ELASTIC DESIGN

Tools for Alternative Understandings

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Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy
Art & Design, The University of New South Wales

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DECLARATIONS

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Imagine stretching an elastic measurement tape. Unexpectedly, a space for speculative thoughts is genuinely expanding your mind.

This practice-based project in speculative design explores possibilities for disrupting everyday constructs of reality, which are apparent in regulations of time, space and matter. These constructs underpin notions of predictability and universal validity. Hybridity and complexity challenge these concepts associated with scientific objectivity, instrumental rationality, and economic efficiency. Both notions are prevalent tropes in art and design practice, pointing out the discrepancy between the rigid order of classical science versus unruly reality. This ideological tension is constructively deployed in eight experimental projects that are located in the field of metrology, the science of measurement. By manipulating measuring devices, industrial standards and protocol compliance attention is drawn to alternative ways of engaging with the world.

The practice-based component is a toolkit that consists of reconfigured measuring devices called *Tools for Alternative Understandings*, which use "elasticity" as a material and conceptual agent to provoke unconventional models of thought. With the intention to reconfigure established modes of knowledge production the toolkit provokes a shift towards material and performative modes of knowing beyond the representationalist thinking within modern Western culture. Such experimentation may trigger a change for more creative and viable futures fostering flexible approaches for meaning making.

The practice is framed as an experimental laboratory that interrogates the regulations determined by current systems of measurement and representation. The experiments are guided by a theoretical framework that builds on material-semiotic approaches emphasizing the entanglement between human and non-human agencies as co-productive constituents in the construction of reality.
Such ideas are inherent in the work of Karen Barad, Donna Haraway and Bruno Latour. In drawing on Barad's reconceptualisation of measurement through the indeterminacy found in quantum physics, elasticity is presented as the fundamental component of the project. The application of *Elastic Design* is discussed using three foci—the unlocking, redirecting and material re-entangling of rational procedures, and ideological concepts to cultivate alternative experiences of reality. Additional strategies associated with new materialism, science and technology studies, conceptual art and speculative design figure as supplements to my research methodology.

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ABSTRACT

Elastic Design – Tools for Alternative Understandings

> *Imagine you are stretching a measurement tape, which is made of elastic. You see the rigid intervals of the measuring scale cracking and extending. As a rule, these interstices are unlikely to change. Unexpectedly, you sense a space for speculative thoughts genuinely expanding in your mind. It feels as if multiple possibilities emerge and come into being while you are pulling the device. In this way, the manipulated tool modifies our understanding. Given logic and linear habits of thought are disordered in a playful encounter with some tiny, flexible interstices that wickedly insert themselves between doing and thinking.*
> (Experimental project *Elastic Standard Metre*)

This practice-based project in speculative design explores possibilities for disrupting everyday constructs of reality, which are apparent in regulations of time, space and matter. These constructs underpin notions of predictability and universal validity. Hybridity and complexity challenge these concepts associated with scientific objectivity, instrumental rationality, and economic efficiency. Both notions are prevalent tropes in art and design practice, pointing out the discrepancy between the rigid order of classical science versus unruly reality. This ideological tension is constructively deployed in eight experimental projects that are located in the field of metrology, the science of measurement. By manipulating measuring devices, industrial standards and protocol compliance attention is drawn to alternative ways of engaging with the world.

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ABBREVIATIONS and GLOSSARY

Alternative Understandings

A formation of concepts, concerns, methods and action patterns combined with a context-dependent susceptibly based on the ideas of change, dynamism and elasticity that allow for transdisciplinary, processual, pragmatic and responsible approaches to reality. The term describes the expansion of conventional scientific knowledge with tacit qualities and an enhanced sensitivity to reconfigure expectations that focus on rationality and efficiency.

Elasticity

The rationale underlying this practice-based research as a performative metaphor linking conceptual and material qualities. Elasticity delineates an enhanced sensitivity offering a spectrum of considerations and interpretations that accepts different modes of existence as it aims to account for contradiction, diversity, indeterminacy and transience while striving for cohesion being embedded in a larger, socio-cultural and environmental context. Moments of rupture within elasticity allow for the emergence of new conceptions.

Elastic Design

A dynamic fusion of mutable methodologies based on elasticity as a conceptual and material component applied for the creation of alternative understandings. *Elastic Design* is a tactical extension of speculative design offering a mode of thought that aims to reconfigure practices of knowledge production. Transformation, unpredictability and diversity expand the leeway for discretion and meaning making challenging ideas of objectivity, efficiency and convenience.

Elastify, Elastification

To *elastify* and *elastification* are neologisms, which I invented to emphasize the material aspects of change, injecting thought-provoking impulses. The terms stimulate unfamiliar associations and express thereby the transformability of thoughts and practices.

Fingerspitzengefühl

The literal translation of the German term is *fingertip feeling*: usual meaning—diplomacy, sensitivity, context-dependency and care. The term expresses the capability to handle (delicate) concerns with intuition and thoughtful sensitivity as it aims to account for the socio-political and/or non-rational dimensions within a situation.

Knowledge Production

On the basis of Science and Technology Studies (STS) the term describes the complex set of practices, instruments, concepts, beliefs, experiences and norms that constitute the fabrication of facts in a scientific setting. In contrast to a positivist paradigm that assumes a Newtonian model of science based on empirical facts and objective evidence, the material-semiotic approach of STS delineates knowledge production as a collaborative practice drawing attention to tacit, material and socio-cultural factors.

Meaning Making

In correspondence to theoretical physicist Karen Barad's use of the term, meaning making includes material, situational and non-representational developments (e.g. non-human factors such as instruments, substances, phenomena) in the process of interpretation and understanding. Meaning making regarded as concerned *mattering* challenges and enhances a conventional, scientific production of knowledge.

Metrology

The science of measurement based on agreement between members of an authoritative group about measurability through units and categories, which facilitate processes of quantification and evaluation. In a new materialist perspective according to Karen Barad, measurement is a material-discursive *boundary-making practice* as it organises information according to context-dependent qualities establishing situated frameworks for evaluation. In contrast, positivist and post-positivist worldviews consider measurement as stable and absolute representing a *Cartesian cut*, which is an unshiftable and unquestioned boundary.

Reconfiguration

The capacity to reshape, remodel and reconceptualise an understanding and its composition emphasising the opportunity to change and to adopt various configurations.

***Tools for Alternative Understandings* (TAU)**

The practice-based component of this research project that consists of a toolbox with reconfigured measuring devices, experiments and applications. The tools are composed following the idea of *Elastic Design* using elasticity as a material and conceptual component with the purpose to reconfigure meaning making practices.

Tools for Alternative Understandings

Fig. 1 Bettina Bruder, assembled toolbox with *Tools for Alternative Understandings*, 2016.

Fig. 2 Bettina Bruder, unpacked toolbox with *Tools for Alternative Understandings*, 2016.

Overview of tools per chapter

Tools for Alternative Understandings

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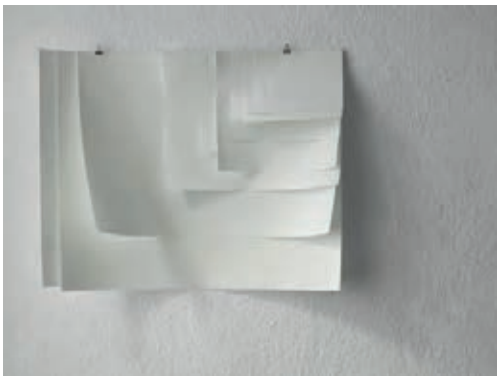

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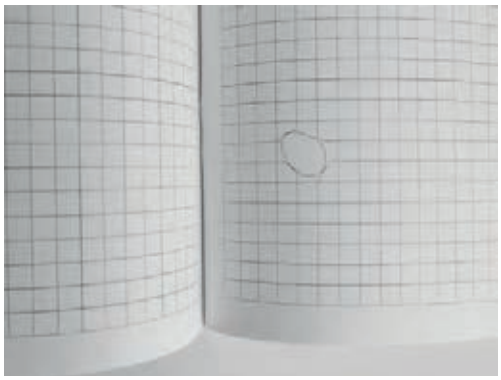

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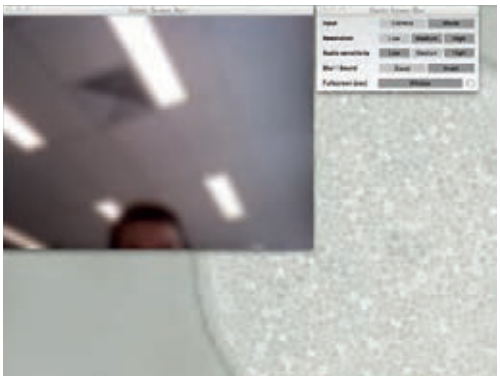

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Table 1: ***Tools for Alternative Understandings***

Toolkit, list of components

Item Number	Quantity	Title	Description
1	1	*Elastic Standard Metre*	measuring tape, latex strip, 100 centimetre measuring scale
2	1	*Elastic Standard Metre*	prototype, rubber wrist band, 10 centimetre measuring scale
3	1	*Unstationery*	paper set, 30 sheets of paper, variable sizes
4	1	*Disorienting Descartes*	notebook A4, limited edition, particular graph paper
5	1	*Disorienting Descartes*	mass-produced notebook A5, manipulated graph paper
6	1	*Cup for Alice*	styrofoam cup with measuring scale (20 to 150 millilitres)
7	1	*Cup for Alice*	shrunken cup from pressure-cooker series
8	1	*Cup for Alice*	inflated cup from saucepan series
9	1	*Cup for Alice*	shrunken cup submersible series (NOAA)
10	1	*Organic Equilibrium*	spirit level integrated in ginger or faked cucumber (depending on customs regulation)
11	1	*Organic Equilibrium*	spirit level integrated in modelling clay
12	1	*Time Stretcher*	time keeper reconfigured fish scale / luggage scale
13	1	*Knotted Timer*	alarm clock
15	1	*Bubble Timer*	hourglass filled with dish-washing liquid (depending on customs regulation)
16	1	USB-Stick *Elastic Screen* *Cups for Alice, Ortho, Time Stretchers, Elastic Standard Metre*	 mode I-III as self-contained MaxMSP applications for Mac OSX video documentation
17	1	Set of rubberbands	
18	1	*Elastic Metric System*	label (English)
		URLs web applications of TAU labtop/desktop computer apps *Disorienting Descartes* smart phones with position sensors *Ortho I (Search)* *Ortho II (Sky)* *Ortho III (Bush)*	 http://www.unexplic.it/?page_id=1791 http://www.unexplic.it/?page_id=1642 http://www.unexplic.it/ortho http://www.unexplic.it/sky http://www.unexplic.it/bush

INTRODUCTION

> Today is the 29th of February 2016—a leap day that only exists every four years. Leap days are necessary to compensate for the "irregularity" of a natural year with 365.242189 days—that is 365 days, 5 hours, 48 minutes, and 45 seconds what the Earth takes to revolve once around the Sun. Such deviation requires the adjustment to human accuracy rendering nature as a quantifiable object. The leap day reminds us that the universe is not a perfect mechanism filled with passive matter running according to human made laws.

This research project aims to provoke a "conversation" between the known and the unknown that is capable of fostering a revitalised understanding between various participants, technologies, cultures and interests, which seem to be incompatible or unrelated. This concern with interdependent transversality and the power of imaginative dialogue can be detected throughout my creative practice.

On the one hand, my work is motivated by the desire to interface across different conventions, contexts and perspectives. On the other hand, I am a designer, and that designation itself implies branding, distinction and the desire for unmistakable representation and transmission of information. My experience as a communication and interaction designer in an international corporation that worked on large-scale projects like the World Cup or the Olympic Games gave me opportunities to work across various cultures, technologies and circumstances. Despite the fact that I encountered cultural diversity, seasonal variability and an immense variety of products and applications in the context of design, my work in this area nevertheless contributed to the imposition of predominantly modern Western values privileging homogeneity, predictability, quantifiability, mass-production and one-sided communication strategies. This obsession with controlled and standardised encounters fuelled an intellectual monoculture, and propagated a particularly capitalist ideology that valued profitability and convenience above all.

Such narrow-mindedness and benefit-driven attitudes are profoundly dissatisfying, and utterly incapable of taking into account complex problems with social, political, economic and environmental concerns. The problems facing us today cannot be approached in singular, unimaginative and mundane ways: they are multifaceted, complex, and interwoven—they resemble Gordian knots that will require new strategies of unravelling and handling.[1]

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[1] The Gordian knot is a proverbial term for a difficult problem that can only be resolved by courageous action and unconventional measures. It is a metaphor derived from a legend about the conqueror Alexander the Great who undid an intricate knot tied by Gordius, king of Gordium in 333 B.C. I associate knots with

Elastic Design – Tools for Alternative Understandings works against a lack of imagination and openness that limits our ability to respond to complex problems. Human engagement and creative inventiveness seem restricted and paralysed by scientific rationality and economic efficiency; consequently, there is the need to address pressing and intricate issues in new ways. *Elastic Design* aims to develop alternative conceptions and modes of meaning making. Thus, the project is guided by the following research question:

> How can the material and the concept of elasticity be employed in art and design to induce alternative understandings of the world that are not limited by classical scientific rationality and economic efficiency?

Elastic Design intends to provoke innovative approaches to reality. The project aspires to reconfigure conventional modes of thought, through the development of a toolkit of reconfigured measuring devices and applications called *Tools for Alternative Understandings* (TAU). These tools, collectively and individually, work with the notion of mobile and malleable materiality rendering unusual interpretations and different conceptions. The project draws on ideas like probability, indeterminacy and dynamic ambiguity that underpin the theory of relativity and the experiments in quantum mechanics, which have challenged mechanistic models of classical physics in the beginning of the 20th century. In contrast to quantum mechanics, classical physics assumed that phenomena can be deterministically described and properties can be accurately measured. But this idea of a separation between an unpredictable quantum world and a mechanistically ordered reality is a fabricated deception.[2] It is guided by a positivist worldview that implies an idea of control and determinability. Such an approach aims to establish general laws based on classical scientific analysis and empirical evidence, which rely on stable distinctions between true and false, cause and effect or subject versus object, regardless of scale or context.

These supposedly "rational" lines of thought and analytical approaches are generally associated with modern Western concepts that organise the world according to firmly set principles, which Bruno Latour calls 'the Modern Constitution'.[3] Latour defines modernity

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assemblages, networks, rhizomes and other hybrid constellations deployed in philosophy and Science and Technology Studies (STS) to describe dynamic formations with various components.

[2] See for example: Vlatko Vedral, 'Living in a Quantum World,' *Scientific American* 304, no. 6 (2011).

[3] Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993), 13.
See also: Anders Blok and Torben Elgaard Jensen, *Bruno Latour: Hybrid Thoughts in a Hybrid World*. (London, New York: Routledge, 2011), 64, 171. Personally, I have issues with the separation and ascription

as the result of scientific, industrial and political changes that led to the ontological split between nature and culture, and the idea of an accurate representability of reality either through natural sciences or through political systems.[4]

The technological progress of modernity correlates with instrumental rationality. It is constituted by the development of measurement, which led to regulated representations of space, time and matter that support the notions of scientific objectivity and economic efficiency. This ideology of instrumental reason is based on mechanistic functionality generating accurate quantifiability, and it plays a major role in shaping human paradigms, mindsets and behaviours. Measurement is a key constituent of modernity as it allowed for the coordination of science, trade and technology through standardisation, protocol compliance and industrial formats. A numerical and logically systematised view of reality is gained through metrology—the science of measurement—rendering the world formable, submissive and ultimately governable.

These scientific idealisations that imply ideas of objective governability and efficiency are challenged by what have come to be known—in design circles—as *wicked* problems.[5]
The term was introduced in the 1970s by design theorists and social planners Horst Rittel and Melvin Webber to distinguish "tame" issues within natural sciences, which are subject to laws of classical physics and a deterministic worldview, and the far more complex problems of social reality.[6] While inquiries in natural sciences may be approached with analytical rigour addressing a singular objective, wicked problems are interdependent complications with multiple causes. They are unforeseen contingencies of an emergent nature, and they involve social, political and cultural intricacies.
The inability of the mechanistic mindset and its technoscientific approaches to address the complexity of wicked problems becomes seriously apparent with respect to the environmental, economical and political issues with which we are currently dealing. Climate change, infectious diseases, financial crises, mass migration or wealth inequality are generally dealt with using emission *standards*, quarantine *laws*, credit *ratings*, national border

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of epistemologies to Eastern or Western values. Ultimately, it depends on where one draws a line of distinction. Concepts and inventions that inform and shape a Western mindset come from the ancient worlds of China, India, Persia, Babylonia and Egypt, thinking of papyrus or the mathematical number zero. From this perspective knowledge is a hybrid construction with Eastern and Western elements.
[4] Latour, *We Have Never Been Modern,* 27. Blok and Jensen. *Bruno Latour*, 55.
[5] Horst W. J. Rittel and Melvin M.Webber, 'Dilemmas in a General Theory of Planning,' *Policy Sciences* 4 (1973): 155.
[6] Ibid.,160.

fences and *indexes* for social justice. But these are not tame problems that can be approached analytically or statistically—they are wicked problems that are unstable, difficult to define with probably more than one solution. To approach them as if they were tame is irresponsible. Rather, we must embrace a plurality of approaches that invites uncertainty—approaches that challenge ideological constructs and expand epistemic potential. In view of wicked problems and the environmental fact of unpredictability, I argue that to enable imaginative responses to intricate realities, a more open understanding is required. This imaginative capacity is a defining feature of my art and design practice, which works to *stretch* the human sensorium beyond the limits of conventional scientific rationality. My project is part of a larger movement towards an ethical science that looks for new tools and new ways of thinking, in order to rekindle play, frankness, curiosity and to energise us for the challenges (the wicked problems) ahead.[7]

The shift in perspectives that this movement insists upon allows for unconventional approaches and innovative advancements. It takes dynamic instabilities into account so that more appropriate ideas for a viable future may be developed. Hence, *Tools for Alternative Understandings* aims to expand our epistemological toolset, fostering imaginative approaches and more emancipated modes of knowing beyond classical dichotomies and simplifying categories. The toolset creates a space for what Daniel Innerarity, researcher in political and social philosophy, calls *regulated anarchy*, and thus provokes an *elastic* form of literacy that intermediates between dualities in the opening up of alternative ideas, beyond simple antinomy and dissimilitude.[8] *Elasticity* acts a visionary device that helps us to think in contradictions, to conceptualise change, to discover new avenues and to provide alternative solutions to the current ideological impasse.

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[7] For example, Lorraine Daston, historian of science, attests art to be the capacity to invigorate a more sensitive human stance in regard to climate change, in contrast to natural science. Ana Ofak, 'Objects and (Their) Time. (Interview with Lorraine Daston),' *Mousse Contemporary Art Magazine,* 37 (2013). Similarly, Isabelle Stengers, philosopher of science, proposes an ethical shift in science that may enable us 'to enter into a new relation with reality, both an aesthetic and practical new relation.' See: Isabelle Stengers, 'The Challenge of Complexity: Unfolding the Ethics of Science. In Memoriam Ilya Prigogine,' *E:CO Special Double Issue,* 6 (2004): 97.

[8] Daniel Innerarity, *The Democracy of Knowledge* (New York: Bloomsbury Academic, 2013), 26.

Initial Encounters with Elasticity

Elasticity is a captivating idea.[9] On the one hand it implies verve, adaptability and transformation; on the other hand, it stands for a resilient coherence that can snap at any time and thus provide even more variation, initiating a different course of events.

Such simultaneous versatility provided a fertile and strategic model for this project and it led to the conception of specially designed, experimental measuring devices that may act as generators for alternative modes of understanding. The notion of elasticity implied a rich continuum of possibilities that enabled me to bypass the deterministic and linear logic of habitual models of reasoning. Thus, I used the concept as a thought-provoking incentive traversing my own explorative approach to this project, and elasticity is the essential material and conceptual component of the reconfigured measuring devices.

***Elastic Design* between Matter and Meaning**

Design itself is an elastic category, as it takes various forms including both applied design and the more wicked discipline of critical and speculative design.[10] Moreover, design is

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[9] One of the initial triggers for my embrace of the idea of elasticity in the context of design and understanding was the exhibition 'Design for the Elastic Mind' (2008) at the Museum of Modern Art in San Francisco. Various projects from artists and designers were curated under the aspects of continuously changing contexts, needs and expectations. See: Paola Antonelli and Museum of Modern Art, New York. *Design and the Elastic Mind*. (New York: Museum of Modern Art, 2008). The website of the exhibition 'MoMA.org | Interactives | Exhibitions | 2008 | Design and the Elastic Mind | Index' is available at http://www.moma.org/interactives/exhibitions/2008/elasticmind/ (accessed 20 February 2016). The book *Findings on Elasticity* (2010) also served as a source of inspiration as it combined observations, musings and reflections from several artists and scientists where the concept of elasticity came into play. Hester Aardse, Astrid van Baalen, and Pars Foundation. *Findings on Elasticity*. (Baden; London: Pars Foundation; Lars Müller, 2010). Though both publications focused on elasticity in their rationale, the application of the concept of elasticity was still not explored to its full potential.

[10] Mike Michael, sociologist of science and technology, differentiates between *critical design* and *speculative design*. He associates critical design projects with the work of interaction designers Anthony Dunne and Fiona Raby. This discipline works with design prototypes that contest and critically engage with a particularly sociotechnical future. Speculative design in the interpretation of Michael, is related to the work of Bill Gaver, design researcher, operating through public engagement in a wider context of sociocultural and environmental relevance. The objective of speculative design is the provocation of unanticipated, irritating and contradistinctive interpretations to trigger a reordering and reconfiguration of issues and perspectives. Mike Michael, 'De-Signing the Object of Sociology: Toward an "idiotic" Methodology'. *The Sociological Review* 60 (2012), 172. James Auger, design researcher, exemplifies the link between critical and speculative design emphasizing the mobilising qualities of both terms when he refers to Dunne and Raby. James Auger, 'Speculative Design: Crafting the Speculation'. Digital Creativity 24, no. 1 (2013). Dunne and Raby underline the focus on products in their work: 'Critical Design uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life.' Anthony Dunne and Fiona Raby, 'Critical Design FAQ', 2007. http://www.dunneandraby.co.uk/content/bydandr/13/0. (accessed 21 March 2016). Bruce and Stephanie Tharp coming from the area of product design, introduce the term 'discursive design' describing design as a 'thought catalyst.' Bruce Tharp and Stephanie Tharp, 'What Is Discursive Design?' *Core77*. http://www.core77.com//posts/41991/What-is-Discursive-Design (accessed 21 March 2016). As the objectives of my project comprise critique, discourse and speculation, I use these terms alternatively within

interfused with other areas such as art, cultural studies, sociology, psychology, natural science and engineering.[11] Daniel Fallman's 'interaction design research triangle' positions critical and speculative design due to its links to art and its unconventional approaches next to commercial design practice and academic design studies.[12] Exactly this position in-between art, applied design and theoretical research, delineates the powerful quality of critical and speculative design as not being removed from reality, classified as one academic discipline or caught by consumer interests within a capitalist society.

Instead, through its versatility and *transdisciplinarity*, critical and speculative design has the potential to provide strategies and techniques to instigate a change in thinking for a more viable future.[13]

The inherent versatility of design is, as Bruno Latour has shown, a result of its concern with the function, the look, the materiality of things, and also with their meanings.[14]

This contingent intersection between materiality and meaning occurs throughout my research. It is a core conceptual ingredient, implying the notion of a transversal relationality between disparate areas and considerations rather than their divisibility and separation.

The coupling of matter and meaning—or what Latour calls the turn from *matters of fact* into *matters of concern*—is essential to the design practice.[15] While matters of fact correspond

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this document. Instead of differentiating within a rivalry of terms and the defence of one's own position, I am adding *Elastic Design* as conceptual extension.

[11] See for example: Uta Brandes, Michael Erlhoff, and Nadine Schemmann, *Designtheorie Und Designforschung* (Paderborn: Wilhelm Fink, UTB, 2009). Brenda Laurel, *Design research: methods and perspectives* (Cambridge, Mass.: MIT Press, 2003).

