

Sana Murrani picks up the influence of the social dimension of cybernetics and how it relates to worldmaking in an attempt to re-evaluate, re-interpret and re-appropriate space through a spatial and technological installation that culminates in a triadic enquiry into the ontological, ontogenic and behavioral conditions that govern a world. Her work focuses on Goodman's notion of irrealism and Leibniz's relational theory, and their impact on the way we perceive and conceive the construct of space and place. Murrani develops a hypothesis that advocates for a bottom-up relationship between the designer/architect and their work which facilitates for the users, participants and inhabitants to occupy, re-appropriate, re-assemble, and re-make their environments. Through critical analysis of the construction and re-constitution of a spatial-technological installation: *Overlaid Realities*, Murrani's chapter puts forward a participatory architectural praxis that is based on principles of second-order cybernetics and post-phenomenology through cognition and indirect perception, network society and the contingent nature of participation in space/place.

World-renowned artist and architect Philip Beesley's *Sentient Canopy: Prototype for resilient, curious architecture* provides a deep insight into the conceptual motivations and technical implementation of his work. In this text, Beesley provides a detailed description of the layers of systems that contribute to the creation of *Sentient Canopy* and how they are developed. Technical considerations are infused with conceptual considerations that embody questions about how architecture can become a living system, what the implications of creating such systems

might be, and how the role of architecture could be shifted to create better connections between our environment and each other. Resilience in his work is therefore not limited to material resilience, but in terms of architecture's function as well. Beesley's approach to thinking and making architectural systems goes beyond Vitruvian utility by also considering the role of agency and experience in the foundation of its development. For Beesley, his work seeks to challenge the control and the lack of empathy of typical interactive systems, by creating a near-living system as a responsive architectural environment that is inspired by natural processes.

Kathrine Elizabeth Johansson uses an analysis of Philip Beesley's *Hylozoic Series* as an exemplar of how technology-based arts can create worlds that have a profound impact on the way we understand consciousness and reality. Johansson offers a sophisticated discourse around art communication and philosophical speculation that presents a real challenge to the ways to approach knowledge and making. As indicated in the title, *On the dynamic relation between thought ontologies and materialised ontologies*, Johansson's text contemplates *how* and *when* the materialized form of an artwork is able to communicate ontological propositions that are free from rhetorical constraints, and primarily experiential. She describes the difference between acquired and experienced knowledge as a mind-altering encounter, and how the latter, which is influenced by the work seen in the design field of near-living systems and environments such as Beesley's *Hylozoic Series*, has a profound impact on the way we understand consciousness and life. The making of experiential ontologies requires the activation of different levels of reality such as the Artefactually Real (human-made material realities), the Socially Real (systems and mechanisms at the social level), and the Virtually Real (any aspect of Nature that must be understood to be intangible). It is through the domain of the Artefactually Real that we can connect (re-acquaint) ourselves to the other levels of reality and stimulate sub-conscious forms of knowing. Therefore, Johansson believes that a well-considered techné requires a deep consideration of the Artefactually Real to *ontologically re-acquaint ourselves and our common significations and interpretations of the Nature*[61] (such as with Beesley's work) in order to engage a practice of worldmaking that can meaningfully affect the process of creativity in constituting knowledge.

[61] Johansson, Kathrine Elizabeth, *On the dynamic relation between thought ontologies and materialised ontologies*, p. 359.

Edward Shanken's text, *Towards a Genealogy and Futurology of Art and Technology: New Media, Contemporary Art, Collaboration* provides a thoughtful discussion of the challenges that face practitioners and curators in the field of art, science and technology (AST). This is supported by a compelling historical account of the foundations of art and technology including an analysis of the motivations behind the AST collaboration Experiments and Art and Technology (E.A.T.), which included, among other artists, Billy Klüver, John Cage, and Robert Rauschenberg. Through this description, Shanken reminds us that such collaborations are risky; nevertheless, they bear significant potential of reaching truly surprising new insights and ideas into the conception and construction of knowledge and society. Shanken also describes how New Media Art (NMA) has struggled to distinguish itself from mainstream contemporary art in terms of its role in the art world, motivations for making, and in finding acceptance. This is largely because NMA sits between art, engineering, and mainstream media but has trouble gaining acceptance in any of these domains. Finally, Shanken calls for work in AST to be bold and take risks in producing meaningful work that will generate breakthroughs in art and technology. AST research must develop *compelling rationales for the importance of their work as an engine for innovation*[62] in order to gain the acceptance and support it needs to continue.