[12] Daniel Fallman, interaction designer and professor of informatics, distinguishes three modes of enquiry within design. Whereas applied design practice delivers commercial designs sustaining the conventional capitalist system of commoditisation, design studies are associated with the formal disciplinary research in the area of scholarly design traditions, which are concerned with analytical, knowledge-oriented and scientific inquiries. In contrast, speculative design exploits its advantage of a more independent position in-between with its ties to scientific research on one side and applied aspects of everyday life on the other. It adopts methods from art with unconventional and idiosyncratic approaches injecting ungoverned and fictional aspects, which provoke alternative viewpoints and solutions. This independent stance instigates different kinds of attitudes and approaches that do not comply with functional or rational standards. See Daniel Fallman, 'The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration', *Design Issues*, Volume 24, Number 3, (2008).

[13] *Transdisciplinarity* is concerned with the creation of knowledge between, across and beyond scholarly disciplines in contrast to multidisciplinary and interdisciplinary approaches, which blend or transfer between different disciplines. The latter two modes of research remain within their main disciplinary frameworks while transdisciplinarity expands and complements various approaches. See Basarab Nicolescu, 'The Transdisciplinary Evolution of Learning,' (paper presented at the Annual Meeting of the American Educational Research Association on *Overcoming the Underdevelopment of Learning*, Montreal, Canada: Learning Development Institute, April 19-23 1999), available at www.learndev.org/dl/nicolescu_f.pdf (accessed 21 March 2016).

[14] Bruno Latour, 'A Cautious Prometheus? A Few Steps toward a Philosophy of Design (with special attention to Peter Sloterdijk).' Cornwall: Design History Society Falmouth (2008): 1.

[15] Ibid., 2.

with the instrumentally fabricated objectivity of scientific reasoning based on empirical evidence, matters of concern reveal a richer perspective that takes subjective, socio-political, environmental and cultural aspects into account. Matters of concern are about alliance, interdependence, care and caution. As design is a context-sensitive practice, it aims to turn undisputed facts and inert things into active matters of concern.

Instead of considering design as a shallow or detached practice that fuels capitalist interests for predictable profitability, Latour proposes a new *philosophy of design* emphasising its adept skillset: modesty, attentiveness, a semiotic aptness to cope with ambiguity, and a context-dependent awareness for ethical and political aspects are the particular assets of design.[16] These attentive skills may enable design to draft innovative tools for how to grasp the wickedness of various matters of concern. This call for an *alternative design* may be able to provide new approaches and perspectives, which can account differently for wicked conflicts and constraints within the construction of realities, while embracing the world's complex hybridity.[17]

Elastic Design and its desire for different approaches pursues the quest for a new philosophy of design that can provide alternative avenues. While the project is situated within critical and speculative design, it expands its inquiry for material, intellectual and interactional plasticity to foster transdisciplinary advancements and openness for pragmatic and provisory forms of engagement. Being concerned with enriching and encouraging our relationship with the world through experimentation and imagination, this creative practice is a broadened application of interaction design, as it not only deals with the design of products, interfaces and experiences in a technically applied and commercial sense, but is also concerned with socio-political, participative and inventive qualities that mutually interact and profoundly affect how we relate to the world.[18]

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[16] Ibid., 3-6.
[17] Ibid., 13.
[18] Gillian Crampton Smith, interaction design researcher, also points out this expanded dimension of interaction design. She suggests that aspects of sociability, innovation and intuition should be addressed more profoundly through the discipline. See Gillian Crampton Smith, 'Foreword: What Is Interaction Design?,' in *Designing Interactions*, ed. Bill Moggridge (Cambridge, London: MIT Press, 2007), xi. Anthony Dunne and Fiona Raby describe the wider dimensions through speculative design with the term *social dreaming* exemplifying its future-oriented intentions with the development of alternative imaginaries for social and political life. Anthony Dunne and Fiona Raby. *Speculative Everything: Design, Fiction, and Social Dreaming* (Cambridge, Massachusetts: MIT Press, 2013), 169.

Tools for an Elastic Methodology

This project is not structured in a classical sense that separates theory and practice, that remains situated in a certain paradigm and that devotes itself to a particular methodology. Instead, different threads and areas are dynamically interwoven and mutually shape each other to become tools for an elastic methodology. This is explicitly apparent in the intertwining of approach, outcome, process and context. Methodology, material, meaning and making are co-dependent constituents of knowledge creation through *Elastic Design* traversing and inflecting each other in the course of this exploration. In this sense, experimentation with the methodology itself is part of my research. In it, I explore different modes of knowledge creation with the aim of provoking alternative forms of meaning making; but further, my own research process intersects with the objective to provide epistemic tools that may alter the meaning making experience of a user. To probe these ideas in an experimental and tangible way, the project assembled eight explorations as reconfigured measuring devices and applications in the form of a toolkit.

Fig. 11 Bettina Bruder, toolbox of *Tools for Alternative Understandings,* prototype, 2015.

This tool-based contextualisation originates from my professional practice in interaction design focussing on devices, interfaces and experiences. Such an approach ascribes a functional agency to objects and tools, which can be explicitly activated and directed. Normally, the design of an interface or a device aims for seamless usability, but in this research the focus was shifted towards the *reconfiguration* of modes of meaning making, the tangible experience of change and the materialisation of new forms of knowledge. Objects and devices such as household appliances I used in previous projects due to their straightforward accessibility. Devices open sites for communication and interaction mediating metaphorically between material, contextual, intellectual and experiential qualities of a situation.[19]

The historical and conceptual precursors for the experimental tools assembled in a toolkit were Marcel Duchamp's *readymades* and the small-scale reproductions of his artworks issued in boxes termed *boîte-en-valise* (box-in-a-suitcase) (1935-41), which were transportable mini-museums. Similarly, the *Fluxkits* from Fluxus, also called *multiples* as they were produced in small batches and circulated as affordable, mobile art-pieces, served as inspiration.[20]

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[19] Earlier projects of mine that provided an enhanced platform for communication and interaction were an open TV-channel called *canal blond* (1997). "Blondness" opened up space for creative exploration in the form of an autonomous TV-station, which subverted the authority of professional media channels by showing homemade videos. Online and offline were linked in the design of the station ID (identity) explicating its imperfection and incompleteness through the missing letter "o" in the word "bl_nd".
This gap had to be completed by the audience in order to understand its meaning. The formal shape of round things depicting a hole or a button worked as a visual device enticing an audience's imagination while it also functioned as a loophole offering the view to the real and unpolished world expressed through the amateurish contributions of an audience. This round shape appeared in print and video as a shower drain, the valve of a steam iron, a camera lens or a belly button with hiccup. Similarly, the project *nearly nothing* (2002) which was about the desire for intellectual independence and new beginnings expressed "nothingness" in several interactive installations. Here, I used a vacuum cleaner and a light switch to access immateriality allowing the encounter of something that cannot be represented. With the *Tools for Alternative Understandings* I returned to the handling of objects as a force for new experiences. Images of *canal blond* and *nearly nothing* are shown in the Appendix.

[20] Daniel Spoerri, an affiliate member of Fluxus coined the term *multiples* 1959 in his edition *MAT (Multiplication d'Art Transformable)*. Spoerri adopted the idea from Duchamp's miniatures. Spoerri was interested to develop a way for 'the multiplication of art which constantly alters itself and is capable of modification.' Museum Tinguely, 'Museum Tinguely,'
http://www.tinguely.ch/en/ausstellungen_events/ausstellungen/2001/Daniel-Spoerri.html
(accessed 16 May 2015)

Fig. 12 George Maciunas, *Fluxkit* (1965). Harvard Art Museums/Fogg Museum, Barbara and Peter Moore Fluxus Collection, Margaret Fisher Fund and gift of Barbara Moore/Bound & Unbound. Artwork © George Maciunas Foundation/ARS. Image © President and Fellows of Harvard College. Licensed by Viscopy, 2017. The CC license does not apply to this picture. The licensor has to be contacted with regards to licence this material if republication is intended.

One advantage of these experiential kits was the convenient portability of the artworks that facilitated the bypassing of the conventions of dissemination and reception within the context of art. In contrast to the representation of untouchable art objects in galleries or museums, these tools and toys enabled a direct engagement offering a haptic and immersive experience to stimulate reflection and further insights through the strategy of recontextualisation. With the *Tools for Alternative Understandings* I also used off-the-shelf products such as office supplies and measurement devices as references to the organisation and production of knowledge. I intended to unsettle assumptions of stability, accuracy and order that are associated with mass-produced stationery and calibrated measuring devices through modifying measurement equipment and applications.

Material Interventions

Tools, toys and objects offered a platform to inject malleable substances into prefabricated rigidity destabilising accuracy and order. The use of synthetic material in modern art practice is examined by Dietmar Rübel, art historian, as a strategy to resist the production of durable and valuable pieces of art. Plastic, rubber and synthetics suited artists' intentions to counteract

quests for timeless and lucrative artworks. In reference to Roland Barthes' *plastification* of the world, Rübel argues that the expectation of durability within sculpture as an art category underwent revaluation, echoing the dilution of formal categories and disciplinary borders within art and society.[21] Contingency and processuality—transformation, decay and moulding—were put into service to mirror and stimulate societal and political change as a kind of *polymerisation* in the 1960s.[22] Barthes described plastic's potential for renewal and change representing the new order of things and a democratisation of values in society:

> So more than a substance, plastic is the very idea of its infinite transformation; as its name indicates, it is ubiquity made visible. And it is this, in fact, which makes it a miraculous substance: a miracle is always a sudden transformation of nature. Plastic remains impregnated throughout with this wonder: it is less a thing than the trace of a movement... The hierarchy of substances is abolished: a single one replaces them all.[23]

Flexible materials like plastic, foam and polystyrene enabled a shift of meanings extending the physical quality of an object to processes of transformation within a cultural and social context.[24]

Deploying malleable materials in this studio practice allowed the wicked complexity of reality to become more tangible. New openings were injected into conventional approaches of meaning making such as measuring and "inscription".[25] These experiences were occasioned in the practical engagement with the reconfigured tools. With the TAU I aimed to provoke an enhanced sensitivity, which I termed *alternative understanding,* to express an

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[21] Rübel, Dietmar. *Plastizität – Eine Kunstgeschichte des Veränderlichen*. (München: Schreiber, 2012), 121.
[22] Ibid., 20-21,
[23] Roland Barthes, 'Plastic (1957),' in *The Everyday Life Reader*, ed. Ben Highmore. (London; New York: Routledge, 2002), 308–307.
[24] A notion that is exemplified by foams in Peter Sloterdijk's *Spheres* trilogy. Sloterdjik examines under the premise of continuous, flexible transmutations the decentralisation of the infrastructural organisation of our world comparing it with foams, spheres, globes and bubbles: 'The guiding morphological principle of the polyspheric world we inhabit is no longer the orb, but rather foam'. Foams are metaphorically deployed due to their 'ungovernable structures' implying a 'morphological anarchy'. Peter Sloterdijk, *Bubbles: Spheres I*. (Los Angeles: Semiotext(e), 2011): 71, 73.
[25] *Inscription* is a term used by Bruno Latour and Steve Woolgar in STS in reference to the transformation processes within scientific inquiries and the production of knowledge where material samples and organic matter are translated into facts and diagrams. See Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (New Jersey: Princeton University Press, 1979), 51. Bruno Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, London: Harvard University Press, 1999), 306-307.

increased awareness of the different intensities and diverse modalities within a situation.[26] *The Tools for Alternative Understandings* purposely deploy malleable materiality to activate this enhanced sensitivity. Such an augmented susceptibility was also required in the manufacturing process of the manipulated tools themselves, as I had to pay particular attention to the behaviour of materials with which I was working. For example, for the production of the *Elastic Standard Metre*, one of the *Tools for Alternative Understandings*, it was necessary to invent a particular production process in screen-printing. Working with latex as substrate required the preparation of a particular ink that was applicable to a flexible material. The consistency of this custom-mixed screen printing ink was determined by hand. Instead of a specified mixing ratio prescribed by a manufacturer, the screen-printing expert who helped me with the production, literally felt the viscosity of the mixture with his fingertips. I describe the enhanced understanding and tacit knowledge that is addressed through these responsive materials with the German term *Fingerspitzengefühl*, which literally translated means 'fingertip feeling'.[27]

The expression describes the ability to deal with sensitive issues not only in an art and craft context but also in political circumstances where diplomacy and intuitive sensitivity are required. This enhanced receptiveness describes the kind of alternative understanding that I

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[26] In contrast to the nouns *thought* and *knowledge* representing abstract concepts, the connotations of *understanding* imply bodily, cognitive and spatial qualities, which are involved in knowledge making processes. Adding the suffix *-ing* to a verb for its inflexion allows its modified usage as an adjective, noun or verb. The affix *-ing* is used in the gerund to express a noun. As present participle the word actively *participates* in the verbal construction expressing a continuous and simultaneous aspect of action. Being not a native speaker, I curiously observe such linguistic and etymological elements. Thus, I purposefully deploy rhetorically stylistic devices in my writing. *Understanding* implies a certain relationality and contingency that I associate with an elastic awareness and responsiveness. Etymologically, the term understanding refers to the spatial metaphor of a situated position, standing "among", "between" or "under" a respective object of interest in order to analyse it, to comprehend it and to recognise it. Understanding emphasises the experience of being actively engaged in a relational position in-between in order to gain a better awareness. The Analytic Dictionary of English Etymology explains understanding as 'one "stands under" and gets to the bottom of things, and while standing between or among things, one acquires the power of discrimination. Understand must originally have referred to the process of observation and learning rather than its result.' Anatoly Liberman, *An Analytic Dictionary of English Etymology* (Minneapolis, London: University of Minnesota Press, 2008), 210.

[27] Bruno Latour describes such enhanced awareness and sensitivity in *Pandora's Hope* following a group of pedologists in the Amazon forest. The researchers determined the subtle variations in the granularity of the soil by hand discussing its grading:

> "Sandy-clay or clayey-sand?"
> "No, I would say clayey, sandy, not sandy-clay."
> "Wait, mold it a bit more, give it some time."
> "Okay, yes, let's say between sandy-clay and clayey-sand."
> "Heloissa, make a note: at P2, between five and seventeen centimetres, areno-argiloso a argilo-arenoso."

Latour, *Pandora's Hope,* 63.

wish to provoke through the concept of elasticity. It is a context-related awareness that acknowledges circumstantial possibilities and emergent constraints and that declines to be reduced to quantifiable or representable data. Such attentive meaning making is a generative practice that oscillates between doing and thinking. Thus, elastic transdisciplinarity is used to encourage exchange and encounter between different practical and theoretical modes of enquiry.

The alternating process between these forms of exploration is reflected within the document itself by shifting and switching between practical exploration and theoretical discussion. The composition of this text enables a user to be immersed in a continuous dialogue of response and discovery. An experimental practice and the complementary processes of reflection and analysis facilitate a generative process of comprehension, while meaning is made in the reading and parallel engagement with the *Tools for Alternative Understandings*.[28]

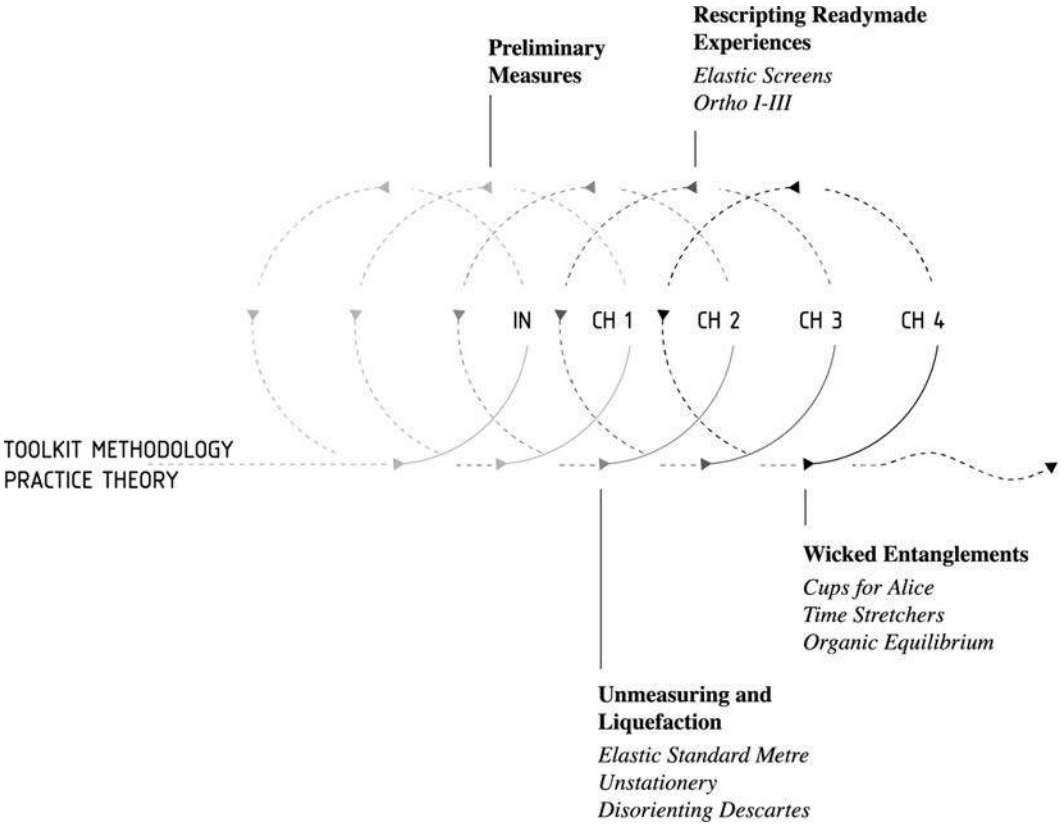

Fig. 13 Diagram of the design and reader experience interweaving practice and theory.

[28] Donald Schön also points out these iterative processes within creative practice. He describes the process as a 'reflective conversation with the situation' between 'constancy and variation' while shifting between experimentation, reframing and eventual commitment. Donald Alan Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983), 268.

The tool-based rationale of the *Tools for Alternative Understandings* articulates the notion of coupling as mediating between material practice and conceptual meanings. It allows shifting between ontology and epistemology to expound the fabrication of meaning as a processual and practical undertaking. This associative and *reassembling* quality is also apparent in the mutability of the theoretical framework that underlies the project.

The project builds on material-semiotic approaches that draw out the intertwining between human and non-human aspects as interacting (f)actors in the fabrication of reality where different paradigms merge and mutually enhance each other.[29]

To illustrate this interweavement, I draw on a text from Estelle Barrett, researcher in art and communication, where she situates creative arts as *successor science* contesting traditional assumptions of qualitative research through its distinct interpretive framework.[30] Barrett points out that different parallel paradigms are at work within scientific inquiry. Traditional approaches like positivism or post-positivism aim to verify or falsify results and observations with the objective to establish generalisable facts, while competing paradigms such as critical theory and constructivism, emphasise the emerging quality of knowledge either through subjectivist interpretations or through relativist analysis based on 'dialogical and dialectical' relationships that are guided by social, cultural, economic or historical contexts.[31] New materialist accounts with material-semiotic perspectives can extend these approaches to epistemology that Barrett describes as 'flows between thought, feeling and the material world'.[32]

Such an alternating course of inquiry provokes a practice-based, performative and participative mode of knowledge production expanding the conventional assumptions and beliefs within scientific research and its focus on matters of facts. By targeting on metrology and manipulating measurements and devices, I intertwine the various scientific research paradigms on a material level to provide metaphorical tools that can activate thought and

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[29] *Material-semiotic* is an expression employed by Donna Haraway and Bruno Latour, while Karen Barad uses the term *material-discursive* to describe the contingent and meaning-generating capacity of materials and objects.
[30] Estelle Barrett, 'Situating Creative Arts Research as "Successor Science",' in *Doctoral Writing in the Creative and Performing Arts*, ed. by Louise Ravelli, Brian Paltridge, and Sue Starfield (Faringdon, Oxfordshire: Libri, 2014), 51.
[31] Ibid., 54.
[32] Ibid., 54.

imagination. The concept of elasticity facilitates this shift and dynamic process, which is also reflected in the intended meandering structure of this document (Fig. 13, 14).

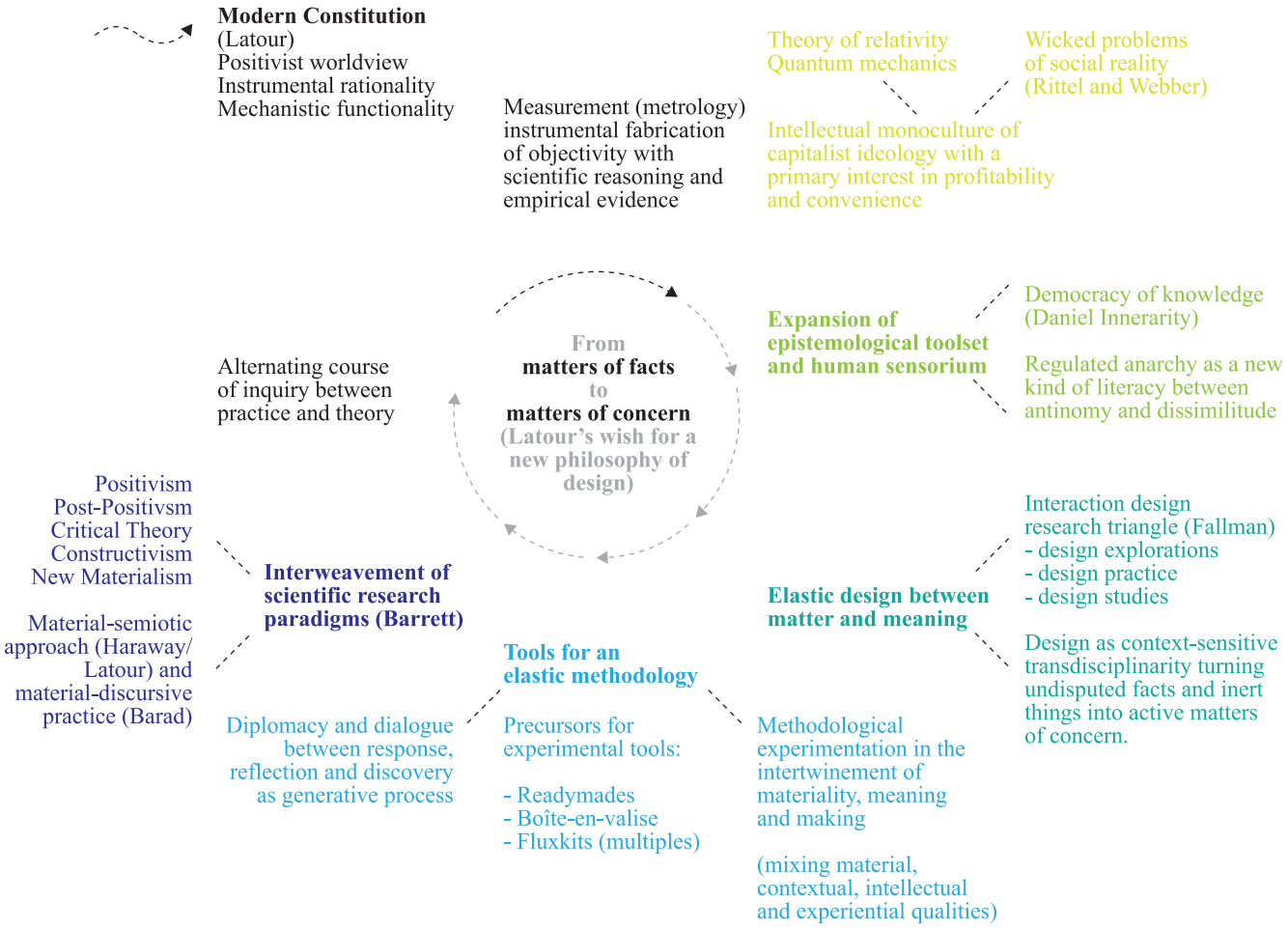

Fig.14 Diagram showing clockwise the flow of guiding concepts and philosophical explorations of this project.

Thesis Outline

Chapter One *Preliminary Measures* explicates metrology as an unquestioned authority in the construction of an objective reality. Measurement is fundamental, coordinating society and scientific research. It authorizes particular forms of human activity. The second part of this chapter directly challenges the asserted importance of measurement. I argue that measurement, standards and conventions target stability and encompass a certain homogeneity that limits our imagination and our scope of action. Based on Karen Barad's reconceptualisation of measurement due to the indeterminacy found in quantum physics, I constructively take advantage of this interpretability within scientific concepts and apply

ambiguity and dynamic mutability within my experiments.[33] Finally, I consider strategies utilised within art and design that employed notions of ambiguity and dynamic transformation. These examples sought to provoke alternative models of understanding that catalysed imagination and inventiveness and stimulated change within social structures, interactions and mindsets. Such experimental strategies (elasticity, playfulness, decontextualisation and chance) and the 'idiotic methodology' of speculative design provoke alternatives in the form of 'what-if scenarios', which challenge conventional knowledge making practices.[34] These strategies inform each experiment and result in the methodological elasticity that is fundamental to this project.

Chapter Two, *Unmeasuring and Liquefaction* introduces *Elastic Design* as a method for "unlearning" and unmaking. It argues that elasticity can be injected as a material and conceptual resource within knowledge making practices to undo conventional and analytical approaches based on calculation, order and transcription. The disruption of these habitual processes may reveal the potential for alternative encounters with emergent, unpredictable and volatile qualities instigating fluid and agile ways of engagement. The discussion revolves around three experiments on a practical, economical and political level – the *Elastic Standard Metre*, *Unstationery* and *Disorienting Descartes*. Using the strategies from art and design and the theoretical concepts of *agency, agential cuts* and *performative understanding* these experiments expand, literally and figuratively, the experience of measuring so that they encourage the unlocking of conventional assumptions to reveal potential creative responses.[35]

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[33] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and The Entanglement of Matter and Meaning* (Durham: Duke University Press, 2007).

[34] Mike Michael uses the term *idiotic methodology* to describe an approach borrowed from speculative design and applied within social scientific research. Michael, 'De-Signing the Object of Sociology':168. Dunne and Raby introduce 'what-if scenarios' to explicate approaches within speculative design. Dunne and Raby, *Speculative Everything,* 86.

[35] *Agency* and associated terms like *agent*, *actor* and *actant* are concepts to shift the perception of materials and devices from passive, immutable and inert objects to their dynamic and active qualities within the production of knowledge. This change of emphasis beyond a hierarchical setup provides a politically different structure acknowledging the interventional capacity of non-human entities.
Karen Barad describes 'agency is an enactment, a matter of possibilities for reconfiguring entanglements', which expresses the capability to actively influence the course of events. Karen Barad interviewed by Rick Dolphijn and Iris van der Tuin, *New Materialism: Interviews & Cartographies* (Ann Arbor: Open humanities press, 2012), 54. Bruno Latour states that 'an actant can literally be anything provided it is granted to be the source of an action.' Bruno Latour, 'On Actor-Network Theory. A Few Clarifications,' *Soziale Welt* no. 47 (1996): 373. With 'agential cuts', Barad emphasizes the circumstantial separability of a particular aspect that is entangled within the relations of a specific situation. Instead of the general validity of a 'Cartesian Cut', she draws attention to the mutable contingency of scientific findings. Barad, *Meeting the Universe Halfway,* 140. A 'performative understanding' is proposed by Barad to exceed the representationalist access to reality that is gained through symbolic, linguistic or mental representations. Performativity focuses on processes, temporality and change, challenging the differentiation between

Chapter Three *Rescripting Readymade Experiences* argues that design can operate as a redirective practice. It considers whether the flexibility of visual representations can be deployed as a pedagogical and informative asset to redirect human encounters and constructions of reality through screen-based technology. It does this by the discussion of two approaches to experimentation with communication technology—*Elastic Screen* and *Ortho I-III*. The projects displace both, the physical and intellectual position of a user by playfully tweaking the relationship between user and display. The applications liberate the user's posture and encourage a shift in standpoints and attitudes. The discussion uses the concepts of *diffraction*, *situated knowledges* and *docile bodies* to explicate how the experiments uncondition a user's position and redirect certain perspectives so that the shifting presentation of visual information allows alternative interpretations and actions to emerge.[36]

Chapter Four, *Wicked Entanglements* argues that material interventions manifested in the *Tools of Alternative Understandings* can be used to redesign and re-entangle human action and awareness to account for complexity. The experiments deploy inefficiency and irrationality to disrupt traditional assumptions and conventional models of thought. The engagement with the particular tools discussed in this chapter – *Cups for Alice, Time Stretchers* and *Organic Equilibrium* – opened up sites for imaginative reflection and situated encounter triggering experimental approaches. Through the reconfigured measuring devices, I deployed mutable substances and uncontrollable, physical forces such as gravity and atmospheric pressure to sabotage the notion of seamless functionality. The chapter draws on the philosophical concepts of *intra-actions, entanglements*, *matters of concern* and *things* as *gatherings* to reveal complex relationships that otherwise would be excluded, ignored or corrected.[37]

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subjects and objects or concepts of observer-independent inquiry. Barad, *Meeting the Universe Halfway,* 49.

[36] Barad uses *diffraction* as an interpretative approach in relation to the concept from Donna Haraway. Barad, *Meeting the Universe Halfway,* 30. Donna Haraway introduces *situated knowledges* as an alternative objectivity that offers a partial rationality as it aims to take various perspectives into account. Donna Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective,' *Feminist Studies* 14, no. 3 (1988): 575–99. Michel Foucault argues that disciplinary technologies shape *docile bodies* and thus, aim to maintain particular hierarchies within a scientific, political and economical system. Michel Foucault, *Discipline and Punish: the Birth of the Prison*. (New York: Vintage Books, 1995), 135.

[37] *Intra-actions* and *entanglements* are concepts that Barad uses to deflect ideas of isolated, lifeless and inert entities. Instead, she conceives an ongoing, dynamic being-in-relation of objects, humans and agencies. Barad, *Meeting the Universe Halfway*. Latour describes the shift from *matters of fact,* which are factual, unquestioned scientific inscriptions to *matters of concern* as things about which we care. He highlights the etymological derivation of "things", which are gatherings or hybrid assemblages of various factors, qualities and aspects. Bruno Latour and Peter Weibel, *Making Things Public*

There is a significant body of work from artists and designers who have been experimenting with measurement, devices and related aspects. With each discussion of my own experiments, I indicate links, similarities and differences in relation to these other works, drawing out the radical potential of the *Tools for Alternative Understandings* to reconfigure a certain ideology that is based on classical, scientific models and an economically driven rationality.

The purpose of these experimental objects is to provoke reflection and alternative interpretations about objectivity, equity, balance and justification both in a literal and metaphorical sense motivated by the handling of the experimental measuring devices.
I argue that such reconfigured engagements may alter our imagination and expand our understanding in order to enable us to face the wicked problems of the present and the future.

(Cambridge, Mass: MIT Press, 2005), 23, 41.

CHAPTER ONE

Preliminary Measures

Introduction

Tools for Alternative Understandings (TAU) use scientific experimentation as their framework in the form of reconfigured measurement devices. The altered tools offer an experimental playground to destabilise the belief in validity and objectivity, which is facilitated through quantified analysis and thus, they explore and provoke possibilities for alternative interpretation. In a series of quasi-scientific experiments I examined the unconventional and idiosyncratic potential of devices, materials and situations within knowledge making attempting to stimulate a different kind of measurement and evaluation to elicit unanticipated consequences and outcomes.

The term *measure* comprises a multiplicity of meanings.[38] It describes a set of actions to achieve a particular outcome, the practice of measuring and the result of a measurement. Throughout my work, I purposefully deploy such a contextual and rhetorical ambiguity of meanings to work metaphorically with them and through them, which explains this chapter's title *Preliminary Measures*.

The chapter describes initially the significance of measurement as an intermediary between concepts and reality, ensuring compliance and validity by regulating time, space and matter. Measurement is relevant to the organisation and maintenance of human society and essential to social order and scientific knowledge, so that a particularly rational course of action is justified. Measurement forms the basis for ideas of objectivity, equality and absoluteness, which guide human paradigms—ideologies, systems of belief, patterns of thought, attitudes and actions. As measurement is based on consensus, scientific fact is interspersed with and based on subjective experience. Despite this conflicting nature in the scientific paradigm (subjective agreement versus objective regulation), I argue that measurement, standards and

[38] By drawing attention to the multiple nuances of the term *measure* that can be used as noun and as verb, I worked productively with its linguistic versatility. Similarly, Karen Barad used the term *matter* referring to a substance and to the practice of *mattering*, which denotes the act of being affective and of importance. Matter is considered as an active factor to emphasise an inherent processuality and a contingent openness of things, operations or events. On the link between matter and meaning in regard to the work of Karen Barad, see also: Marietta Radomska, 'Towards a Posthuman Collective: Ontology, Epistemology and Ethics,' *Praktyka Teoretyczna* 1 (2010): 108.

conventions limit imagination, experiences and human scope of action. Hence, I use the interpretability of scientific concepts in the form of measuring devices by drawing on Karen Barad's reconceptualisation of measurement inspired through the indeterminacy of the results that were gained during the experiments in quantum physics. I link Barad's discussion of the apparatus as material-discursive practice with the methodology of *object as discourse* developed within critical design. I aim to demonstrate how discursivity and indeterminacy can be deployed productively in the form of artefacts and devices to develop new models of thought and ideas about reality.[39] Finally, I consider concepts of elasticity and associated notions of heterogeneity, multiplicity and ambiguity that were constructively used in art, design and philosophy. I outline exemplified strategies along the areas of playfulness, decontextualisation and chance to describe how these techniques were deployed to provoke alternative models of understanding with the objective to spark imagination and inventiveness stimulating change within social relations, mindsets and actions.

1.1 Measurement and Apparatuses

> [C]ommon measurement depends, of course, on the quality of what is transferred.
> The question is not to fight against categories but rather to ask:
> 'Is the category subjecting or subjectifying you?'[40]

Measurement is essential to social, political and ideological cohesion. Unification through measurement became effective during the French Revolution as the national emancipation from a domineering system of political power, which privileged a small social group within the nation.[41] Surpassing national borders, the new measurement was meant to be implemented as a universal measure for the benefit of all humankind following the concept of liberty, equality and fraternity. Ken Alder, historian in science and technology, states that the new measuring system unified approximately 250,000 different units of measurement used in the different areas of the French nation.[42] Thus, a consolidated measurement system meant greater independence and efficacy fostering science, trade and administration.

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[39] Anthony Dunne and Alex Seago, 'New Methodologies in Art and Design Research: The Object as Discourse,' *Design Issues* 15, no. 2 (1999): 11.
[40] Bruno Latour on measurement and categories. Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press, 2005), 230.
[41] On the history of measurement see for example: David J. Hand, *Measurement: Theory and Practice. The World through Quantification (*London, UK: Arnold Publishers, 2004)
[42] Ken Alder, *The Measure of All Things: The Seven-Year Odyssey and Hidden Error That Transformed the World* (New York: Free Press, 2002), 3.

Measuring devices and analytical instruments ensure the adherence to standards and facilitate their implementation. Instruments for quantitative analysis are essential for administrative tasks and economic efficiency building the basis for the production of scientific knowledge. Thus, scientific instruments comprise a knowledge-constituting capacity.[43] Measuring devices produce data and information determining how humans relate to the world and how a particular reality is constructed. Quantification as the translation of experiences and observations into numbers and values allows the association of inputs with outputs and facilitates the fabrication of predictable statements following a mathematical logic.[44] The process of mapping and conversion from the real world to an ideal world is a translation, or to deploy the term used by Bruno Latour, an *inscription* that enables the construction of verifiable facts and empirical evidence, which in turn grant efficient control and reliable predictability. Measurement subordinates materials, objects and actions to organisational structures and rigid operations based on facts, figures and classifications. That means, for example that space, time and matter are arranged in a firm set of rules, which allow the representation and efficient application of these scientific concepts. This particular logic and order is an integral part of a regular measuring instrument.[45]

The inbuilt logic and proficiency within scientific devices facilitate controlled operations independent from subjective, locational or temporal conditions. Such technoscientific autonomy of analytical instruments allows the bypassing of human involvement to provide mechanical objectivity, scientific neutrality and the constructability of a standpoint-independent reality.[46] The inherent configurations of the instruments with default settings, index values and measuring scales, signify an ordered space for operation that indicates the juncture between a conceptual world and a material reality. Thus, measurement is a conversion between the accuracy of conceptual rationality and the irregularity of the real world. Measurement represents an artificial construction that arranges different variables in a particular relationship, which is described by mathematician David Hand as

> [a] mixture of representational and pragmatic constraints: one creates a model for what one believes is the empirical situation, or as near as one can get to it (using representational

[43] Davis Baird, a philosopher of science and technology describes scientific instruments as 'pragmatic crutches that help thinking'. Davis Baird, *Thing Knowledge* (Berkeley: University of California Press, 2004), 1.
[44] Hand, *Measurement,* 3.
[45] Baird, *Thing Knowledge*, 12.
[46] Lorraine Daston and Peter Galison. *Objectivity* (New York; Cambridge, Mass.: Zone Books; MIT Press, 2007), 378-381.

> models) and then adopts certain assumptions or conventions for the remainder, for the gap between the model and the reality (using pragmatic constraints). The gap-bridging pragmatism is needed for almost all measurements...[47]

Measurement is a convention based on agreement between members of an authoritative group, for example, a scientific community like the French Academy of Sciences, which initiated and implemented the current metric system. Thus, conventions are based on common consent. This means that they are to some extent imaginary or illusionary—what Henri Poincaré called 'the fruit of an unconscious opportunism'.[48] By that, he pointed out that measuring rules are not pre-existing. Instead, alternative formulas could have been conceived.[49] This interpretability of measurement is deployed productively in the work of Barad. She uses the various interpretations of the perplexing measurement results obtained in the double slit experiments of quantum mechanics as the foundation for her concept of *agential realism*.[50] The results and observations in quantum mechanics contradicted the models of classical physics, which are based on ideal, universal concepts where physical phenomena follow Newtonian laws implying determinacy and predictability.

The Measurement of Uncertainty

With the experiments in quantum physics the notion of objective and universal predictability was no longer tenable. Barad elaborates how the interpretability of the observations of the discontinuous change in an electron's momentum and the incoherence of the respective measurement outcomes with the laws of classical physics caused Werner Heisenberg to formulate the Uncertainty Principle. Heisenberg's interpretation underlines the epistemological limitations of human knowledge due to technical constraints inherent in the measurement apparatus. Barad explains Heisenberg's account that

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[47] Hand, *Measurement,* 14.

[48] Henri Poincaré, *The Value of Science* (New York: Dover, 1958), 36.

[49] For example, multiple methods of arithmetical thinking and measuring are indicated by *ethnomathematics*, a field of enquiry within mathematics. It is a comparative area of study within mathematics education introduced by Ubiratan D'Ambrosio, a Brazilian mathematician. By examining the relationship between culture and mathematics, the discipline challenges the Eurocentrism within modern mathematics and draws awareness to other more intuitive systems of mathematical practices as they are used by traditional, indigenous cultures. The idea of mathematics as a universal language was put at risk as different means of calculation were acknowledged. Ubiratan d'Ambrosio, 'Where Does Ethnomathematics Stand Nowadays,' *For the Learning of Mathematics* 17 (1997).

[50] In Barad's new materialist articulation of knowledge making practices as *agential realism*, she attributes *agency*—the capacity to be affective and influential—not only to apparatuses, instruments and technical equipment but also to unmanufactured matter such as particles, energy and phenomena. Barad, *Meeting the Universe Halfway,* 170.

> [A] determinate value of the electron's momentum is assumed to exist independently of measurement, but we can't know it; we remain uncertain about its value, owing to the unavoidable disturbance caused by the measurement interaction.[51]

Alternatively, Niels Bohr proposed a different interpretation and conceived a rather diverging epistemological framework that allowed him to surpass the rigid lines set by Democritus, Descartes and Newton.[52] Bohr abandoned the assumption of separate objects with distinct boundaries and explicit values. Rather than assigning uncertainty to the observer, he described the results as *indeterminate* and not definable.[53] Bohr's alternative conception challenged the idea of clear-cut, numerical values that can be detected by scientific devices, which are supposed to be representable as stable and distinct entities. In his view, a detectable quantity may have a certain latitude, which corresponds with a margin of discretion allowing only for a partial definability.[54]

Through this wider perspective, Bohr drew attention to the intertwining between processes of measurement, the testing apparatus, the scientist as observer and the observed phenomenon itself. Thus, an object of research is not just a passive surface for the inscription of human values. Instead, the participation of devices and substances in knowledge-making processes has been recognized and scientific instruments were assigned a constitutive function. Barad expands Bohr's interpretation by drawing attention to the fact that 'there are no things before the measurement, and that the very act of measurement produces determinate boundaries and properties of things'.[55] In other words, the idea that a particle's position can be predicted precisely within the ordered space of measurement is a human invention and does not exist as a naturally given entity, which is supposed to be discoverable. Instead, measurement comprises subjective aspects and is a construction of the human mind where matter meets meaning.[56] Barad states:

> Measurement is a meeting of the "natural" and the "social." It is a potent moment in the construction of scientific knowledge – it is an instance where matter and meaning meet in a very literal sense.[57]

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[51] Ibid., 116.
[52] Ibid., 138.
[53] Ibid., 114.
[54] Ibid., 400-401.
[55] Ibid., 62.
[56] Ibid., 173.
[57] Ibid., 67.

On the basis of measurement as the intertwining of physical materials and interpretation, Barad develops her concept of material-discursive practices where she combines Michel Foucault's apparatus as *dispositif* with Bohr's account of scientific machinery.[58] Barad uses the notion of the apparatus as a generative device, emphasising its dynamic and constitutive quality not only within scientific research but also in a wider social and ethical context.[59]
In her definition, she emphasizes that apparatuses 'are not bounded objects or structures; [instead] they are open-ended practices', which should be considered as material-discursive processes participating as active collaborators in the course of events.[60] Measurement in this agential realist view links materiality with concepts; therefore, matter is intertwined with meaning and both are interdependent. The key aspect in Barad's comprehensive approach is her critique of *representationalism* that separates materiality and meaning implying a certain predictability of statements and a distinct assignability of cause and effect where passive objects can be separated from active subjects.[61] Barad describes matter and meaning entwined in a fluid process of becoming in which discursive, material, human and non-human factors are actively involved. This alternative conception draws attention to processual and non-representable qualities of knowledge that are constitutive aspects in the construction of meaning.

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[58] Foucault's notion of the dispositif links practical and material with theoretical, social and conceptual aspects. The dispositif is a set of strategies that is specified by Foucault as '[A] thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions…
The apparatus itself is the system of relations that can be established between these elements.'
Michel Foucault, *Power/Knowledge*, ed. Gordon Colin (New York: Pantheon Books, 1980), 194.

[59] Karen Barad asks: 'What is an apparatus? Is it the set of instruments needed to perform an experiment? Is it a meditating device that allows the object world to give us a sign of its nature? Is it a prosthetic extension of our sensing abilities? Shall we understand an apparatus in terms of Kantian grids of intelligibility? Aristotelian schemata? Heideggerian background practices? Althusserian apparatuses? In Foucault's sense of discursive practices or dispositif (apparatus)? In Butler's sense of the performative? As Latour's inscription or translation devices? Or as Haraway's apparatuses of bodily production?' Barad, *Meeting the Universe Halfway*,141.

[60] Ibid.,170. Barad reads the different understandings of an apparatus against each other and formulates the following description: '(1) apparatuses are specific material-discursive practices (they are not merely laboratory setups that embody human concepts and take measurements); (2) apparatuses produce differences that matter-they are boundary-making practices that are formative of matter and meaning, productive of, and part of, the phenomena produced; (3) apparatuses are material configurations/dynamic reconfigurings of the world; (4) apparatuses are themselves phenomena (constituted and dynamically reconstituted as part of the ongoing intra-activity of the world); (5) apparatuses have no intrinsic boundaries but are open-ended practices; and (6) apparatuses are not located in the world but are material configurations or reconfigurings of the world that re(con)figure spatiality and temporality as well as (the traditional notion of) dynamics (i.e., they do not exist as static structures, nor do they merely unfold or evolve in space and time).' Ibid., 146.

[61] Barad discusses representationalism in detail. Ibid., 46-67.

Apparatus, Material Discursive Practice and Objects as Discourse

In the development of the TAU, I drew on indeterminacy as outlined in Bohr's and Barad's reconceptualisation of measurement and the apparatus to link material discursiveness and limited definability with the messy multiplicity that is found within wicked problems.

The TAU refer to the concept of the apparatus being situated between the discursive-material practice of meaning making as outlined by Barad and the *object as discourse*, which is a method within critical design introduced by Anthony Dunne and Alex Seago.[62] Coming from a design context, the authors proposed object as discourse as a way to instigate perceptive examination to reveal preconceived notions and stimulate critical reflection through particularly designed artefacts. Objects considered in that sense can shape the relation to socio-technical issues by expanding familiar perspectives about technologies that are predominantly driven by conventional scientific and economic models. The object as discourse drafts an altered terrain for engagement in the form of an artefact that is conceived as a materialised form of a discussion provoking debate and hypothetical approaches to challenges within society, technology and environment.

The designers describe such engagement 'as a form of socio-aesthetic research towards the integration of aesthetic experience and everyday life through the development of conceptual products'.[63] *Elastic Design* advances this approach. Rather than developing conceptual products within a certain technoscientific and critical perspective, *Elastic Design* provokes thought-experiments instigating *new* forms of conceptualisation that are based on elasticity and that arise through the engagement with the TAU. While the object as discourse remains within a particular paradigm, *Elastic Design* challenges the classical scientific and mechanistic models of conceptualisation and evokes alternative conceptions intentionally intermingling various paradigms as described in my introduction.

Elastic Parafunctionality

Parafunctionality is a methodical component of the object as discourse facilitating to surpass conventional settings and economical postulates of efficiency and representability.[64]

The function of a discursive object is deviated to access poetic and critical connotations beyond conventional purposes. Dunne and Seago describe the term parafunctionality as the

[62] Dunne and Seago, 'New Methodologies', 11.
[63] Ibid., 14.
[64] Ibid., 16.

> [I]dea of using the process of invention as a mode of 'discourse', a poetic invention that, by stretching established conventions, whether physical, social, or political, rather than simply affirming them, takes on a radical critical function.[65]

The TAU deploy parafunctionality in the sense that they criticise, challenge and also inspire and transform certain paradigms and conceptual conventions, which shape the wicked conditions within and the concerns about society, technology and environment.

Addressing tacit qualities such as experience, sensitivity and the conceptual grounds of understanding, directs beyond factual values, profitable calculation and representable information. The TAU subvert instrumental rationality and interfere with conventional concepts provoking unfamiliar experiences within meaning making. The parafunction of the TAU is the shifting of analytical gears as they operate at the juncture between theory and practice where rational concepts and regulations meet material and political concerns.
As this studio-practice explores new ways of knowledge making, tools, materials as well as concepts and concerns are all treated as active configurations formatting and shaping our relationship with reality.

The project proposes modes of meaning making that are percipient and responsive, attempting to take the uncertainty and complexity of material, psychological and cultural concerns into account. Thus, the parafunctionality of the TAU expands the (design) space for conceptualisation amending a user's attention and providing enhanced contextual and even counter-intuitive information by using elasticity as a key factor to open sites for reflection, imagination and the reconfiguration of conventional approaches and viewpoints.

1.2 Components of an Elastic Methodology

Elasticity reveals its multiple meanings and various areas of application when considered etymologically.[66] The term describes a certain quality of properties and relations in material

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[65] Ibid., 15-16.

[66] My interest in etymological explorations arose from a curiosity to detect speculative and poetic possibilities for a prospective reading of semantic ambivalences. Different meanings that are enclosed in an expression may create shifts in articulation and counter scientific terminology. Etymology allows for combinational and associative contributions through a comparative and deconstructive inquiry in Jacques Derrida's sense. This extended understanding points towards further meanings of a term that have been transformed over the course of time. Derrida used this strategy to unwind Western predominant thinking that classifies the world in hierarchies and oppositions. See for example Leonard Lawlor on Jacques Derrida. http://plato.stanford.edu/archives/fall2011/entries/derrida/ (accessed 8 March 2015).

sciences, physics and economics.[67] Elasticity can specify immaterial qualities, for example, emotions or concepts as well as physical properties of objects or substances. To say something is elastic implies its mutability and capacity to adapt to different situations, as it is able to regain its original shape or condition after being stretched or compressed. Mineralogy differentiates between flexible and elastic materials upon their reaction to the discharge of force effects. While flexible materials develop a different position, elastic minerals regain their initial state. While flexibility describes the capacity to bend and change, elasticity comprises the ability to change and to reverse to a previous condition.[68] The inspirational agency of elasticity as a dynamic concept connotes this discursive and paradoxical nature implying both, a contracting and an expanding capacity with enabling and constraining qualities while being enmeshed in a larger context. Thus, the concept suggests the potential for change and simultaneously, it offers coherence and continuity.