[62] Shanken, Edward, *Towards a Genealogy and Futurology of Art and Technology: New Media, Contemporary Art, Collaboration*, p. 383.

For the final selection of this chapter and the book, we chose a seminal text that looks forward to the future and thinking of what worldmaking could be. For those familiar with Heinz von Foerster's (1911-2002) life and work, *Perception of the Future and the Future of Perception* is not a surprising text. The originator of second-order cybernetics, von Foerster is a polymath whose impressive range of work spanned the domains of philosophy, physics, cognitive science, computer science, and mathematics. The philosophical focus in his research is particularly present in the later half of his life, when there is a gradual shift from a technical focus to issues of aesthetics, ethics, and epistemology. One could easily argue, however, that there was really not much difference in his mind between the two eras. For von Foerster second-order cybernetics functioned as a metaphysics that glued the world together, whether addressing problems in hard or social sciences.

Written in 1972, *Perception of the Future and the Future of Perception* comes at a time, like today, when there was much turmoil in the world. The urgency in tone of this text is marked by the aftermath of a turbulent 1960's, a war in Vietnam, and an ongoing Cold War, which left the world uncertain about its future. One way to interpret this text is as a description of how to make a better future world, and for von Foerster the future of the world is dependent on our perception. Therefore von Foerster provides a guide for *how* to perceive the world, stating boldly:

if we can't perceive,  
we can't perceive of the future  
and thus, we don't know how to act now[63].

[63] von Foerster, Heinz,  
*Perception of the Future and  
the Future of Perception*, p.  
386.

He does this through the reevaluation of language, for how we use language tells about what we prioritize in our world. The text turns into a manifesto by encouraging us to question, play, and do our irreverent thinking in order to resist modes of discourse that keep us within conventional limitations. His text is as relevant today as it was when he wrote it. After all we live in an era of great divisions driven by unwavering ideologies and alternate-facts, we can see the power of words to *enframe* the world, and even to create bubbles (Umwelten) that are seemingly impenetrable, as rationally untenable as they may be. It is not a leap to say that, if we had the rhetorical tools to properly evaluate our world, then perhaps we could start to find ways out of the difficulties that plague us today.

Our ambitious goal in this volume is to attempt to outline practices that challenge the World and its possibilities through a kind of future-making, and/or other-world making. But most importantly, what we strive to create in our work are alternate realities that are simultaneously ontological propositions that can be understood through experience, as much as through language. We see our works as the expression of ontological propositions enframing the world through the creation of art-worlds. By exploring art as *techné* we create experiential concepts that enframe the World we live in. In doing so we offer a critical discourse about our World and how the World is constructed.

By positioning worldmaking as a kind of techné, we seek to position worldmaking as an enframing of the world by exploring art-concepts through the development of art-worlds. Therefore, worldmaking can be understood as an expressive practice, one that is enacted through arts, as a techné.

While the foundation of this worldmaking is deeply philosophical and rigorous in its approach, there is a need to connect this work to the World of our everyday experience. As we contemplate issues of why we might want to make a world, we are confronted with the responsibilities of making the World as well. There is an ethical urgency in the world today to change from a path of mutually assured destruction to one that leads to viability. In this context, we see the future of a worldmaking based practice as an opportunity to explore the World as it is, and the myriads of ways how it could also be, to make the World a better place for now and for future generations.

– *Mark-David Hosale, Sana Murrani, and Alberto de Campo.*

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