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[67] I include the definitions for *elastic* from the Oxford English Dictionary Online and Oxford Dictionaries Online (here in an abbreviated form) in order to show the diversity and flexibility of the term itself. The consultation of the Oxford English Dictionary Online states amongst other listings for elastic:

> **Adjective and noun:**
> A 3 c. fig. Of feelings, temperaments, etc., hence, also, of persons: Not permanently or easily depressed; buoyant.
> A 4 a. (Partly attributively use of the noun) In popular language, esp.: That can be stretched without permanent alteration of size or shape. Elastic gum [= French *gomme élastique*]: india rubber; elastic web: cloth woven with india-rubber threads so as to stretch.
> A 4 b. fig. Of immaterial things: That can be 'stretched' or expanded to suit circumstances; flexible, accommodating.
> A 4 c. Anat. elastic tissue: one of the varieties of areolar or connective tissue.
> B. n. Elastic cord or string, usually woven with India rubber.

Oxford English Dictionary Online, s.v. "Elastic, Adj. and N," http://www.oed.com/view/Entry/60128 (accessed 19 March 2016).

The Oxford Dictionaries Online states for the word elastic:

> **Adjective:**
> 1 (Of an object or material) able to resume its normal shape spontaneously after being stretched or compressed.
> 2 Able to encompass much variety and change; flexible and adaptable.
> 3 Economics (of demand or supply) sensitive to changes in price or income.
> 4 Physics (of a collision) involving no decrease of kinetic energy.
> **Noun:**
> Cord, tape, or fabric, woven with strips of rubber, which returns to its original length or shape after being stretched.
> **Origin:**
> Mid 17th century (originally describing a gas in the sense 'expanding spontaneously to fill the available space'): from modern Latin elasticus, from Greek elastikos 'propulsive', from *elaunein* 'to drive'.

Oxford Dictionaries Online, s.v. "Elastic - Definition of Elastic in English from the Oxford Dictionary," http://www.oxforddictionaries.com/definition/english/elastic (accessed 19 March 2016).

[68] Information from 'Mining Terms Glossary,' Greatmining.com, http://www.greatmining.com/gloss-alpha-e.html (accessed 20 March 2015).

Elasticity is used in this project as a thought-provoking device acting in a *push-pull dynamic*—a term used by Katherine Hayles, scholar of literature and science, to illustrate the enlarging of possibilities versus the confinement of conceptual space within scientific practice describing the interplay between metaphors and restraints.[69] Elasticity as a performative metaphor does not imply an unconstrained dynamism in a frictionless environment offering decontextualised alternatives. On the contrary, the concept works with and through constraints that are otherwise ignored in an objective and idealised worldview. Consequently, these constraints and concerns may appear contradictory and irrational. Thus, elasticity is an attempt to incorporate awareness and thoughtful responsiveness to resistances and subtle contingencies that would not be considered in rationally calculated modes of understanding.

Elasticity operates as an agile metaphor and interpretive principle, as described by James J. Bono, researcher in the history of science, when he points out that metaphors should not only be understood as linguistic or representational tools but as performative 'instruments of thought and action' that transform scientific practices.[70] In this project, I consider elasticity and the associated notions of heterogeneity and multiplicity when applied in art, science and philosophy as dynamic metaphors providing productive disruptions and disorganising established concepts to foster alternative configurations.

Heterogeneity and Multiplicity

The search for change and transformation through the notion of heterogeneity is indicative in the concepts of Michel Foucault, Gilles Deleuze and Félix Guattari. These authors developed alternative drafts for a future beyond traditionally rational approaches and fixed categorisations. Taking the 'rhizome' as an (anti-)organisational model, Deleuze and Guattari proposed unrestricted configurations and non-hierarchical forms of articulation, which were also considered as assemblages or altering arrangements.[71] Nomadism, change and alteration

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[69] Hayles' posthuman approach considers human and non-human agency in knowledge making practices emphasizing their capacitating and constricting qualities as a kind of distributed cognition. Katherine N. Hayles, 'Desiring Agency: Limiting Metaphors and Enabling Constraints in Dawkins and Deleuze/Guattari,' *SubStance* 30, no. 1 (2001): 146.

[70] James J. Bono, 'Why Metaphor? Towards a Metaphorics of Scientific Practice,' *Science Studies: Probing the Dynamics of Scientific Knowledge*, ed. Matthias Winterhager and Sabine Maasen (Bielefeld: Transcript Verlag, 2001), 228.

[71] Deleuze and Guattari deploy *assemblages* as *rhizomatic* structures, which they propose as interpretive, organic frameworks in opposition to linear, hierarchical or tree-like organisations that are based on static and dualist categories. The rhizome is used as a model of thought generating multiple passage points and semiotic threads that emerge and disappear in a constant flow of passing and becoming. Rhizomatic

were core aspects in this rhizomatic way of thinking. Inspired by biology, the concepts were developed by taking morphology and transmutation into account. Multiplicity is another model of thought triggering this form of alternative understanding that attempts to consider diversity and change as relevant factors in the course of events, culturally and politically.

Multiplicity in the work of Deleuze and Guattari goes back to Henri Bergson, who developed his ideas based on Bernhard Riemann's description of manifold theory and geometry within physics and mathematics.[72] Two types of multiplicity are distinguished: one describes a numerical multiplicity of order, quantification and juxtaposition mirroring differences in degrees. This disjunctive multiplicity opposes an indeterminable multiplicity associated with fusion, heterogeneity and qualitative differences described by Deleuze as a 'virtual and continuous multiplicity that cannot be reduced to numbers'.[73] Through the focus on measurement, I work precisely at this junction of quantitative versus qualitative multiplicity integrating the implicit tension constructively in the TAU.

Dynamic conceptualisations disrupt conventional assumptions and facilitate a transformative ideation indicating the potential for cultural and political change. Thinking in heterogeneous, unpredictable and indeterminate associations generates an inspirational friction as it allows breaking out of the fixity of certain ideological structures and traditional paradigms dissolving the rigidity of hierarchically ordered arrangements and linear thought patterns.[74]

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descriptions attempt to address transformations within cultures, social networks, data representations or the organisation of knowledge facilitating links and associations. Assemblage is the general idea to describe compositions and arrangements (such as rhizomes or trees) outlining dynamic and complex configurations of various elements and qualities. Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis [Minn.]; London: University of Minnesota Press, 1987), 3-25.

[72] Gilles Deleuze, *Foucault* (Paris: Editions de Minuit, 1986): 13. Riemann's manifold theory is a keystone of modern topology. Tate Modern stated as part of an event series on topology in 2012: 'Static ideas of space as a container were replaced by understandings of movement-space, of multiplicity, differentiation and exclusive inclusion that in turn have led to new ideas of power, subjectivity, and creativity.' 'Topology,' http://www.tate.org.uk/whats-on/tate-modern/eventseries/topology (accessed 27 November 2015).

[73] Deleuze, *Bergsonism* (New York, Zone Books, 1991), 38.

[74] Vibrancy is for example a related proposal developed by Jane Bennett, political theorist and associated with the new materialist movement. She assigns vibrancy to things and relations. In her work, Bennett draws on Latour, Spinoza and more, being interested in developing a new vocabulary and different conception where she imagines the political implications of agile materials, objects and mechanisms in order to emphasise processual and relational modes of action. In her project, material substances like food, metal or stem cells are interpreted as assemblages of vivid entities. These concepts of heterogeneity and vibrancy shift the focus within explanations and representations from human to nonhuman materials and objects whereas the non-representable and processual qualities of matter are described as a vibrant 'thing-power'. Bennett describes her objective as the enabling of a certain 'anticipatory readiness' fostering conceptual openness. Jane Bennett, *Vibrant Matter* (Durham: Duke University Press, 2010), 5.

Ambiguity is a concept associated with these ideas that is fruitfully employed within art and design and also within this project as I explicate in the following section.

Ambiguity and Uncertainty in Art and Design

Ambiguity is defined by Verena Krieger, art theorist, as an aesthetic paradigm considering its historical, semiotic and material aspects. She describes ambiguity, open-endedness and the infinite recombinability of signs as artistic principles of postmodernism and as key constituents for the epistemological foundation of poststructuralism.[75] Ambiguity in art is utilized to disrupt preconceptions denying established meanings to undermine the perpetuation of a particular status quo. By dissolving commoditised certainties and traditions, ambiguity triggers reflection and produces space for multiple interpretations thus implying the possibility for change and transformation of certain social and cultural conditions.

Krieger links the 'psycho-hygienic and didactic function' of art with the psychological concepts of *ambiguity tolerance* and the *need for closure* that emphasise an individual's disposition to experience uncertainty as a positive encounter.[76] These concepts in psychology are related to one's receptivity of diversity and the capability to cope with complexity.[77] The need for closure is associated with the preference of homogeneity and the rejection of

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[75] Verena Krieger, Rachel Mader and Katharina Jesberger, *Ambiguität in der Kunst: Typen und Funktionen eines ästhetischen Paradigmas* (Köln: Böhlau, 2010), 40.

[76] Elisabeth Fritz and Katharina Steidl, 'Ambiguität in der Kunst: Paradigma, Stereotyp, Qualitäts-merkmal?' Interview mit Verena Krieger, *Kunstgeschichte Aktuell. Mitteilungen des Verbandes Österreichischer Kunsthistorikerinnen und Kunsthistoriker*, XXVI (02/2009): 2-3.

[77] This link is for example indicated in organisational psychology and management. Part of my work experience in a global corporation was the regular participation in workshops for cultural diversity in order to raise tolerance for ambiguity and psychological stability within the workforce. I enjoyed reading the following paragraph in an article about organisation, management and cultural diversity from 1991, mainly due to its formulations and secondly due to the demonstrated advantage of flexibility on several levels: 'System Flexibility. Managing diversity enhances organizational flexibility. There are two primary bases for this assertion. First, there is some evidence that women and racioethnic minorities tend to have especially flexible cognitive structures. For example, research has shown that women tend to have a higher tolerance for ambiguity than men. Tolerance for ambiguity, in turn has been linked to a number of factors related to flexibility such as cognitive complexity, and the ability to excel in performing ambiguous tasks. Studies on bilingual versus monolingual sub-populations from several nations show that compared to monolinguals, bilinguals have higher levels of divergent thinking and of cognitive flexibility. Since the incidence of bilingualism is much greater among minority culture groups (especially Hispanics and Asians) than the majority-white Anglo group, this research strongly supports the notion that cognitive flexibility is enhanced by the inclusion of these groups in predominantly Anglo workforces. The second way that managing cultural diversity may enhance organizational flexibility is that as policies and procedures are broadened and operating methods become less standardized, the organization becomes more fluid and adoptable. The tolerance for different cultural viewpoints should lead to greater openness to new ideas in general. Most important of all, if organizations are successful in overcoming resistance to change in the difficult area of accepting diversity, it should be well positioned to handle resistance to other types of change.' Taylor H. Cox, Stacy Blake, 'Managing cultural diversity: implications for organizational competitiveness,' *Executive*, 5 (1991): 51.

unconventional perspectives reflecting a resistance to change.[78] Based on this premise, ambiguity in art and design can serve as a testing ground probing conventional assumptions and provoking alternative perspectives. Thus, ambiguity is deployed by the TAU to evoke moments of uncertainty and doubt stimulating reflection and provoking the reconsideration of routines, formulas and programmed procedures that typically imply notions of certainty and predictability through measurement and quantification.

Ambiguity and uncertainty are also used within design as demonstrated by William Gaver et al.[79] The authors propose *cultural probes* as a method to utilize uncertainty constructively in the peculiar process of design-led research.[80] Cultural probes are an experimental research method, in the form of peculiar test kits with evocative tasks that allow the gathering of unusual and subjective responses from a sample group of users.[81]

The engagement with the probes advances uncontrolled scenarios that evoke unconventional insights and unpredicted solutions undermining rationalized approaches and preconceived ideas within a design problem. A conventional design approach avoids ambiguity by instructive guidance limiting a user's scope of interpretation to ensure efficient usability. In contrast, ambiguity and uncertainty provoked by the cultural probes demands the active participation of a user stimulating rather suggestive and interpretative explorations than the instructed processing of preconfigured tasks. Thus, ambiguity generates a productive and thought-provoking exchange between a participant, an artefact, a design researcher and a problem providing headway for alternative exploration where different ideas and solutions beyond standardised approaches may emerge.

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[78] See for example: Simon Moss, 'Need for closure,' *Psychlopedia -- Key concepts -- Cognitive concepts -- Need for closure*, last updated 19 November 2008. http://www.psych-it.com.au/Psychlopedia/article.asp?id=212 (accessed 06 May 2015).

[79] William W. Gaver, Jacob Beaver and Steve Benford. 'Ambiguity as a Resource for Design.' In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM (2003). William W. Gaver et al. 'Cultural Probes and the Value of Uncertainty.' *Interactions - Funology* 11, no. 5 (09/10, 2004).

[80] Ibid., 53.

[81] Cultural probes are test kits that contain recording devices such as cameras, mapping tools, diaries and often unconventional instruments (for example a dream recorder) in order to deepen an understanding about personal attitudes, concerns and desires. 'It's an approach that values uncertainty, play, exploration, and subjective interpretation as way of dealing with … limits [of knowledge]'. Ibid., 53. See also: Bill Gaver, et al.,'Design: Cultural Probes,' *Interactions 6*, no. 1 (01-01-1999).

Crafting Ideas through a Fictional Practice

Conversely to an applied design practice that communicates target-driven messages in an efficient manner, speculative design triggers a "fictional" practice as described by Dunne and Raby creating space for inventive discovery.[82] The designers explain:

> To find inspiration for speculating through design we need to look beyond design to the methodological playgrounds of cinema, literature, science, ethics, politics, and art; to explore, hybridize, borrow, and embrace the many tools available for crafting not only things but also ideas, fictional worlds, cautionary tales, what-if scenarios, thought experiments, counterfactuals, reductio ad absurd um experiments, prefigurative futures...[83]

Rather than executing a "storytelling" approach that imposes precast information onto a passive recipient, I pursued a *story making,* fictional practice that I applied in my own research and simultaneously, I invited a user of the TAU to develop individual ideas about the construction of situated realities.[84] Hence, measuring and inscription devices were used in my project not only because of their operational functionality to indicate measured values of a certain reality. Furthermore, measurement prescribes a particularly rational relationship between people and things how humans relate to the world. I intended to address and change this particularly rational approach through the reconfigured measuring tools.

An art and design practice that uses references to technical interfaces, scientific devices and procedural routines exemplifies constitutional linkages and relationships between human and things correlating scientific representation with socio-political structures. References from management, science and bureaucracy describe routines and practices of control and organisation. Warren Sack, media theorist, discusses the relevance of administrative and organisational elements and the aesthetic of control within the context of information visualisation aesthetics and democratic art:

> [T]he aim of such artwork is against the rationalisations of bureaucracy and, thus, deductively, counter to the forms of social, political, and economic formations that depend upon these rationalizations and optimisations: it is anticapitalist and antiauthoritarian…. its goals might be said to be 'socialist'… given the focus of much conceptual art on egalitarian

[82] Dunne and Raby, *Speculative Everything,* 100.
[83] Ibid., 3.
[84] Ibid., 88.

> power structures its goals might, alternatively, be described as democratic — that is, rule by the demos, the people, rather than rule by the bureau, the office (holders).[85]

Aspects of rationality imposed by science and industry with the managerial techniques of control and administration were countered through art with creative strategies that linked an aesthetic experience with the unpredictability and complexity of everyday life. I found these strategies and tactics explored by the Dadaists, Fluxus and Situationists as well as in the work of more contemporary artists and designers. They intended to provoke different encounters outside of the conventional realm of control and efficiency, while sensitising an audience's perception through irrational and ludicrous interventions. Consequently, I composed the creative underpinning for my project according to the key aspects of playfulness, decontextualisation and chance, by drawing on strategies from art and speculative design. Fig. 15 depicts tendencies within each experimental project of *Elastic Design* towards one of these three key aspects.

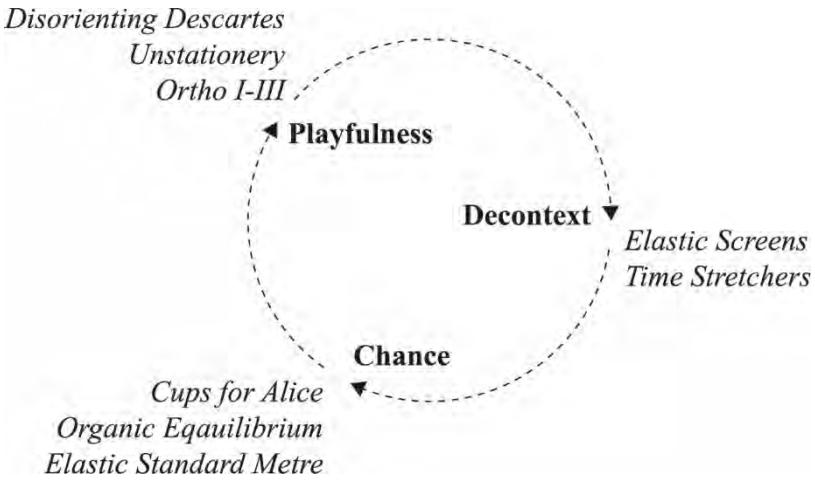

Fig. 15 Creative strategies in the development of the *Tools for Alternative Understandings*.

The choice for these techniques is reflected in the three chapters in which I discuss my experiments. Firstly, these subversive strategies break open established boundaries and assumptions based on scientific rationality and economic standards ensuring efficiency and convenience. Secondly, the catalogue of creative methods allows new ideas and forms of engagement to emerge where experimental and explorative encounters with tools and

[85] Warren Sack, 'Aesthetics of Information Visualisation,' *Context Providers*, eds. Margot Lovejoy, Christiane Paul and Viktorija Bulajić Vesna (Bristol, UK: Intellect, 2011), 130.

interfaces as mobile boundaries and devices were used and alternative modes of interaction were provoked. Lastly, the strategies of playfulness, decontextualisation and chance are employed to work with the flexible materiality within measuring devices to reveal delicate, ignored or excluded forces inviting these physical energies as active participants in a meaning making process. In the following section, I give a brief overview of creative strategies and techniques, which I deployed in this research linking art, design, science and the everyday life.

Playfulness

An early forerunner located at the intersection of art, science and philosophy linking these disciplines playfully is *'pataphysics*.[86] The 'pataphysical art movement from the end of the nineteenth century is a concoction of French poet and provocateur Alfred Jarry as set out in his 'neo-scientific novel' *Dr. Faustroll*.[87] In order to accentuate the movement's disparity, Jarry determined a prefixed apostrophe as the official, orthographical spelling of 'pataphysics, describing the concept as 'the science of imaginary solutions'.[88] Conversely to traditional science, 'pataphysics proposed exceptional, irrational and grotesque narratives.[89] Jarry's intellectual freedom developed counter-proposals and thought-experiments like the *clinamen*, *syzygy, ethernity* or *anomalos*, which he drafted from phenomena within physics and astronomy in order to point out unexpected deviations and exceptional constellations provoking absurd associations.[90] 'Pataphysics countered the ideas of classical science foreshadowing the unimaginable discoveries of quantum mechanics and the theory of relativity.[91] The movement's inspirational quality lies in its radicality and weirdness expanding imagination with irrational anecdotes, wordplays and portmanteau words.

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[86] 'Pataphysics influenced Jean Baudrillard, Jacques Derrida, Gilles Deleuze and Michel Serres as well as art movements like Dadaism, Surrealism and Fluxus. See for example, Christian Bök, ''Pataphysics: The Poetics of an Imaginary Science,' (PhD diss. York University, North York, Ontario, 1997), available at www.collectionscanada.gc.ca/obj/s4/f2/dsk2/tape15/PQDD_0020/NQ27282.pdf (accessed 19 March 2016).

[87] Alfred Jarry, *Exploits and Opinions of Dr Faustroll Pataphysician*, trans. Simon Watson Taylor (Boston, Exact Change, 1996), xii.

[88] Jarry states: 'Pataphysics will examine the laws governing exceptions, and will explain the universe supplementary to this one; or less ambitiously, will describe a universe, which can be—and perhaps should be envisaged in the place of the traditional one.' Ibid., 21-22.

[89] The amusing aspect of these alternative concepts is delivered on a narrative level through the grotesque stories in the form of novels, journals and various publications. Today, these are issued by museums, institutes and colleges, which subscribed to the 'pataphysical idea. See for example: 'Collège de 'Pataphysique,' http://www.college-de-pataphysique.fr/ (accessed 19 March 2016).

[90] Johanna Drucker, *SpecLab: Digital Aesthetics and Projects in Speculative Computing* (University of Chicago Press, 2009), 103.

[91] See for example: Jonathan Williams, 'Pata or Quantum Duchamp and the End of Determinist Physics,'

Another reference to playfulness are the *philosophical toys*. These were optical instruments in the nineteenth century combining science, objects and play. For example, kaleidoscopes, thaumatropes or stroboscopes are considered to be philosophical toys. The instruments allowed the experimental exploration of physical phenomena while offering joyful divertissements proffering a rational form of entertainment as described by Tomáš Dvorák, philosopher of science.[92] While the instruments not only disclosed physical processes, they also facilitated the development of imaginative and conceptual models by which a subject matter within the natural sciences could be articulated and debated.[93] In that sense, philosophical toys were material objects, which assisted in the creation of new understandings, linking material, tactile, societal and intellectual aspects to generate exploratory moments through which physical phenomena were made tangible and respective ideas were discussed.

Playfulness was also employed in the *Fluxus* movement as a strategy to disrupt a monotonous course of events, aiming for a constant flow of cultural change and societal transformation by infiltrating everyday life with art. George Maciunas coined the term Fluxus in 1960 for a series of magazines.[94] In the *Fluxus Manifesto* (1963) he emphasized the different kinds of bodily discharges as fluidifying components, and positioned them in a critical attitude against commercialized middle-class culture.[95] Ken Friedman humorously states: 'Art was so heavily influenced by rigidities of conception, form and style that the irreverent Fluxus attitude stood out like a loud fart in a small elevator'.[96] Playfulness, irony and joyful confusion were deployed in Fluxus' performances and projects with the objective to break down established conventions of a commoditised culture, instigating alternative ideas about the societal conditions of that time while implying that these circumstances are mutable and fluid.

Ludic design is the constructive application of playfulness in design as drafted by Bill Gaver.[97] He emphasizes play as a valuable capacity of objects and devices to undermine

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Tout-Fait: The Marcel Duchamp Studies Online Journal, no. 3 (2000), available at www.toutfait.com/issues/issue_3/Articles/williams/williams.html (accessed 13 March 2016).
[92] Tomáš Dvorák, 'Philosophical Toys Today,' *Theory of Science* no. XXXV (2013/2): 177.
[93] *Ibid*., 182.
[94] Ken Friedman, *The Fluxus Reader* (London: Academy Editions, 1998), 7.
[95] Gillian Young, 'MoMA | Unpacking Fluxus: An Artist's Release,'
available at www.moma.org/explore/inside_out/2010/06/30/unpacking-fluxus-an-artists-release (accessed 17 March 2016).
[96] Ken Friedman, 'Fluxus and Company,' in *The Fluxus Reader*, ed. Ken Friedman (West Sussex: Academy Editions 1998), 249.
[97] Bill Gaver, 'Designing for Homo Ludens'. *13 Magazine* 12 (2002).

rational approaches within design solutions. Playfulness challenges usability, productivity and commercial applicability. The idea is based on Johan Huizinga's concept of Homo Ludens, which describes humans as playful beings who utilize technology not only for reasons of efficiency, precision or practicality. In contrast, purposeless activities enable to imagine the feasibility of illogical and unpredictable developments. Ludic design is not directed towards a favoured outcome or a preferred way of proceeding. Instead, activities are left open-ended, interpretations remain opaque and indeterminate, encouraging wonder and unconventional perspectives. As Gaver points out, this approach suggests a shift in research paradigms. It may revolutionise methods, concepts, actions and aesthetics due to its potential to cultivate alternative values and qualities.[98]

Playfulness and irrationality unravel established authorities and circumvent assumptions.
A certain order is disrupted and an antagonist position is rendered possible fostering different ideas and approaches. The humour in the discussed movements work in the context of everyday life breaking through the routines and conventions imposed by science, commerce and education so that the mobilisation of nonsensical experiences redirects awareness often in an unobtrusive manner. This strategy is also deployed by the *Tools for Alternative Understandings*.

Decontextualisation

Under the heading of decontextualisation, I consider the readymades of Duchamp and the strategies of *dérive* and *détournement* of the Situationist International as a resourceful input for my project. Decontextualisation and respectively, recontextualisation within art and design can be used to facilitate the interaction between a user/an audience and a subject matter that is specified through an object, a situation or a location. Situating an object or an action in an atypical, unrelated setting creates a contradiction of meanings, generating new relations and viewpoints so that a user in the search for understanding, becomes actively engaged with a situation.

Readymades were Duchamp's tools to shift thoughts and to engage an audience intellectually in the juxtaposition of art and everyday life. By placing ordinary objects with provocative titles in a gallery setting, the conventional understanding about art making as a process, the art piece itself, the role of the artist and what is considered to constitute an exhibition were

[98] Ibid., 16.

challenged and hence required redefinition. Readymades were both—objects and critical invitations for reflection, which engaged the viewer directly in the cognitive activity of making sense. Readymades signified a shift away from the material object to conceptual notions, by provocation and bewilderment. Art historian Dalia Judovitz describes readymades as 'intellectual interventions … as a form of sagacity that combines intelligence and humor'.[99] The paradoxical quality of readymades as being neither affirmative nor negative is in itself dynamic and thought-provoking.[100] Duchamp used the readymades as functional devices for speculative exploration stimulating pensiveness and imaginative associations through irritation and decontextualisation. As readymades are material expressions of social norms, industrial production and preconceived notions, the objects function as thought shifters to reframe the experience of art and to radicalise new perspectives.

The Situationist International (SI), a political art collective that existed between 1957 and 1972 with Guy Debord as the main representative, worked with propaganda strategies such as *détournement, dérive* and the construction of experimental situations described as *momentary ambiences* to thwart the cultural and political conditions of capitalism.[101] SI criticised an image-dominated ideology of consumerism, which produced *spectacles* to mediate pseudo-social relationships with stereotyped worldviews. In order to proffer alternatives outside an existing social order and beyond the confines of its structures, the established system had to be destabilised and fractured from within.[102] *Dérive* was a psychogeographical concept that aimed to alter experiences of an audience within an urban environment. The focus was on subjectivity, awareness and behaviour in the context of political actions organised as spontaneous and experimental counter-movements, to subvert the capitalistically organised urban landscape and to disrupt respectively, a commoditised experience. *Détournement* was a strategy to hijack existing communication materials and artefacts, to disguise them with troubling messages, which challenged and frustrated habitual

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[99] Dalia Judovitz, *Unpacking Duchamp: Art in Transit* (Berkeley, CA: University of California Press, 1995), 76.

[100] Duchamp presented the mass-produced objects in absurd positions, for example, flying up in the air, mounted upside down or nailed to the floor.

[101] Guy Debord, 'Report on the Construction of Situations (Debord),' *Bureau of Public Secrets*, http://www.bopsecrets.org/SI/report.htm (accessed 16 May 2015).

[102] Present-day, the work of Adbusters, Metahaven or the activist duo Yes Men is associated with *détournement* and subvertising. The visual language and controversial course of action is taken from media coverage mirroring advertising, info graphics, press conferences and (faked) appearances in public media. For example, Adbusters propagates the Buy-Nothing-Day, Metahaven rebranded WikiLeaks and the Yes-Man group published a bastard version of the New York Times in 2008 dated in the future and announcing the end of the war in Iraq. The duo is also famous for their appearance as scientific experts or representatives of big corporations and governmental institutions in public.

readings while at the same time new perspectives and meanings were generated.[103] By means of circumvention and disorientation, habitual routines and social practices were disclosed and the deficiencies of the commoditized world were uncovered. These strategies aimed to reclaim space for ungoverned experiences by breaking away from the prefabricated and restrictive context of omnipresent capitalist spectacles.[104]

Decontextualisation sets up a constructive tension that can immerse a user in a situation more intensively. Such productive circumstances may provoke unexpected and dissonant viewpoints deviating established procedures in the search for sense and solutions—a strategy that was useful for the development of the *Tools for Alternative Understandings*.

Chance

The indeterminacy and unpredictability of the experiments in quantum physics challenged the mechanistic worldview of classical physics. Chance and randomness were also deployed in art linking creative expression with scientific rationalisation to challenge certain conventions. Two particular artworks by Marcel Duchamp and Joseph Beuys exemplify how unpredictability was used to undermine established forms in the production and reception of art as well as notions of scientific (and metric) accuracy, thus instigating ideas of transience and imperfection. With the *Three Standard Stoppages* (1913-14), Duchamp escaped the traditional modes of expression to transgress conventional notions of art (Fig. 16).[105]
The stoppages show the coincidental contours of three dropped strings that Duchamp proposed as alternatives to the primeval metre. He described his new standards as a 'joke about the meter' and emphasised uncertainty as 'canned chance' being the decisive element

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[103] The subversive manipulations are associated with the tactics for modification and situated usage proposed by Michel de Certeau. Here, consumers employ tactics to develop contrivances as operational combinations to transform objects and services from the capitalist society. In contrast to this bottom-up approach, the industrial and technical production sets a plan of action pursuing strategies of management and communication, which are becoming effective in a top-down manner. Michel de Certeau, *The Practice of Everyday Life*: v. 1. Trans. Steven Rendall, (Berkeley, University of California Press, 1984).
[104] Two interventions in public space (*Zero point* of Redfern and Clandulla State Forest as well as *Elastic Metric System*), which were developed in the course of this research, make use of the technique of the *dérive* by challenging measurement and geographical marking systems. The projects are not discussed in the body of this document, but images are shown in the Appendix.
[105] The artwork *Three Standard Stoppages* (1913) is considered to be a pseudo-scientific experiment: Duchamp dropped three strings from a distance of one metre. These accidental configurations were fastened and defined by Duchamp as new standards. The curved lines appeared as graphical elements in several later works underlining the consistency of randomness in Duchamp's idiosyncratic approach. See for example Herbert Molderings, *Duchamp and the Aesthetics of Chance*. (New York: Columbia University Press, 2010). An image of *Three Standard Stoppages* can be accessed via the Museum of Modern Art online collection.

in his artistic process.[106] As the original standard metre was a straightened line derived from a rounded meridian in a process of approximation, Duchamp reversed this process with his experimental operation, which allowed bending and twisting the rectified line according to the ungovernable laws of gravity and air resistance, thus explicating the liberating quality of his work.[107]

Fig. 16 Marcel Duchamp, *Three Standard Stoppages* (1913-14), exhibited in the Museum of Modern Art, © Succession Marcel Duchamp/ADAGP. Licensed by Viscopy, 2017. The CC license does not apply to this picture. The licensor has to be contacted with regards to licence this material if republication is intended.

Beuys' work—the *thermisch-plastisches Urmeter (Thermal/Plastic Primeval Meter)* (1984)—represented a little steam cloud, which was released through a hidden construction with a gas cooker (Fig. 17). The project may be read as a reference to the law of entropy in thermodynamics implying a regime of instable fluidity and irregularity that links material and

[106] Duchamp as cited in Herbert Molderings, *Duchamp and the Aesthetics of Chance* (New York: Columbia University Press, 2010), xii, 2. Francis M Naumann, *The Mary and William Sisler Collection* (New York: Museum of Modern Art, 1984), 170-71. Pierre Cabanne, *Dialogues with Marcel Duchamp*, trans. Ron Padgett (New York: Viking Press, 1971), 46-47.

[107] The original standard metre is the result of a triangulation process, which allowed the determination of the length of the metre through a mathematical approximation. The French Academy of Sciences defined the metre in 1791 depending on the Earth's meridian, in order to find an objective basis independent from anthropomorphic standards such as the foot or the ell. It was decided that the new standard metre should be the one ten millionth part of a quarter of the earth's circumference. David, J. Hand, *Measurement*, 220.

semiotic layers in the process of interpretation.[108] The project represents art as a mechanism for transportation, provoking creative thought and imagination. Beuys used artworks as a 'medium of understanding' and 'vehicles for the spirit' as pointed out by Antje von Graevenitz, art historian.[109]

Fig. 17 Joseph Beuys, *Thermisch-plastisches Urmeter* (videostill), 1984, exhibited at Hamburger Kunsthalle/bpk.

Unplanned outcomes were provoked by inviting random factors, glitches and accidents. Fluxus deployed a laboratory approach to encourage chance and experimentation in the production of alternative experiences. Craig Saper, co-author of *The Fluxus-Reader,* traces the laboratory idea back to the short-term courses organised by prospective members of the Fluxus movement.[110] The core aspect of these gatherings was the liberation of art as taught in institutionally set frameworks. Indeterminacy and the configuration of open-ended events

[108] Antje von Graevenitz, 'Breaking the Silence: Joseph Beuys on his "Challenger", Marcel Duchamp (1995),' in *Joseph Beuys: The Reader*, ed. by Claudia Mesch and Viola Maria Michely (London: I. B. Tauris, 2007), 36.
[109] Ibid., 37, 33.
[110] Seminars in experimental pedagogy at the Black Mountain College in the US around 1948 and the composition classes of John Cage at the New School for Social Research in New York are examples for these early exploratory testing grounds. Craig Saper, 'Fluxus as a Laboratory'. In *The Fluxus Reader*, ed. Ken Friedman (New York: Academy Editions, 1998), 138.

were later transferred to a larger audience with the Fluxus scores, musical compositions and happenings.[111] Scores, scripts and instructions mediated a particular protocol and framework in which performances and presentations were executed and experienced.[112] Scores and compositions purposefully set up a particular context—a pattern of regularity and expectations that was subverted with vague and irrational instructions.

While measurement and scientific discourse establish a particularly rational relationship between humans and the world, elasticity, playfulness, decontextualisation and chance foster alternative avenues.

Final Measures

In this chapter, I introduced measurement and measuring devices as cultural techniques through which processes in science, trade and administration are established and organised. Measurement and standards prescribe a certain form of human activity, which is driven by quantifiable determinability and scientific rationality. This interest in objectivity, efficiency

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[111] Three examples of Fluxus' event scores are

Composition #10 to Bob Morris (1960), La Monte Young:
Draw a straight line and follow it.

Word event (1961), George Brecht:
*** Exit**

Voice piece for Soprano to Simone Morris (1961), Yoko Ono:
Scream
1. against the wind
2. against the wall
3. against the sky

Liz Kotz, 'Post-Cagean Aesthetics and the 'Event' Score,' *October* No. 95 (2001): 54 –56.

[112] An example for the experimental deployment of scores, scripts and protocols are two compositions of John Cage. For the musical composition *Organ²/ASLSP* (As SLow aS Possible) from 1985, Cage did not specify the tempo of its performance. Cage's instructions suggested that it should be played as slow as possible. Thus, the actual duration of a performance varies being dependent on the decision of the conductor of each concert. This vague parameter implemented the moment of eventuality within a composition rendering each performance unique. Another example to breach a certain expectation is Cage's soundless composition *4'33"* (1952). It is a musical score that instructs the musicians to remain silent. When it is performed, it is staged as a concert in an auditorium. Cage undermined the expectance of an audience by dismantling the idea of a musical composition. This intervention scrutinised the distinctive roles of the composer, the conductor and the artist as well as the institutional function of the concert hall. Thus, formal understandings about systems of musical notation in the European tradition were defied. Cage re-defined not only the concept of the musical score, but as well the established expectations in regard to the experience of music. See for example: Hannah Higgins, *Fluxus Experience* (Berkeley, University of California Press, 2002), 71. Sharon Daniel, 'Collaborative Systems: Redefining Public Art,' *Context Providers: Conditions of Meaning in Media Arts,* eds. Margot Lovejoy, Christiane Paul and Victoria Vesna (Bristol, UK / Chicago, USA: intellect, 2011), 61.

and control ensures convenience, safety and material prosperity (in a conventional sense). On the grounds of Barad's reconceptualisation of measurement based on the indeterminacy discovered in quantum physics, I drew a link between material-discursive practices in science and the objects as discourse from critical design. I expanded this approach and considered concepts and strategies in philosophy, art and design that productively deploy heterogeneity. Outlining my experimental approach, I introduced elasticity as key concept and grouped the examined techniques according to playfulness, decontextualisation and chance constituting essential components of my methodology. Fig. 18 displays the flow of concepts and creative strategies within the chapter.

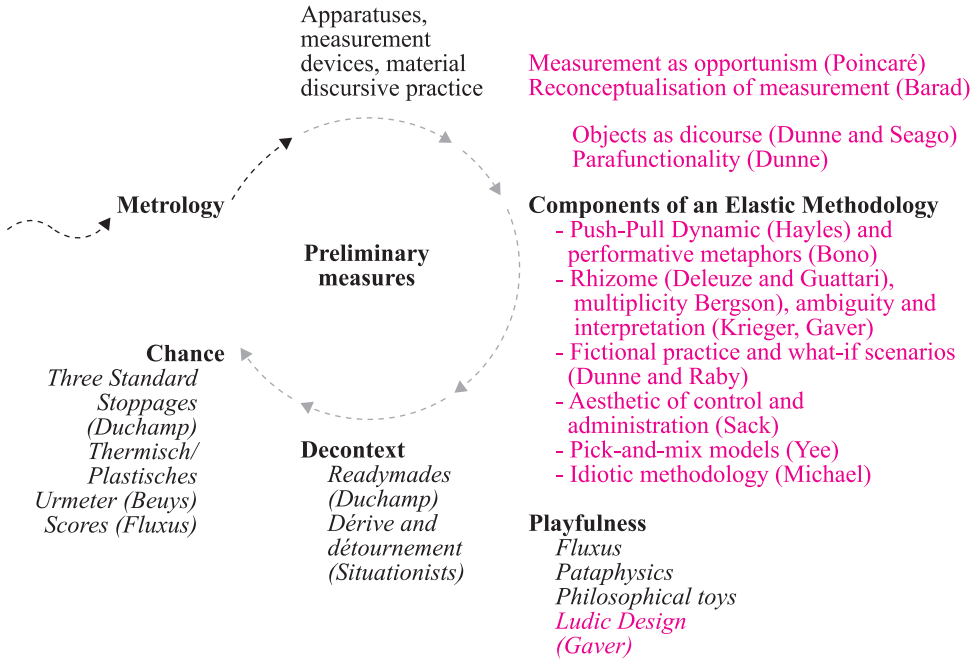

Fig. 18 Diagram showing clockwise the guiding concepts, artworks and philosophical explorations within this chapter.

In the following chapter I discuss three experiments where I applied a methodological mix of elastifying strategies to break open conventional understandings of measurement and standards and respective representations in order to instigate the potential for a change in thinking and meaning making.

CHAPTER TWO

Unmeasuring and Liquefaction

CH 2.1

Fig. 1 B. Bruder, *Elastic Standard Metre*, 2014

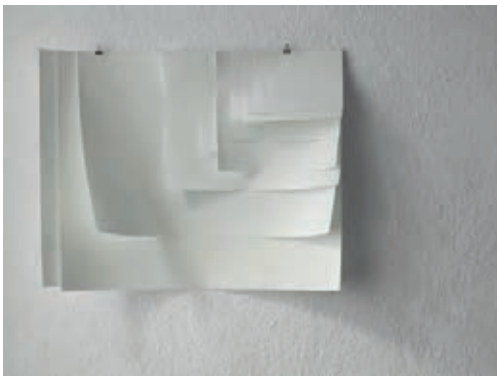

Fig. 2 B. Bruder, *Unstationery,* 2014

CH 2.2

CH 2.3

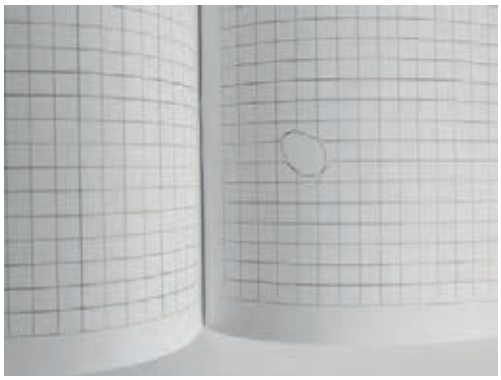

Fig. 3 B. Bruder, *Disorienting Descartes,* 2014

Unmeasuring and Liquefaction

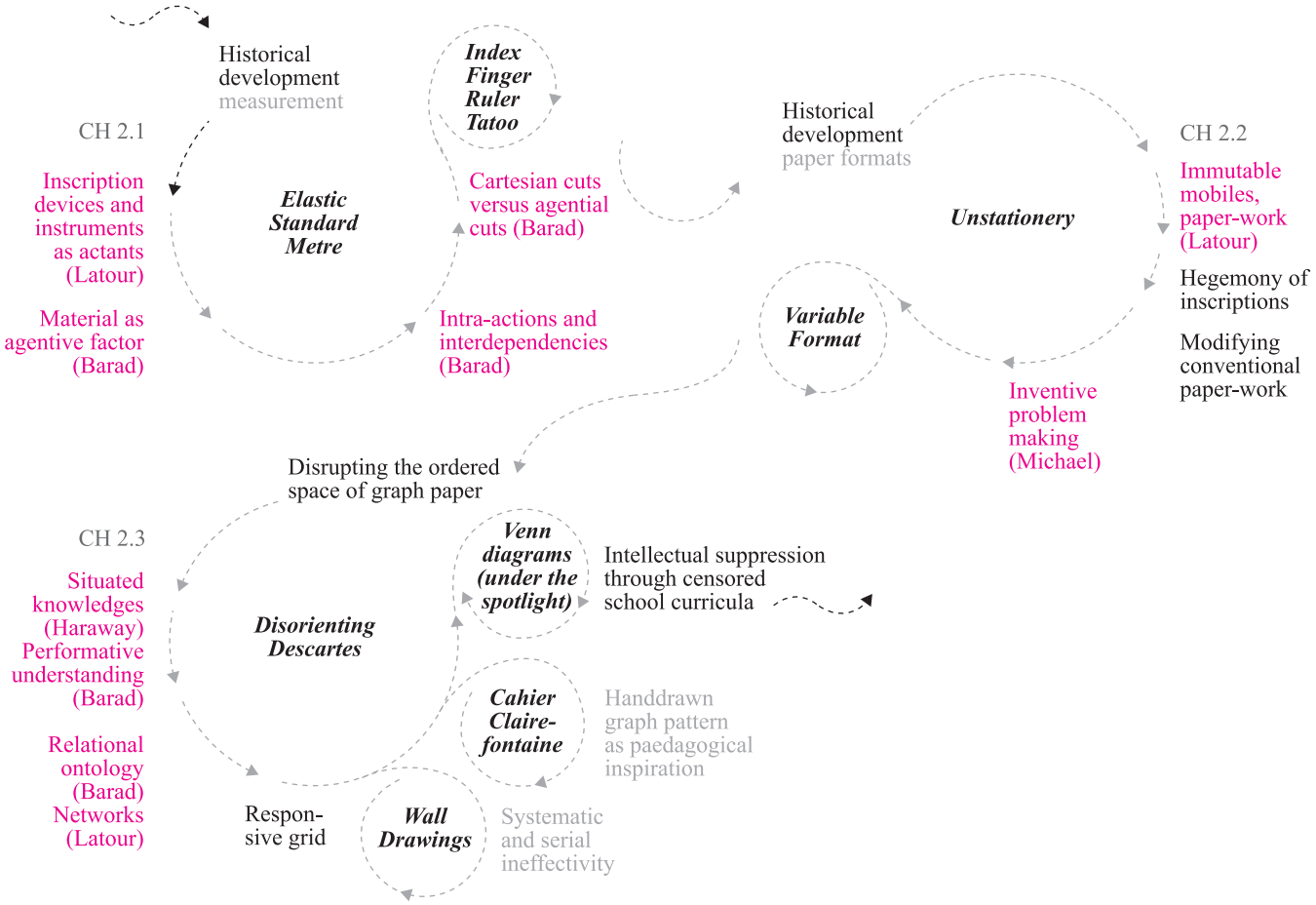

Fig. 19 Flow of this chapter with historical developments, philosophical concepts, explorations and related artworks for each experiment.

Introduction

The title of this chapter—Unmeasuring and Liquefaction—refers to the tactics and techniques used in my research method to unravel disciplinary and analytical constraints in knowledge-making practices. My research builds on speculative design, and as such I have sought a particular openness to experimentation and unpredictability to facilitate an explorative practice. Consequently, this project employs a deliberately unconventional approach. This is in line with the kinds of *pick-and-mix models* described by design researcher Joyce Yee that foreground and provide active components for methodological innovation within practice-based design research.[113] Her survey reveals an increasing integration of exploratory, participatory and contingent processes in creative inquiries in order to challenge simple and formulaic approaches.[114] Similarly, my approach with *Elastic Design* questions conventional pathways within the production of knowledge, and lays the groundwork for what I call alternative understandings. Thus, the experiments intertwine thinking and doing by linking meaning and matter.

An example of the methodological elasticity I am committed to is what sociologist Mike Michael calls an *idiotic methodology*.[115] The "idiocy" that Michael refers to is the impulse of disorganisation and entanglement that occasions the productive interventions central to speculative design. This methodological approach pays attention to a multitude of open, relational and emergent qualities, which I will explore in more detail through the discussion of my projects. Michael also draws attention to the speculative aspects of objects, which are capable of provoking reflection and imaginative encounters. He terms such objects used in this way *idiotic artefacts*, as they do not comply with the empirical and practical requirements of conventional scientific inquiry.[116] Michael refers to cultural probes as idiotic artefacts—objects, tools and tasks that elicit unconventional responses from participants in the context of qualitative design research as described in Chapter One. Probes are deployed as they create

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[113] Joyce S. R. Yee, 'Methodological innovation in practice-based design doctorates,' *Journal of Research Practice*, 6/2 (2010): 16.

[114] Formulaic approaches entail qualitative and quantitative research methods. Qualitative methods represent an exploratory approach that aims to uncover underlying viewpoints and motives.
These methods include interviews, participative activities, focus groups, experiments, interventions and observations. Quantitative approaches render numerical data that is represented as statistical information. Related methods survey the quantitative distribution of attitudes, behaviours and other aspects.
Such measurable data gives indications about trends and patterns for a particular research topic. It also enables the articulation of facts as basis for evidence. Methods are for example surveys, interviews and online polls.

[115] Michael, 'De-Signing the Object of Sociology,' 168.

[116] Ibid., 172.

an extended framework, which potentially draws out personal, inspirational and unexpected responses revealing subjective and precarious aspects of a situation. Michael underlines this active role of the probe as a kind of mediator that negotiates 'relations in unreliable and contingent ways'.[117]

My own interpretation of this form of explorative provocation has resulted in the development of a set of measuring devices and applications, which, in conjunction with a series of interventions and installations, have come to constitute the *Tools of Alternative Understandings* (TAU). The tools function as elastifying cultural probes: ungovernable objects that provoke and generate paradoxical, but constructive, experiences in a nonsensical and ungovernable manner. The interplay between logic and irrationality, or in other words the tension between reliability and contingency (Innerarity's *regulated anarchy*), is activated and employed productively through the engagement with the TAU.

The reasons for choosing measurement, standards and quantitative procedures as the source material for my experiments, is their vast acceptance and extensive application. Measurements and associated processes embody ideas about truth, objectivity and justice. Metric systems have evolved from the demands of commerce and administration, as well as the need for the comparability of scientific findings. As described before, measurements form the foundation for the scientific and economic principles driving calculation, planning, mass-production and global trade.

In the context of this research, the limitations metrology places on us serve as the counterpart to creativity, experimentation and change. I argue that in certain ways, practices of measuring, calculating, filtering, analysing, categorising and clustering of objects, ideas and people limit our encounters with the dynamic contingency and wicked diversity of the world, and thus constrain our imagination and creativity.

By injecting a material and conceptual elasticity into measurement, I provoke paradoxical encounters for users who engage with the TAU sparking creativity and imagination. In contrast to scientifically dissecting and deductive approaches, the reconfigured tools generate random and unreliable outcomes by entangling experiences with unexpected situations and results. Thus, the TAU become collaborators in the production of contingent encounters and

[117] Ibid., 175.

volatile moments of uncertainty that may encourage contemplation and openness to accidental and unusual discovery. Such redirected awareness may enrich human conceptual and practical possibilities stimulating associative processes, ideation and inventiveness useful for approaching wicked problems.[118]

This chapter analyses three experimental projects based on the theme of elasticity. These projects consist of measuring devices and auxiliary means of organisation that are made unstable and stretchable. Rather than treating elasticity in measurement processes as aberrant and undesirable, I examined the disruptive and productive possibilities of using a flexible tape measure. Substituting the rigid material of a measuring tape with stretchable latex generates uncertainty and raises questions about the validity and objectivity of measurement. In a performative exploration I juxtaposed the original standard metre from 1795 located in Paris in public space with the new *Elastic Standard Metre* and re-measured the original metric standard in situ on a daily basis for one month. In a subsequent experiment, the *Elastic Standard Metre* was applied in a study of paper sizes guided by ISO 216, the international norm determining dimensions for paper. In the course of this one-month exploration various irregular paper formats were produced as *Unstationery* to examine the repercussions when applying these deviating paper formats. Lastly, *Disorienting Descartes* involved aberrant graph paper as a topological test base to provoke alternative interpretations inspired by elasticity through meaning making practices such as writing, drafting or plotting mathematical functions.

I discuss these three projects with reference to concepts from Barad and Latour. Inspired by their ideas, I argue that it is possible to use idiotic measures and irrational arrangements to break open existing infrastructures and patterns of thought, thereby inducing alternative understandings. Concepts such as intra-actions, agential cuts (Barad), actants and agency (Latour) help to articulate the shift in values, attitudes and mindsets that I anticipated would result from my experiments injecting elasticity into knowledge-making practices associated with measurement and inscription. Firstly, I introduce each project by outlining the standard device or conventional object and comparing that with the reconfigured copy or idiotic

[118] With the term *wicked* I refer to *wicked problems* from Rittel and Webber as discussed in the introduction. Wicked problems are problematic arrangements of multi-causality with unforeseen consequences and of emergent nature. Examples for wicked problems are global issues like climate change, the financial crisis, avian flu, AIDS or the refugee crisis. My thesis does not claim to be able to provide solutions. But it aims to supply tools to disrupt established beliefs and linear thinking to expand our analysing awareness and inventiveness in order to equip us better for current and future challenges of complexity.

artefact produced in the course of the experiments. After a discussion of the wider practical and theoretical implications, I juxtapose a related art or design project that works in a corresponding field of application to identify similarities and differences with my approach.

2.1 Unmeasuring a Standard – The *Elastic Standard Metre*

The *Elastic Standard Metre* is a stretchable measuring tape. It was the key device for my research investigating material practices of measurement. The tape of the *Elastic Standard Metre* resembles any common tailor's tape purchased off the shelf. Normally, these common kinds of measuring tapes are used in tailoring and dressmaking, health and fitness. Due to their small size and easy handling they are probably found in many private homes. The tapes are approximately 1 mm thick and 1 to 2 m in length and feature both the imperial scale (units in inches and feet) and the metric scale (measurements in millimetres, centimetres and metres).[119] These measuring tapes are usually made of coated linen fabric, fibreglass or plastic. Their supple texture makes them suitable for measuring irregular shapes such as a person's girth, arm length or malleable materials, for example, fabric and textiles. Regular tapes are sealed at both ends with a metal fastening to protect against wear and tear. To ensure consistency, the tapes are flexible but they do not *stretch*. In contrast, the *Elastic Standard Metre* is a pure latex strip in creamy white without any fastening on the end. It is approximately 0.8 mm thick, 2 cm wide and 105 cm in length and it also indicates both imperial and metric measures. The tape has a smooth, skin-like texture with a subtle smell of natural rubber. As latex is an organic material, it decays over time so that sweat, oils, sunlight and ultraviolet radiation are known to have detrimental effects.[120]

The choice of this particular material for the production of the *Elastic Standard Metre* was made due to its extraordinary capacity for elongation: up to 800% according to one distributor's specifications.[121] The particular materiality of latex gives the tape an inherent spring and agility.

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[119] A more robust measuring tape used in carpentry, construction and the everyday consists of a stiff metallic ribbon: these measuring tapes are coiled. When they are applied, they can be extended while they keep their rigidity. The tape retracts for convenient storage in a small plastic container. Standard tapes for these kinds of applications are usually between 2 and 10 metres long. Due to its length and its stiffness the tape allows the user to make accurate measurements longer than arm's length with one hand.
Longer surveyor tapes are produced in lengths of 30 to 100 metres. They are made of durable, waterproof, reinforced vinyl-coated fibreglass. These tapes are also stored in a plastic case. A collapsible reel allows for fast rewinding and keeps a tape tight and organized to avoid abrasion.

[120] The durability of the *Elastic Standard Metre* has not yet been tested, but normal latex products are supposed to last for 5 to 6 years.

[121] Modulor (Berlin), 'Latex Film, Coloured Online at Modulor.' http://www.modulor.de/en/latex-film-coloured.html (accessed 20 December 2015).

The peculiar nature of the flexible tape measure is made apparent with the first handling: a user notices a subtle yielding and the slight shifting of the inscribed numbers with an indistinct deformation of the scale. Such gentle and malleable irregularity implies that something is different about this tape. Perhaps it is this material's responsiveness that causes people to handle the tape with care. This observation is worth mentioning because care, time and attention counteract the demands of swift productivity and convenience, which are guiding factors in a world ruled by rational logic and efficiency. In particular, the TAU aim to subvert these aspects, which deter us from thinking and acting more attentively and responsibly.

Unmeasuring the Metric System

For a series of experimental measurements with the *Elastic Standard Metre*, I chose a historically relevant site in Paris where the current metric system was first implemented and installed in public space in 1795.[122] This was an ideal object for my operation for scrutinizing measurement, due to its unquestionable validity and authority.[123] Sixteen *monuments métriques* were placed at the most frequented places of the city to familiarize the population with the new system.[124] The last *monument métrique* to remain in its original location is situated at 36 rue de Vaugirard across the Musée Luxembourg and the French Senate in the 6th arrondissement (Fig. 20, 21). It was here for a period of one month that I applied the *Elastic Standard Metre*.[125] While it may appear an act of idiotic irony, to repeatedly re-measure this widely accepted standard, playfully contesting the metric order constitutes a fairly serious critique, and demonstrates a form of absurd examination of the established rules and protocols for analysis and scientific research.

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[122] The French Revolutionary Calendar being based on the decimal system with 10 days per week and 10 hours per day was also implemented during the French Revolution in 1792. The new metric system came into effect on the 18th Germinal in year III (1795). Hand, *Measurement,* 221.

[123] At this stage, the metric system is implemented and accepted by a majority of nations with the exception of Burma, Liberia and the United States.

[124] To introduce and to make accessible the new metric system, the architect Jean-François-Thérèse Chalgrin was commissioned to design 16 sample metres engraved in marble called *monuments métriques*, which were installed between 1796 and 1799 at the most frequented places in the civic centre of Paris. Fernand Gerbaux, *Le mêtre de marbre de la rue de Vaugirard* (Paris: Firmin-Didot et cie, 1904), 22. In the course of my project, I reinstalled the *Elastic Standard Metre* at these 16 locations and subsequently also as interventions at other public places and events to implement the *Elastic Metric System* on a larger scale. Images are shown in the Appendix.

[125] I draw attention to the particular circumstances at that location as my daily survey was eyed with suspicion by the security guards at the entrance of the governmental institution across the street. A second standard metre that is similarly well guarded can be found at the facade of the Ministry of Justice at 13, *Place Vendôme in the first arrondissement of Paris*. Contrary to my object of research in Rue de Vaugirard, this second standard metre was relocated and reinstalled. A regular measurement operation would not have been possible at that location due to increased security issues.

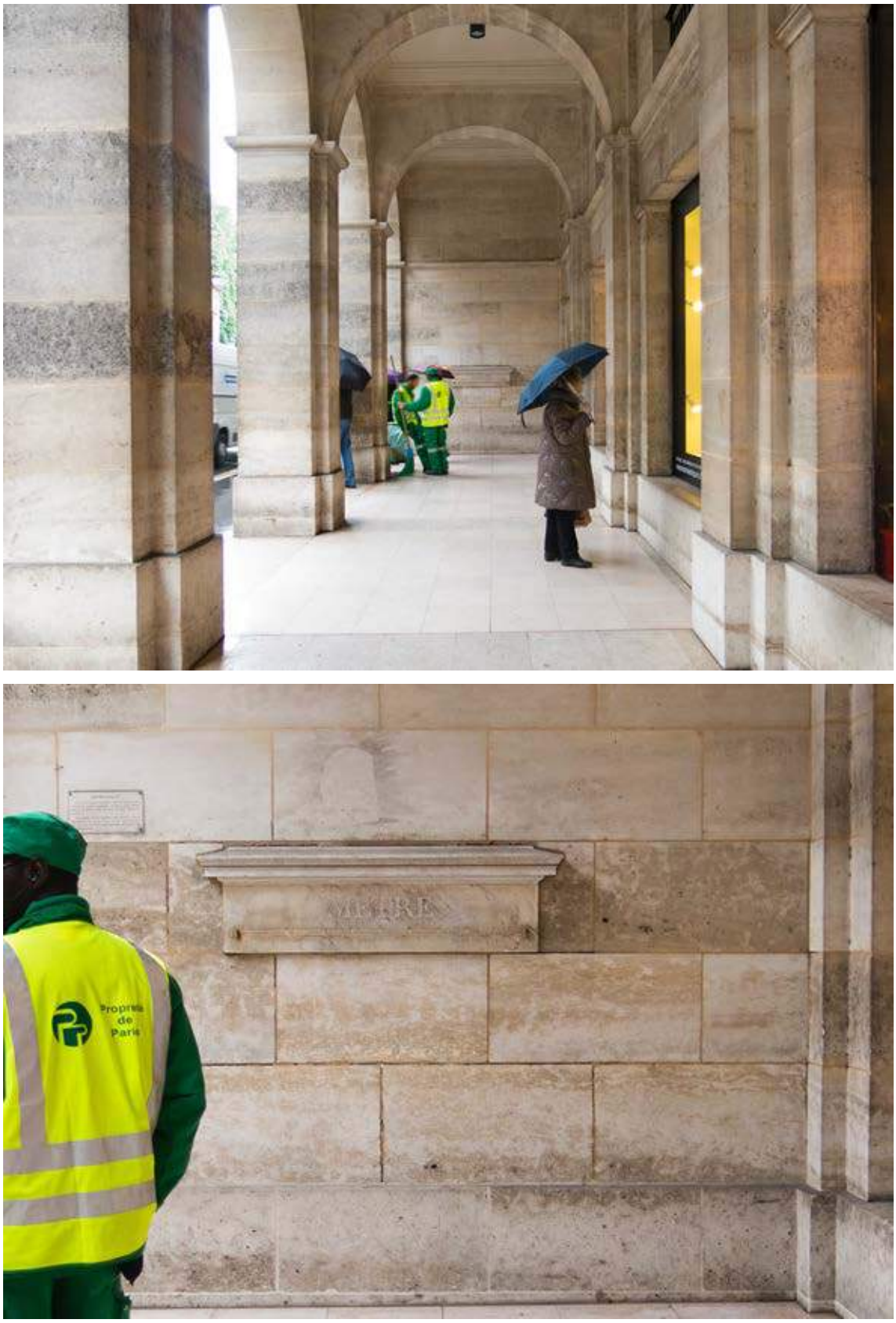

Fig. 20, 21 The original standard metre as *monument métrique* in the arcade at 36 rue de Vaugirard, 6th arrondissement of Paris. Pedestrians and municipal staff members in the foreground.

The Stone Metre meets the Agent Provocateur

In the following section I describe the daily measurement performance by using the material, operational, instrumental and contextual differences between the two systems of standard versus elastic. The incommensurability of the two systems is explicit in their material differences. In contrast to the modest and agile *Elastic Standard Metre*, the dignified metric monument is a bloc of marble that is embedded in the centre of a wall in a neoclassical arcade. In reference to ancient Roman architecture the metric monument is highlighted with a cornice. The capital letters METRE are engraved in the centre of the bloc and a line of 100 centimetres length that is segmented in sections of 10 centimetres is carved into the marble. The beginning and the end of this line are marked with two pins of brass indicating zero and one hundred centimetres. This marble bloc symbolises the French people's liberation from an autocratic class system privileging a ruling power. The bloc also expresses the social and political cohesion of the French population at the time of the French Revolution and their noble aim to unify all humankind through the metric system. As the metric system was based on a specific part of Earth considered to be a neutral and eternal entity, this was an attempt to maintain objectivity and equality for eternity.[126]

The first meeting of the *Elastic Standard Metre* with its older counterpart took place early in the morning. When arriving at the location, direct access to the test object was obstructed as the municipal waste collection had parked several garbage bins in front of the wall. I had to move the bins aside to execute my performative experiment.[127] In my regular measurement routine, I aligned the zero mark of the elastic tape measure with the starting point of the stone metre (point A).[128] I fixed the flexible tape in position with a clip and pulled it in a straight line across the marble bloc.

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[126] The French Academy of Sciences sought to define the metric system independently from any human judgement, sovereign or particular nation. In order to provide such everlasting, universal validity, the new measure was intended to correspond with one ten-millionth of the distance from the North Pole to the Equator. This is a quarter of the perimeter of the Earth. For the determination of the length of the metre, the distance between Dunkirk and Barcelona (both cities at sea level), was measured along the Paris meridian through the technique of triangulation. See for example: Alder, *The Measure of All Things*.

[127] Further incidents happened in the course of the experiment: on one of the following days, I met the municipal workers cleaning the arcade telling me that they had never noticed the *monument métrique*. Other encounters that affected the measurement routine were the passengers of the bus stop near the arcade, the security guards at the entrance of the French Senate, who observed my daily routine or curious tourists and passers-by who engaged me in conversations or asked to perform a measurement process by themselves.

[128] For reasons of simpler differentiation, I use the term *stone metre* for the standard metre from 1795 and *elastic metre* when I speak about the manipulated measuring tape.

Fig. 22 Bettina Bruder, *Elastic Standard Metre*, measurement performance, day 27.

I lined up the brass pin at the end of the stone metre (point B) with the metric scale of the elastic tape that would specify the distance between point A and B (Fig. 22). One hundred centimetres indicated by the stone metre complied on that day with 88 cm on the elastic metric scale. As expected each measurement process produced a different result for the subsequent thirty days.[129] Moreover, with each application the elastic measurement tape seemed to gradually lengthen while the measurement units insidiously faded away in a slow process of abrasion.

My irrational measuring action was observed by passers-by, some of whom occasionally asked if they could they use the device. Anecdotally, I observed different methods and intensities in how the elastic measuring tape was applied and stretched by others. Some people used the tape with extreme care attempting not to interfere with the measurement.
For example, some aligned the 0 cm and the 100 cm marks of the *Elastic Standard Metre* straight away with the beginning and end of the stone metre ignoring the sagging tape but

[129] The measurement results are listed in the Appendix in Table 2.

aiming for consistency and the maintenance of established values. In this way, the sagging tape expressed the absurdity and irony of the exercise (Fig. 23).

Fig. 23 Bettina Bruder, *Elastic Standard Metre*, sagging.

A skilful use of humour was an essential part of my work as playfulness and certain irreverence were deployed to engage an audience more poetically and intellectually stimulating creativity and imagination. In this example, the flexible tape humorously disrupted the straightened measurement routine and relaxed the rigidity of its instrumental logic. Amusement and delight were also noticeable in joyful engagement when some of the audience pulled the elastic tape strongly so that the measured figures resulted in lower numbers and the measurements were less reliable. This delight might be interpreted as a sense of satisfaction about the capacity to interfere with the prevailing metric system in such a simple way, and thus rewarding the surveyor with a feeling of autonomy and empowerment.

Ultimately, the measured values were unusable within the conventional understanding of measurement so that the *Elastic Standard Metre* became an *agent provocateur* as its unreliability and ambiguity revealed the dynamic and contingent qualities within a situation: anomalies, glitches and error, ethical and moral concerns, subjective biases or weather-

contingencies that are typically not considered when a "reliable" measuring device is applied. In this instance, the reconfigured measuring tape acted as a troublemaker in the search for objective and reproducible information about the dimensions of an object. Instead of delivering solid and truthful facts, the measuring device fostered thoughtful reflection, joy and conversations provoking a different form of engagement. Such experiential outcomes cannot be predicted, represented or controlled, as they exist outside of a rational logic that focuses on factual evidence and predictable efficiency.

The term *agent* or *actant* is used in the area of STS to assign an active role to humans and non-humans in the production of knowledge.[130] In Latour's application of the term, he emphasises the active involvement of constructs, objects, substances and devices in the fabrication of knowledge in contrast to a traditional understanding that only assigns humans active capacities while things are considered as passive objects: 'An actant can literally be anything provided it is granted to be the source of an action'.[131] Likewise Barad introduces matter and apparatuses as agentive and constitutive factors; in her view, material is not a passive, immutable or inert mass, and measurement devices are not treated as lifeless pieces of technology that merely execute a specific function according to preconfigured parameters. Rather, this different approach draws attention to the dynamic and active qualities of materials and devices by shifting the focus from representationalism—reinscribing a separation between matter and meaning—to a vital, generative and performative conception, which considers matter and meaning intertwined through *intra-actions*. Thus, Barad delineates matter as a

> [S]ubstance in its iterative intra-active becoming—not a thing, but a doing, a congealing of agency. It is morphologically active, responsive, generative, and articulate. Mattering is the ongoing intra-active differentiating of the world.[132]

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[130] These can be technical devices, organic elements or natural phenomena. Thus, measuring devices are actants due to their organising and regulating capabilities as they provide the groundwork for knowledge while framing a context and narrowing down the number of potential interpretations within a measuring process. For example, gauging devices are actants as they specify physical quantities such as length, mass, or time so that various phenomena are made calculable and classifiable.
The concept of actants and actors is an essential part of actor-network theory (ANT), a material-semiotic approach within STS to study the production and structure of knowledge. ANT was developed by Michel Callon, Bruno Latour and John Law amongst others.

[131] Latour, 'On Actor-Network Theory,' 373.

[132] Adam Kleinman, 'Intra-actions (an Interview with Karen Barad),' *Special dOCUMENTA (13) Issue of Mousse Magazine* 34 (2012): 80.

The elastic material of the latex metre emphasises this material agency evidenced by its mobilising and activating capacity. Hence, measurement actively entangles matter and meaning.[133] While the predominant function of a conventional measurement device is its separating, stabilising and verifying capacity to produce truthful and reliable values, the *Elastic Standard Metre* disturbs and enriches a measuring process provoking alternative encounters.

In both cases, the capacity to influence a course of action reveals the material agency of the device. Agency describes the capacity to influence and re-configure a situation. Thus objects, artworks, materials or concepts can have real-world effects. In the words of Barad:

> [A]gency is about response-ability, about the possibilities of mutual response, which is not to deny, but to attend to power imbalances. Agency is about possibilities for worldly re-configurings. So agency is not something possessed by humans, or non-humans for that matter… It [agency] is an enactment. And it enlists, if you will, "non-humans" as well as "humans".[134]

The differentiation between *interactions* and Barad's *intra-actions* can also help to understand the differences between a conventional measurement operation and an elastified measuring process with the *Elastic Standard Metre*. Interactions describe an activity between *separate, distinct* entities while intra-actions arise *within* the entanglement of a specific circumstance such as the moment of measuring. This different perspective changes the concept of causality, as a causal force is no longer clearly attributable in a linear fashion to a specific factor extractable as a value out of a context. Instead, intra-actions denote the

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[133] An example of such entanglements and intra-actions that may influence a measurement can be pictured with the determination of the historical metre in 1792. A measurement operation lasting for several years was executed by two astrophysicists to determine the length of the metre based on a particular portion of the Paris meridian. One team with Jean Baptiste Delambre headed north towards Dunkirk, while the second team of Pierre Méchain travelled south to Barcelona. The surveyors used a new precision surveying instrument, the *Borda* repeating circle, and the technique of triangulation. Their undertaking was troubled by political unrest during the French Revolution and the war between France, Prussia and Spain. The surveyors were several times arrested due to suspected espionage. Further conditions led to faulty measurements. For example, the irregular shape of the Earth, variations in temperature, difficult terrain and unfortunate atmospheric circumstances led to poor conditions of visibility during the survey and improper application of the measurement devices. In addition, health issues, mental depression and diseases but also jealousy, distrust and an uncooperative attitude within and between the research teams added on to the occurrence of measurement errors. In contrast to the initial specification from the French Academy of Science, the metre turned out approximately 0.2 millimetres too short. This error is maintained in the current definition of the metre demonstrating that scientific research and measurement can be even executed within "inaccurate" conditions. On the history of the metre, see: Alder, *The Measure of All Things*.
[134] Dolphijn and van der Tuin. *New Materialism,* 55.

emerging relationships *within* a (measurement) process and come into being through the wicked entanglement of various agencies.[135] These agencies arise from the mutual dependency and contingency of discourses, conventions, materials, humans and non-human components.

Fig. 24 Garbage bins and the *monument métrique*.

Besides the significant variation in measurement results and multiple applications of the flexible measuring tape, I noticed a change in my own awareness. Normally, I would not expect differences within a measurement routine of an object that is firmly fixed in a wall and that does not move or change over time. In contrast, the engagement with the *Elastic Standard Metre* expanded my attentiveness for subtle occurrences and intra-actions that I would have otherwise considered indiscernible. For example, encounters with obstructing garbage bins (Fig. 24) and municipal workers, curious passers-by or the security guards who observed my measuring routine would not have been worth to mentioning in a conventional measurement process. However, in such an elastic methodology incidental events disturbed

[135] For instance, apparatuses, viruses and emergency measures have *agency* as they influence and *intra-act* in a situation. Barad explains intra-actions with the example of avian flu: the reasons for the disease cannot be ascribed to a single factor, nor could its spreading be controlled by radical provisions. Instead, avian flu develops as an ongoing co-constitutive and reconfiguring correlation between nature, culture and technology. Ibid., 55.

the goal-oriented measurement process rendering infallible results doubtful and debatable. The manipulated *Elastic Standard Metre* sabotaged the ordering agency of the classic metric system as an authoritative convention. Now, the measurement, the measuring instrument and a diligent measurer were entwined with the uncontrollable factors within that particular situation.

Fig. 25 Bettina Bruder, *Elastic Standard Metre*, video still, 2013.

The Construction of Empirical Evidence – Executing Cartesian Cuts

The daily engagement with the flexible device at that location, the walks to the stone metre and the experience of insignificant episodes intensified my relationship with that very act of measuring and that particular test object. I became aware of the disciplined recruitment as a kind of enrolment of the various components within the fabricated situation of measurement. *Enrolment* describes the artificial construction of specific configurations between various factors and actants.[136] Particular actants like the measuring device, the measurer, the

[136] Michel Callon, 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay,' *The Science Studies Reader*, ed. by Mario Biagioli (New York: Routledge, 1999), 74.

measured object and the result are enroled while other components are ignored and rejected (personal bias, weather, tourists, garbage bins etc.). Thus, a classic measurement operation dissects a complex situation separating out particular aspects and excluding them from the assemblage of various elements and actants. This process of simplification and disintegration focuses on the measurement *results* rather than the measuring *process*. Moreover, a measurement generates an absolute value that conveys a distinct assignability. Employing Barad's concept of measurement as a *boundary-making practice*, a measuring apparatus establishes a *Cartesian cut* – a crisp line of distinction that separates internal from external, important from meaningless and true from false values.[137] Thus conventional measurement generates a binary conception isolating subjects and objects as disjunctive entities that can be neatly aligned in linear sequences and hierarchical structures.

Fig. 26 Bettina Bruder, *Elastic Standard Metre*, measurement performance, 2013.

Such controlled and target-oriented approach is critically described by Mike Michael within science and social research using the example of a cat disturbing an interview process. The pet began to play with the tape recorder and cables, thus altering the outcome of that

[137] Barad, *Meeting the Universe Halfway,* 146, 114.

conversation. Michael explains: 'a whole array of entities had to be disciplined for an interview to be possible.[138] Thus, the cat, the tape recorder, the garbage bins, the passers-by or the street sweepers could be considered meaningless, or at least only a slight distraction if I were conventionally measuring the metric standard. But, using the *Elastic Standard Metre* blurred boundaries and differences such that it precluded the possibility of a Cartesian cut so that unruly factors were invited to interfere with the measuring process. Deploying the *Elastic Standard Metre* undermined a Cartesian subject-object divide that is considered absolute as *a priori* distinction.[139] Hence, in this experiment, conventional understandings of subject and object were subverted and the segregating logic that intended to pursue a specific order, was made messy and confused. The formerly clear functions of the measurement apparatus and the measured object were disarranged as one metric measurement device was used to re-measure another one. What is now the measurement device and what is the measured object? Is the stone metre measuring the elastic metre or vice versa?

Agential Cuts and Contingent Separability

A conventional measurement process with a Cartesian cut establishes a description of a situation or an item as a distinct and representable result. In contrast, the deployment of an elastifying device directs a user's awareness to the very act of gauging rather than its result. In Barad's words, it is the 'enactment of an agential cut', which is a situated measurement of contingent separability that registers subtle relations and gradual differences instead of absolutely defined and unalterable states.[140] This agential way of boundary-setting renders a porous and transient kind of statement that is considered flexible and re-negotiable. As a consequence, the idiosyncrasy of a *particular* measuring instant became physically and cognitively accessible as each day of the measurement performance produced another experience and a different result undermining notions of absolute validity and transferable objectivity (Fig. 27-34). If the measurement results were meant to be used in a subsequent transaction such as buying, selling or determining the value of a particular stock, product or amount of material, it would have been necessary to negotiate prices and quantities every time anew.

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[138] Michael, 'De-Signing the Object of Sociology,'170.
[139] Malou Juelskaer and Nete Schwennesen, 'Intra-Active Entanglements—An Interview with Karen Barad.' *Kvinder, Køn & Forskning*, Women, Gender & Research, no. 1–2 (2012): 19.
[140] Barad, *Meeting the Universe Halfway,* 350.

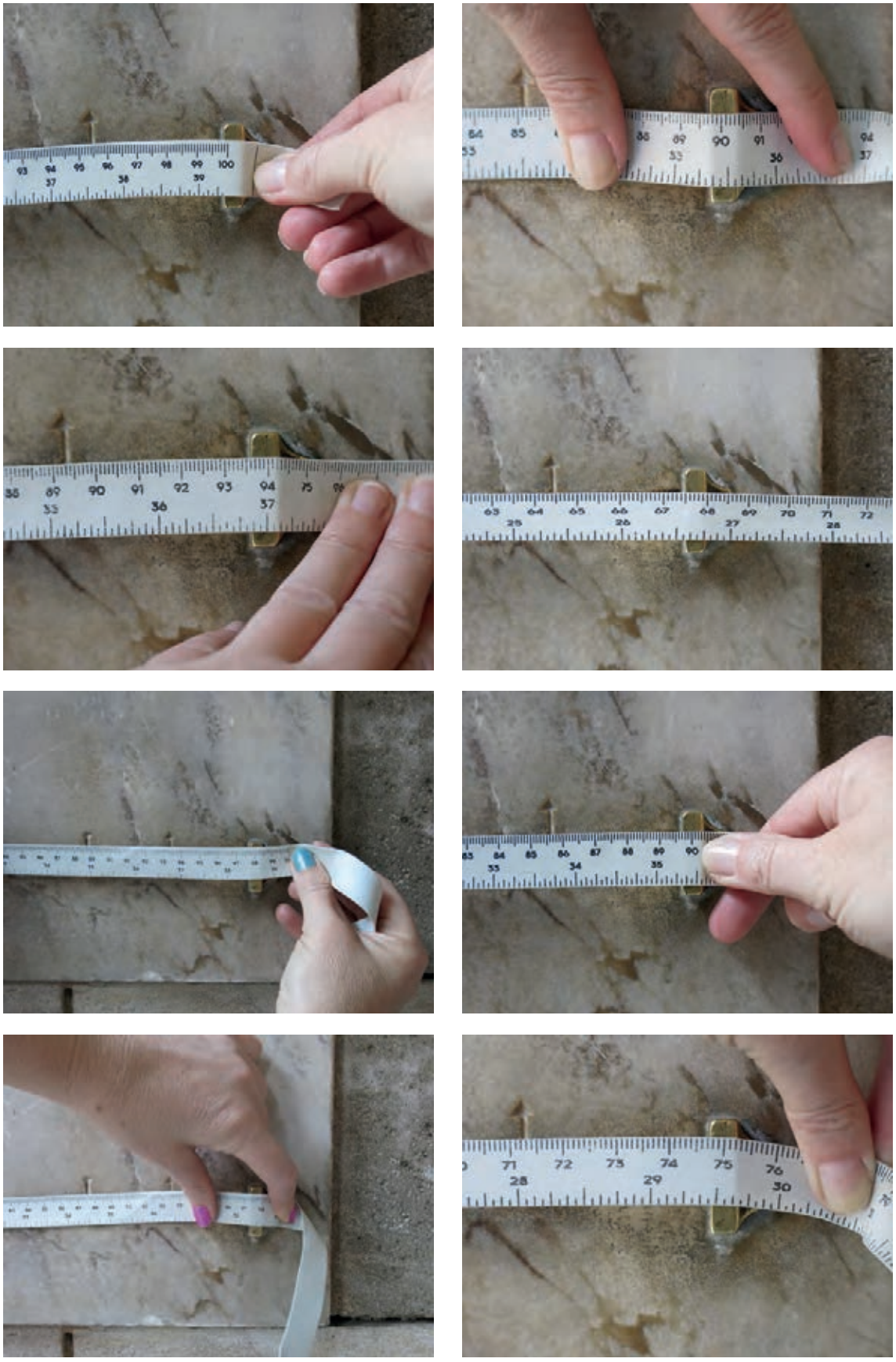

Fig. 27 - 34 Bettina Bruder, *Elastic Standard Metre*, measurement performance (details), 2013.

Fig. 35 - 39 Bettina Bruder, *Elastic Standard Metre*, measurement performance, 2013.

Validity and reliability of measured results can be considered central to claims of scientific objectivity in knowledge-making practices. In a scientific context, objectivity aims for generalisable results through repeatable methods independent from a researcher. Objectivity strives to ensure that scholarly research is unaffected by ideological attitudes, obligations, prejudices or personal interests. To challenge this idea of infinite objectivity and independent reproducibility within scientific experimentation, I designed the experiment with the *Elastic Standard Metre* for a test period of one month conducting a regular measurement routine to stress test both metric measures (Fig. 35-39).[141] Normally, repeated processes in science are performed in order to generate a range of data that can serve as the basis for comparison, and thus detect regularities and potential convergences in a range of results. Moreover, repeated measurements compensate for inaccuracies, fluctuations or possible misreadings so that trustworthy and objective information can be delivered. Thus, conventional measurement is considered the controlled construction of an event with the intention to establish and maintain an unambiguous order of cause and effect that supports the scientific claim for impartiality and an observer-independent reality.[142] That means that objectivity, reproducibility and control are co-constitutive of each other. This interweavement is explicated by Barad who asserts:

> The reproducibility of measured values under the methodology of controlled experimentation is used to support the objectivist claim that what has been obtained is a representation of intrinsic properties that characterize the objects of an observation-independent reality. The transparency of the measurement process in Newtonian physics is a root cause of its value to, and prestige within, the Enlightenment culture of objectivism.[143]

As the results of my measuring performance were never the same, I reproduced *irreproducibility* in order to access the agential, processual and non-representable qualities that would emerge during a flexible measurement encounter. I sought to *de-control* the inherent linearity of a conventional measurement process and redirect my focus from the *result* to the *process* of measuring and the respective moment. My idea was that such

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[141] A video documentation of this measurement performance is available on the accompanying USB-stick of the TAU.
[142] Jost Halfmann, 'Wissenschaft, Methode und Technik. Die Geltungsprüfung von wissenschaftlichem Wissen durch Technik,' *Wissen - Nichtwissen - Unsicheres Wissen*, eds. Christoph Engel, Jost Halfmann, and Martin Schulte (Baden-Baden: Nomos, 2002), 8. https://secure-redaktion.tu-dresden.de/die_tu_dresden/fakultaeten/philosophische_fakultaet/is/technik/aktuelle_aufsaetze/methutech.pdf (accessed 10 August 2014).
[143] Barad, *Meeting the Universe Halfway*, 107.

irreproducible experiences may unhinge the accustomed conception of causation with its templated linearity where one input renders one direct output implying a clear separability and assignability of cause and effect.

Integrating versus Segregated

An engagement with the *Elastic Standard Metre* questions the segregating and devitalising character of conventional analysis and measurement. Such traditionally epistemic methods that align scientific literacy with the quests for objectivity, reproducibility and accuracy, constitute a *practice of negativity* in the words of Barad.[144] These are activities of withdrawal, dissociation and delimitation that aim for results with clear disparities, generalisable outcomes and exclusive definitions, while ignoring the circumstantialities of a particular measuring context. In contrast, each operation with the flexible measuring tape produced an agential cut with dissimilar readings, and thus generated different contingent meanings opened up space to discover lost intimations and the possibility of integrating yet to be considered concerns.[145] The engagement with the reconfigured measuring device rendered an integrative, fluid and synthesizing approach encouraging a different style of finding agreement requiring attentiveness, openness, care and creativity. Hence, the *Elastic Standard Metre* injected unpredictability and ambiguity into encrusted categories, procedures and practices of measurement, dismantling traditional modes of thought. Ambiguity within measurement provoked a shift in engagement as it encouraged the questioning of established routines and values stimulating imaginative interpretation beyond technical limitations with preconfigured outcomes.

Measuring with the *Index Finger Ruler Tattoo*

An associated design development within speculative design dealing with measurement and its implications for industrial production and economic distribution, is the *Index Finger Ruler Tattoo* (n.d.) from Marti Guixé.[146] Similarly as in the *Elastic Standard Metre*, the project

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[144] Dolphijn and van der Tuin, *New Materialism: Interviews & Cartographies*.

[145] These might be unquantifiable qualities such as smell, taste or temper, the finiteness of resources (natural, human or temporal) or bias, privileges and political power—aspects, which are usually neglected are now revealed and become noticeable.

[146] The work of self-proclaimed "ex-designer" Marti Guixé challenges the limitations of commercial design. Guixé uses the prefix 'ex' to expand the traditional image of the design profession provocatively. He aims to establish a new, unlimited terrain beyond the habitual space of conventional design practice that is driven by the one-sided interests of industrial profitability. With the ambiguity of the term ex-designer he intends to spark social and practical alternatives. Marti Guixé, 'Ex-Designer.' Available at http://www.ex-designer.com/ (accessed 9 December 2015). See also Jeffrey Swartz who elaborates on the strategies of Guixé and the prefix 'ex'. Swartz, Jeffrey. 'Critique, Language and Strategy in Martí

explores an irreverent methodology. The ten centimetre long metric scale that can be tattooed on the index finger (Fig. 40) demonstrates Guixé's quest to go beyond the traditional expectation of product design inventing objects that are suitable for commercial exploitation. Guixé criticises the commoditisation process that accompanies the industrialising of objects by offering alternative proposals to consumerism rendering the possession of products and the concept of disposables obsolete. In order to frustrate economic and industrials concerns, he focuses on applicabilities, purpose and concepts disseminating immaterial products as ideas that can be freely adopted and interpreted.[147] Guixé's designs are 'a type of open source application, a conceptual freeware or no-cost app' as Swartz aptly describes.[148]

Fig. 40 Bettina Bruder, own interpretation of Marti Guixé, *Index Finger Ruler Tattoo*, n.d., re-enacted. Photographer: Dorothee Stickling, 2016. The CC license does not apply to this picture.

The *Index Finger Ruler Tattoo* mirrors Guixé's attempt to transform society by rearranging a social practice. By stripping away the device's physical materiality, Guixé proposes a reconfiguring of social relations not yet ruled by consumerist interests and a profit-oriented

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Guixé's 'ex-Designer.'' In *Design Activism And Social Change* (paper presented at Design History Society Annual Conference, 7-10 September 2011, Barcelona). Available at: https://www.academia.edu/5571340/Critique_Language_and_Strategy_in_Mart%C3%AD_Guix%C3%A9_s_ex-designer_2011 (accessed 13 August 2015)

[147] See for example Loredana Mascheroni. 'Domus – c/o Castiglioni,' (April, 2005) http://www.domusweb.it/en/design/2005/04/06/c-o-castiglioni.html (accessed 10 August 2014).

[148] Swartz, 'Critique, Language and Strategy', 6.

industry. A tattooed measurement scale on the individual forefinger enables constant availability, reducing dependency on a manufactured and calibrated measuring instrument and making this commodity redundant while increasing the owner's autonomy. Guixé's concern is not the scale itself but the expanded functionality of the hand implicating a radical change of the conventional production and distribution system. By doing so, he emancipates a user and a production process from any subjectivation through a market.

Both, the *Elastic Standard Meter* and the *Index Finger Ruler Tattoo* use a material intervention to encourage reflection whereby a measurement scale is applied to a bendable, organic substrate (latex or skin). However, the metric scale with Guixé's *Index Finger Ruler Tattoo* remains unchanged, but limits every gauging process to a multiple of 10 centimetres. Thus, it complicates and decelerates each industrial production process as each measurement operation is segmented into unreasonably smaller and smaller steps. Possible actions and transactions in a conventional sense are limited and rendered improvident, while personal capacities are increased through the extended functionality of the hands, raising awareness about individual competence.

Guixé reinvents the idea of *measuring* by operating beyond the chain of economic profit and surplus value. The capacity to act is expanded as the *Index Finger Ruler Tattoo* allows for extended capabilities on a practical level augmenting the autonomy and proficiency of a user. Guixé's proposal reminiscent of the "rule of thumb" invigorates the capability for individual assessment according to personal values offering a seamless, hitch-free engagement with the world independent from industrial constraints and scientific accuracy.[149] Similarly, every

[149] The finger as a tool is derived from the tradition of craftsmanship emphasising individual expertise and a Heideggerian *readiness-to-hand* where dimensions can vary anatomically and where the situated relevance of a particular circumstance is underlined. Early units of measure like the foot, the ell or the hand were used in ancient times to measure dimensions. Distances could be determined and communicated with the fairly similar sizes of human body parts as a reference. For instance, the average width of a thumb determined the size of an inch. See for example, Hand, *Measurement: Theory and Practice*. Bryan H. Bunch and Alexander Hellemans, *The History of Science and Technology: A Browser's Guide to the Great Discoveries, Inventions, and the People Who Made Them, from the Dawn of Time to Today* (Boston: Houghton Mifflin, 2004). The Oxford English Dictionary explains the expression "rule of thumb" as an overall acknowledged guideline that can be rough and unscientific. The expression proposes an approach of assessment based on personal practice and experience rather than on factual and precise information that is predetermined. *Oxford English Dictionary Online*, s.v. "Rule of Thumb, N. and Adj.," http://www.oed.com/view/Entry/168726 (accessed 15 August 2014). According to Philip Hiscock, a professor of folklore at Canada's Memorial University of Newfoundland, the phrase "rule of thumb" emphasised the thumb as an always-available gauging device for wood workers and carpenters when measuring wood in a rough assessment. Christina Hoff Sommers, *Who Stole Feminism? How Women Have Betrayed Women* (New York: Simon & Schuster, 1994), 204. Lee E. Ross, *Continuing the War against Domestic Violence* (Boca Raton: CRC Press, Taylor & Francis Group, 2015), 144.

measurement with the *Elastic Standard Metre* injects a quality of unpredictability and subjectivity generating variable results that introduce a context-dependent, unstable reality beyond industrial concerns and scientific regulations. Ultimately, both tools subvert conventional measuring procedures, and provoke confrontation and debate, as each subsequent process and transaction must be renegotiated. Such changes in analysis, trade and production may shift human behaviour and attitude within a consumer society contesting aspects of control and predictability. Both tools sabotage and criticise established ways of measurement and (scientific as well as industrial) production, while the *Elastic Standard Metre* aims to expand the ideological patterns that govern mindsets and ideas as well as the ethical aspects that underlie social and cultural practices. Similarly as the *Index Finger Ruler Tattoo*, the flexible measuring tape of the TAU sabotages conventional measurement. But furthermore it renders a user more sensitive to processes of cognition, judgement and agreement inducing the potential for change and transformation of contemporary consumer society and its ruling values of profitable efficiency and "objective" rationality. The *Elastic Standard Metre* demonstrates the need for ongoing re-negotiation and care to collaborate in building a mutual understanding. This elastification of the measurement process led me to the following experiment called *Unstationery*.

2.2 *Unstationery* – Unhinging and Mobilizing Paperwork

Unstationery is the outcome of a month-long measurement experiment where the *Elastic Standard Metre* was used to re-measure a regular A4 paper. The sheet of paper complied with the official standard for paper sizes prescribed by the International Organization for Standardization called ISO 216. Based on the resulting variations generated with each measurement routine, I produced a different paper format for each day. *Unstationery* was inspired by an exhibition at gallery Platform 72 in Sydney where the audience-participants had the opportunity to engage with the *Elastic Standard Metre*.[150] Similarly, as with the measurement performance of the original standard metre at the French Senate, I observed different ways of how to use the device. The flexibility of the tape seemed to encourage alternative applications as different ways for measuring were invented so that the measurement tape was curled, knotted, twisted or rolled (Fig. 41-48). I was inspired by these observations and wanted to expand on such non-conventional ways of measuring.

[150] Platform 72, Art Month Sydney 2013, 'Double Whammy', curated by Mike Barnard, 06-24 March 2013. Available at http://platformstore.com.au/pages/double-whammy (accessed 15 March 2016).

Fig. 41 - 48 Bettina Bruder, different measurements during an exhibition with the *Elastic Standard Metre*, re-enacted, 2013.

The title *Unstationery* is derived from stationery, which is a term that designates conventional letter paper used for publication and administration. The term stems from the occupation of stationer—a publisher and merchant of printed matter, books, magazines, writing materials and paper paraphernalia. As the term suggests, and in contrast to itinerant traders, stationers had a fixed market stall.[151] I emphasize this stability and exclusivity in regard to the organised distribution of writing tools and the controlled publication of printed matter as aspects of durability, control and regularity became sites for potential intervention through the TAU.

Current standard paper formats are determined by a fixed ratio of the length to the width of a paper that is specified by ISO 216.[152] It is based on $1:\sqrt{2}$, also called the Lichtenberg Ratio of 1:1.4142. This is a particular mathematical constancy, which allows that paper can be folded or cut in half along its width whilst the resulting parts maintain their aspect ratio. Thus, various paper sizes can be derived from *one* format while the relationship between the width and the length of the paper remains consistent. This uniformity across different paper sizes facilitates efficient and practical usage by keeping layouts, texts and drawings identical. For example, scaling, enlarging or reducing a page using a photocopy machine does not deform an image or distort a layout. Visual representations are kept stable and consistent. Drafts showing circular shapes remain round and squares keep their lateral lengths by not turning into rectangles.

Before the mass-production of paper, dimensions depended on the size of the frames that were used in the workshop where the hand-made paper was fabricated.[153] Technical improvements that enabled the industrial production of books and printed matter through the printing press and other machines for writing and reproduction, for example, the typewriter,

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[151] See for example: Peter Beal, 'A Dictionary of English Manuscript Terminology 1450–2000,' Online entry *Oxford Reference,* s.v. "Stationer," http://www.oxfordreference.com/view/10.1093/acref/9780199576128.001.0001/acref-9780199576128-e-1001 (accessed 15 March 2016)

[152] This organisation of paper standards goes back to a system from Walter Porstmann, engineer and mathematician. Systematised paper formats were introduced in Germany 1922 as DIN standard (DIN means *Deutsche Industrie-Norm*, which describes the German industrial standard). Porstmann developed this coherent system of paper sizes based on ideas from Georg Christoph Lichtenberg, mathematician and experimental physicist, who proposed regulated paper sizes in 1786. Twelve years later in the course of the metrification during the French Revolution, the law on the taxation of paper—*Loi sur le timbre* (no.2136)—was introduced in France in 1798. These specifications for paper sizes aligned with Lichtenberg's ideas. Thus, the current paper size ISO 216 is equivalent with the paper sizes that were introduced in 1786. See for example, Markus Kuhn, 'A4 Paper Format / International Standard Paper Sizes.' http://www.cl.cam.ac.uk/~mgk25/iso-paper.html (accessed 19 December 2015).

[153] The frames are called mould and deckle in the jargon of papermaking.

led to the regulation of standardized paper formats.[154] Such regulated organisation caused a cascade of consequences that pervaded institutional education, administration, industrial production, trade and communication.

Paper is the material basis for the representation of (scientific) facts and data. Preformatted paper sizes determine the dimensions for publications such as for books, leaflets, flyers, brochures and letters, with each sheet of paper limiting the possible scope of action as it specifies and stabilises the ordered space for arranging ideas represented through sketches, layouts, texts or images. Processes of inscription such as writing, marking, documenting, reading, archiving and coding rationalise and organise our thoughts and ideas. These practices of inscription are associated by Latour with the 'domestication or disciplining of the mind'.[155] Inscriptions produce *immutable mobiles*, which are (scientific) representations, diagrams, data or measurements. Immutable mobiles are widely accepted and unquestioned. They can be transferred to other places and applied in different contexts, while their content remains unchanged and preserved.[156] Printing and copying technologies allow for the identical reproduction of these facts in large volumes (not only on paper) while the data can also be published and distributed via various media channels across wider distances. Thus, immutable mobiles collapse the relation between time and space by offering a homogenous stage for the simplified consolidation and representation of various data.

Practices of documentation, publication, communication and administration (through paper) regiment discourses. Normative regulations and discursive practices reproduce and enact authority, efficiency and governmentality wherever intricate procedures, technical routines, rational forms and established standards, frame and form policy-and-decision-making

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[154] Besides the stability indicated with the term stationery, I draw attention to another form of constancy within the mass-production of paper: in order to keep the conditions for the production of paper constant, the first electrical air conditioning system was developed for a Lithography and Printing Company in Brooklyn, New York in 1902. As paper is an organic material, it tends to shrink and stretch due to changes in moisture and temperature. The air conditioning system maintained stable conditions and allowed to control humidity and temperature during printing. See for example 'Willis Carrier - The Invention That Changed The World - 1876-1902,' available at http://www.williscarrier.com/1876-1902.php (accessed 19 December 2015). The advantages of such reliable environment with stable conditions during a technical production process were subsequently introduced in other industries working with materials like textiles, rubber, pharmaceutical products, sweets and confections where variations in the manufactured product were undesired. 'Willis Carrier - Manufactured Weather – 1915 - 1922,' available at www.williscarrier.com/1915-1922.php (accessed 19 December 2015).

[155] Bruno Latour, 'Visualisation and Cognition: Drawing Things Together.' *Knowledge and Society: Studies in the Sociology of Culture Past and Present*. A Research Annual, Jai Press Vol.6 (1986), 4.

[156] Latour, *Pandora's Hope,* 306-307.

processes.[157] It is an entanglement between political and economic consequences where matter meets concerns and meaning. This interdependency becomes apparent when considering for example how the specification of paper formats regulates and penetrates many aspects of everyday life. Standardised paper both conditions, and is conditioned by, technology. Not only machines for printing, copying, scanning and faxing require particular paper formats. Moreover, folders, binders and filing systems rule entire administrative, educational and industrial sectors. Scientific publications, books and conference papers, reports, certificates, office supplies and the management of forms and templates are formatted by paper.[158] Their distribution using electronic technology and postal services, taxation and banking processes as well as administrative and political communication, is all arranged based on formatted paper sizes.

Thus, through a series of experiments, TAU intend to "unformat" and redirect discourses, information exchange and practices of inscription in the production of knowledge. In this way, challenging ISO 216 can be considered an attack on the common foundations of a prevailing infrastructure that runs through administration, communication, education and industry.

A detailed examination of "paper-work" by Latour reveals the advantages of documents, facts and information as these records allow for the dislocation, straightening, scaling, evidencing, reproducing, recombining, superimposing, transcribing, and manipulation of facts and (scientific) representations.[159] This series of intertwined processes leads to the hegemony of inscriptions. Such knowledge making practice, with its focus on efficiency and productivity in regard to the construction, communication and distribution of facts advances a particular course of action and thus privileges a specific group of decision makers. Latour criticises this rationalising and universalising practice particularly of scientists and politicians when he states that 'in our cultures "paper shuffling" is the source of an essential power, that constantly escapes attention since its materiality is ignored'.[160]

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[157] See for example Patricia Falguières, 'The Realm of Norms,' *ROSA B N°3 – Format Standard* (2009). http://www.rosab.net/format-standard/pdf_download/uk-The_realm_of_norms.pdf (accessed 19 March 2015).

[158] For example, this present document complies with the formatting guidelines of the University of New South Wales. Available at UNSW, Graduate Research School, 'SUBMITTING A POSTGRADUATE RESEARCH THESIS AT UNSW-thesis_format_guide.pdf,' https://research.unsw.edu.au/document/thesis_format_guide.pdf

[159] Latour, 'Visualisation and Cognition,' 24.

[160] Ibid., 26.

This statement portends the separation between matter and meaning occasioned by Cartesian thought—a separation that is likewise criticised by Barad as discussed before.

Though paper is a delicate and weak material, it becomes the most powerful medium linking matter with meaning in the form of facts and representations that are shuffled, rearranged, controlled and administered drawing visualisation together with cognition as demonstrated by Latour using examples of maps, money and construction plans.[161] My interest in the standardized paper format lies in this delicate connection between materiality and contextual significance. As the tension between these two poles goes unnoticed and ignored it may be deployable constructively. The disruption of common paperwork may stimulate alternative articulations and expand the space for ideas, experiences, policies and decisions.

Through this, the established ways of engaging with the world could be altered and hierarchical power structures could be disordered and unsettled. This idea was the rationale behind *Unstationery*. The following section describes my experiments with ISO 216 and the *Elastic Standard Metre*.

Challenging ISO 216 through Disobedient Measurements

In the process of re-measuring A4 sized paper I placed the *Elastic Standard Metre* cautiously and without any deliberate distortion along the sides of the sheet of paper. The measurement results did not differ remarkably from the usual dimensions given by a regular paper format. In order to generate results that altered significantly, I had to invent different ways of measuring that would corrupt the linear one-dimensionality of an orderly measurement process. One way to achieve variations in results was by measuring different objects other than the A4 paper. I also built on randomness and playful experimentation to expand the variety of measurement outcomes similar to Duchamp's approach when he produced the *Three Standard Stoppages* (1913). As I wanted to gain alternative dimensions beyond the previously defined parameters with the rectangular constancy of the Lichtenberg ratio, I purposefully lengthened, folded, knotted, looped and rolled the measuring tape (Fig. 49). The ductility of the tape made it possible to add further dimensions. Thus, I stretched and twisted the straightened uniformity of a flat plain, undermining its simplifying operationality by introducing irregular and troublesome outcomes. In a figurative sense, I deployed the *Elastic Standard Metre* almost as twisted as a Möbius strip to inject disturbing and irregular factors into a measuring process. To experiment with the measuring process turned measurement into *intellectual tools*, as art historian Herbert Molderings described

[161] Ibid., 29.

Duchamp's projects.[162] Such practices challenge and dissolve the supremacy of scientific logic being the regulatory paradigm explaining and ruling the world.

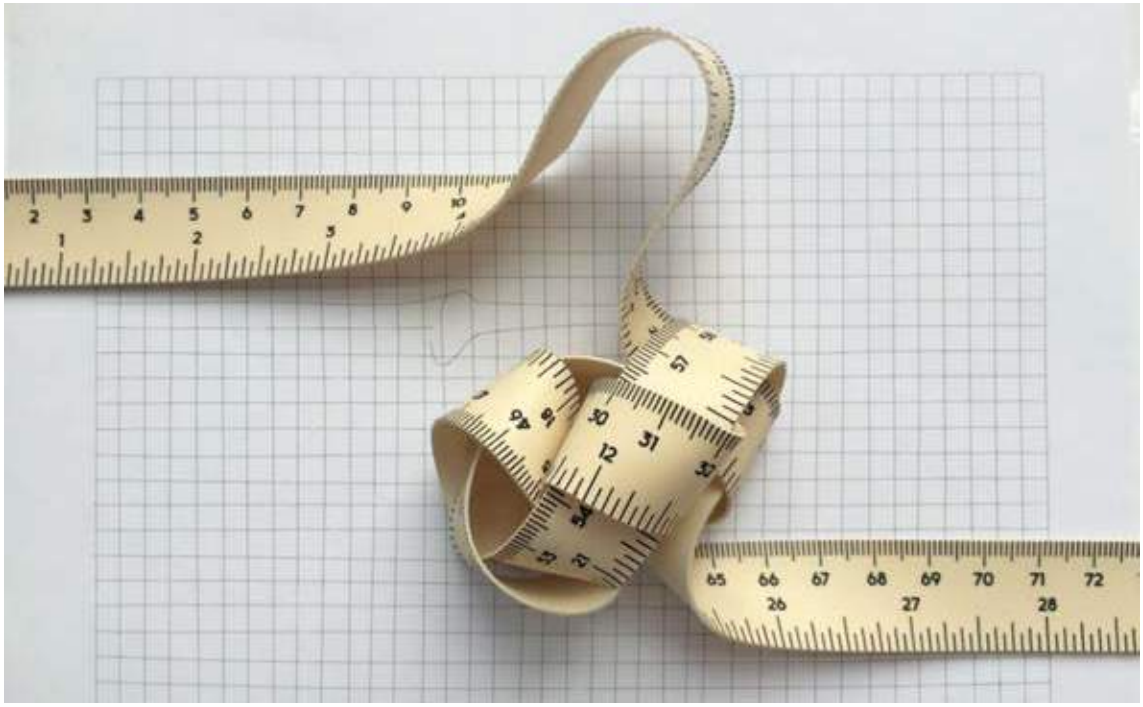

Fig. 49 Bettina Bruder, *Elastic Standard Metre*, re-measuring an A4 sized paper for *Unstationery*, 2014.

Exploring New Boundaries

My unruly approaches to the assessment of size and shape of the paper format shifted ratios and boundaries. The irrational measuring operations literally displaced limits and shifted borders. As the measurement results varied per day, the specified sizes of the sheets of paper that I fabricated each day differed as well. These irregular paper formats rearranged the dimensions of the space for representations injecting uncertainty and visionary accounts into standard practices of measurement, inscription and communication.[163] *Unstationery* emphasized the peculiarity of each paper as every sheet and every day had to be considered individually. Thus, irregular stationery undermined authoritative censorship and automated processes of inscription and administration. Preformatted operations were complexified, as the sheets were incompatible with various technical devices. Furthermore, filing and circulation through mailing and institutional services turned out to be laborious, as the irregular shapes did not fit the standardized criteria of punches, envelopes or publication formats. Using some of these irregular paper sizes for official communication with

[162] Molderings, *Duchamp and the Aesthetics of Chance*, xvi.
[163] The exact results are listed in the Appendix in Table 3. Fig. 48, 49 show the resulting sheets of paper.

administrative bodies like bank institutions and local authorities turned out to be problematic. An answer was never received and I suspect that the letters were not considered as veritable pieces of communication.

Fig. 50, 51 Bettina Bruder, *Unstationery,* compiled at a wall hanging and folded, 2014.

Through the converted formats, I modified conventional ways of engaging with written information. The additional amount of time required to produce a particular paper format, to print or to write on it, to transport it by mail, to process, file and answer it, did not facilitate a simple, direct and efficient communication. Conventional usage was refused, as the paper did not comply with technical and procedural specifications implying legitimate and authoritative values. *Unstationery* shifted the attention of a user by revealing behavioural patterns of writing, reading and understanding. The project literally expanded the space for interpretation by unveiling a plurality of formats and facilitating alternative forms of communication, so that different thoughts and experiences might be envisioned that would otherwise be ignored due to reasons of efficiency, protocol compliancy and compatibility. Thus, the reformatted paper formats were a form of *formal nonconformity* provoking critical awareness by unfolding the complexity of a circumstance.

The project *Unstationery* subverted the controlled channels of communication and explanatory authority by injecting irregular and controversial qualities in a process of understanding and decision-making. These qualities may have not appeared as opportune, convenient or rewarding as *Unstationery* obliged a user to invest more time, effort and consideration in the handling of paperwork. This thoughtful retardation may have sparked a shift in an overly functional problem-solving attitude provoking alternative responses that remained so far unthought-of.

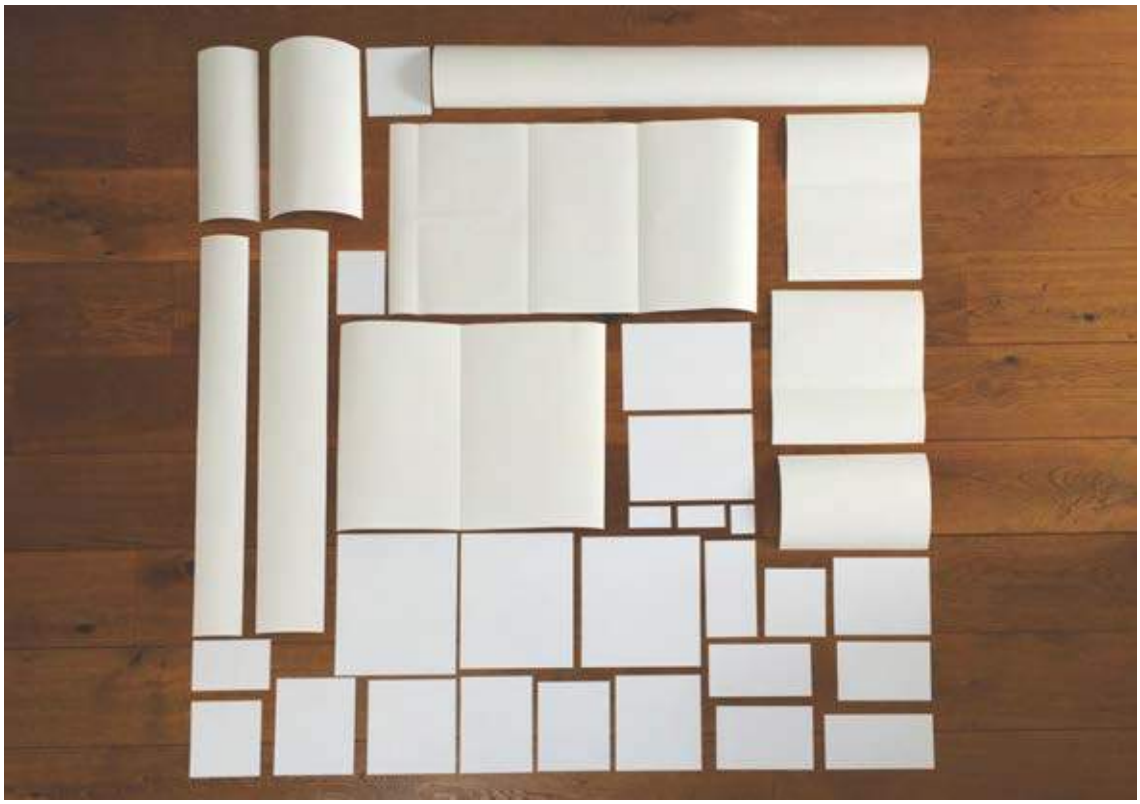

Fig. 52 Bettina Bruder, *Unstationery*, paper formats laid-out on the floor, 2014.

Deploying the *Elastic Standard Metre* and *Unstationery* is a form of *inventive problem-making* as described by Mike Michael.[164] The erratic formats of *Unstationery* function as innovative problem shapers as they problematise and *reframe* practices of policy-making, communication and knowledge production. In reference to design, Michael drafts such speculative practice 'as a form of "de-signing", in the sense of loosening, or "ambiguating", the significations that contribute to the eventuation of objects'.[165] Rather than targeting a specific issue or a distinguishable cause of a problem, the irregular paper formats complicated and altered a problem. Using *Unstationery* shifted my attention from the description of a problem on paper to the process of *how* a problem is framed and communicated.

This deviant practice revealed the immanent bias in conventional processes of problem-solving targeting habitual approaches due to technical convenience and operational blindness. Ultimately, it is a question about fairness and rationality—the question for which such standardised approaches are viable, which in turn benefit from the infrastructural advantages of consistent formats and if these benefits are vital for our common world foregrounding

[164] Michael, 'De-Signing the Object of Sociology,' 171.
[165] Ibid., 178.

relationships between natural resources, mass-production, global trade, science, technology, administration and transportation.

Using *Variable Format*

The experimental book project *Variable Format* (2012) designed by Pierre Pautler from the design agency Abäke in London was a comparable project playing with paper formats (see Fig. 52).[166] The book was commissioned by the independent AND Publishing, which is a publishing service that organizes projects in print-on-demand, a printing process suitable for niche productions. *Variable Format* was a range of sample books, each with identical content but in twelve variable formats. Such multiplicity resulted as each issue was printed through a different print-on-demand service while identical files, texts and imagery were delivered as original material for reproduction.[167] The book project *Variable Format* compared the technical limitations and explored the possibilities of print-on-demand, the expectations of customers with printed matter and the connotations of the various outcomes, materialities and formats. Each book conveyed a different experience and unless a customer did not order all 12 versions, any particular edition in the hands of a reader gave only a limited idea. Co-director Lynn Harris from AND Publishing compared the project with a journey through time and possibilities. In an interview, she emphasized that 'other variations and avenues of creation, rather than a fixed absolute' could be invented allowing a *multiverse* to emerge.[168]

The project revealed how digital input can result in variable interpretations through technical reproduction depending on the production place. Limitations in the publishing industry were disclosed where long-established publication houses prescribed certain formats to maintain their mass-productions limiting expression and channelling communication. Through the parallel presentation of the same content in different formats it was shown how technical and economical restrictions condition the distribution and reception of information and how the scope of experience is limited reducing the range of possibilities for an enhanced and independent understanding that allows for surprise and anticipates uncertainty.

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[166] Abäke. 'VARIABLE FORMAT,' http://abake.fr/amper5and-2/. (accessed 15 March 2016).

[167] The results varied in different qualities of paper, binding, printing, ink and technical reproduction including some surprising, faulty and unintentional outcomes. The prices for the different editions ranged from £15 to £86 depending on quality, design and size. For example, the variations reached from newsprint in black and white with 64 pages to editions with up to 800 pages in colour, with hardback and dust jacket.

[168] Smoosh Studio, 'Variable Format,' *Smoosh Studio*. Interview with Lynn Harris. http://www.smooshstudio.com/variable-format/ (accessed 11 December 2015).

Fig. 53 Abäke, *Variable Format*, 2012, © Abäke. The CC license does not apply to this picture.

Variable Format focused on publishing and print-on-demand services. While it offered a comparative examination across various formats, the project still operated within a conventional framework of commercial design with its focus on templated reproduction and a one-way distribution and communication between the book and its reader. Engaging with the books from *Variable Format* revealed the range of (technical) interpretability through the readymade solutions of print-on-demand displaying the variety of different outcomes. But the project remained in the traditional paradigm of display and representation not encouraging other kinds of communication and intervention that may have disturbed or expanded the established system of publication. In contrast, *Unstationery* suggests a low-budget intervention for everyone as irregular paper formats can be used as a tool to stimulate reflexion and provoke different experiences. The aberrant formats sabotage an unquestioned, format-dependent authority disclosing a prior interest in convenience and efficiency. *Unstationery* may appear irrational and absurd but it exposes this persistent one-sided focus in which humans encounter, explain and act in the world. *Unstationery* fosters unconventional ways for expression and communication by suggesting alternative, thoughtful and creative modes of engagement.

2.3 Infusing Loopholes into the Cartesian Grid – *Disorienting Descartes*

Unstationery discussed blank paper as the material surface for inscription, while graph paper orders the two-dimensional arrangement of visual elements on a sheet. *Disorienting Descartes* is a work using manipulated graph paper, which interferes with the rectangular arrangement of visual information on the ordered space of grid paper. Conventional graph paper organises elements on a sheet in an orthogonal fashion through vertical and horizontal lines. Depending on the reading and writing direction of a language, geometric letters and numbers are aligned from left to right progressively. When writing, one alphabetic character follows the next forming words with interstices between them in compliance with typographic rules. One word follows the next to form sentences; therefore, a page slowly fills up from top to bottom. Text is further structured by lines and paragraphs ordered by grammar and rules of punctuation.

In a similar fashion, the Cartesian coordinate system constructs a mathematical graph as a hierarchical structure with zero at its centre point and positive and negative areas right and left of the y-axis as well as above and below the x-axis.[169] This rectilinear alignment imposes a twofold, ranked order that allows for expedience, precision and clarity. Within a Cartesian grid, single lines or plotted points are assigned distinct locations, which can represent for example, the positions of stars, construction drawings of cars or comparison charts of the gross national product of different nations. Complex compositions can be neatly moved and re-arranged so that the elements can be conveniently surveyed, scaled, controlled and compared without variation.[170] *Disorienting Descartes* interferes with this visual and conceptual order in three approaches. Firstly, I produced notebooks in the style of exercise books of graph paper as they are commonly used in primary school for mathematics. However, these exercise books of the TAU exhibit a peculiarity as the graph paper is subtly altered and the pattern is slanted and twisted so that the lines occur with uneven angles and in wavy curls (Fig. 54). Consequently, some squares have turned into misshapen cavities with frayed margins and curly tails. At first sight the deformations are barely visible and the subtle distortions are detectable only with careful consideration.

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[169] The Cartesian coordinate system is named after René Descartes. However, the development of comparable systems with coordinates is also attributed to Apollonios von Perge, Nikolaus von Oresme, and Pierre de Fermat. See for example: David B. Johnson and Thomas A. Mowry. *Mathematics: A Practical Odyssey* (Belmont, Calif.: Brooks / Cole / Cengage Learning, 2012). Carl B. Boyer and Uta C. Merzbach, *A History of Mathematics* (New York: Wiley, 1991).

[170] Latour, 'Visualisation and Cognition,' 19.

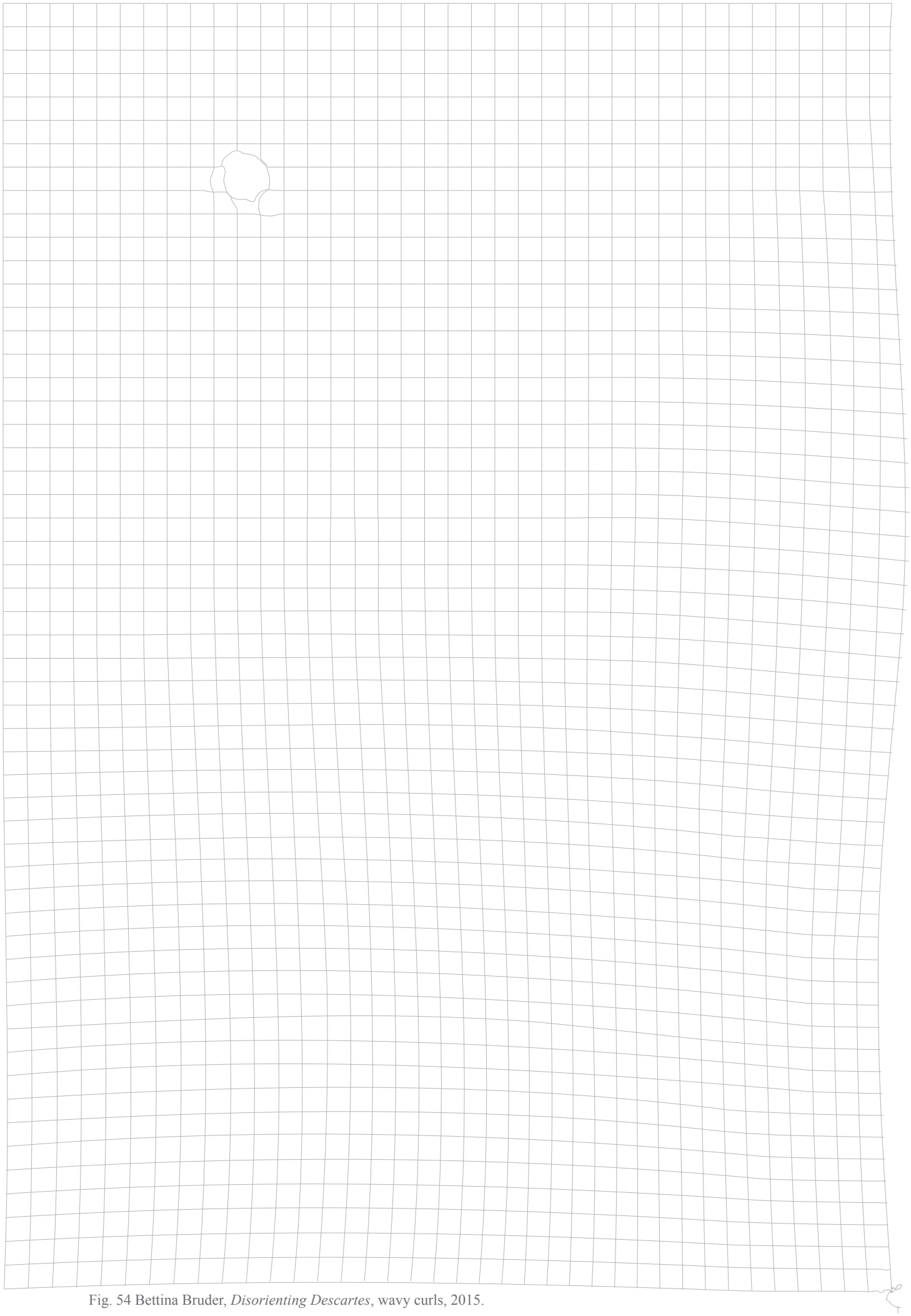

Fig. 54 Bettina Bruder, *Disorienting Descartes*, wavy curls, 2015.

Secondly, I purchased several regular notebooks from supermarkets where I exchanged some of the existing pages with the deformed graph paper. The manipulated notebooks were smuggled back into the shelves of the supermarket (Fig. 55, 56). It was not possible to record any reactions to or outcomes of this experiment. Nevertheless, the inspirational momentum of this intervention may have instigated an imaginary process outside of the traditional ideas when using a regular notebook and a wide range of possible responses could be envisioned on the discovery of these interventions.

Fig. 55, 56 Bettina Bruder, *Disorienting Descartes*, manipulated notebooks, 2016.

The third approach in which *Disorienting Descartes* interferes with the conventional conception of space takes the form of an online-application that allows a user to manipulate the Cartesian grid directly when using the computer mouse as input device.[171] The grid can be deformed in three different modes and the manipulated end result can be saved as a pdf file in order to be printed and deployed as graph paper. Mode one deforms and gently undulates the grid. The pattern responds like a flexible membrane that reacts to the soft touch of the cursor. The results are subtle deformations with wavy lines and mild curls. Mode two of this application creates holes in the grid eliminating the lines as if a bacterial infestation has affected the Cartesian arrangement. Some lines are broken apart and suspended freely in Descartes' ordered space (Fig. 58). Mode three skews and tilts the lines in irregular but parallel angles, as if natural forces like wind or rising water affected the pattern. The grid appears squeezed, washed or blown away (Fig. 59). Every interference with the grid has an impact on the structure in such a way that it bounces and then gradually relaxes over time.

[171] The application is programmed in Processing (an open source programming language) and currently published under http://www.unexplic.it/?page_id=1642. This application is kept as a prototype. Usability and the interface design were not the focus in the application's development.

The intensity of this bouncing effect is adjustable by degrees and the elastic behaviour of the grid can be deactivated by the user.

Using the "disturbed" plotting paper changes the experience of reading, writing and sketching. Writing on normal graph paper requires the coordination of a skilled hand holding a pen and following the lines of the grid pattern, subjugating geometrical shapes, letters or other graphical elements under the regiment of the grid. This regulated control of gesture is a mechanised and engineered undertaking that disciplines the movement of the hand, boxing thoughts and actions into the little squares on the paper. In contrast, using the deformed graph paper of *Disorienting Descartes* alters any habitual or automatic engagement with the sheet. The flow of writing is interrupted when it encounters an obstacle like a loophole or a slump (Fig. 57). Letters, text and graphical elements appear congested in patches while other areas on the paper remain empty. Following the curvy, horizontal lines gently modifies the rhythmic action of writing or drawing and the position of the body might needs to be shifted in order to follow these dynamic waves.

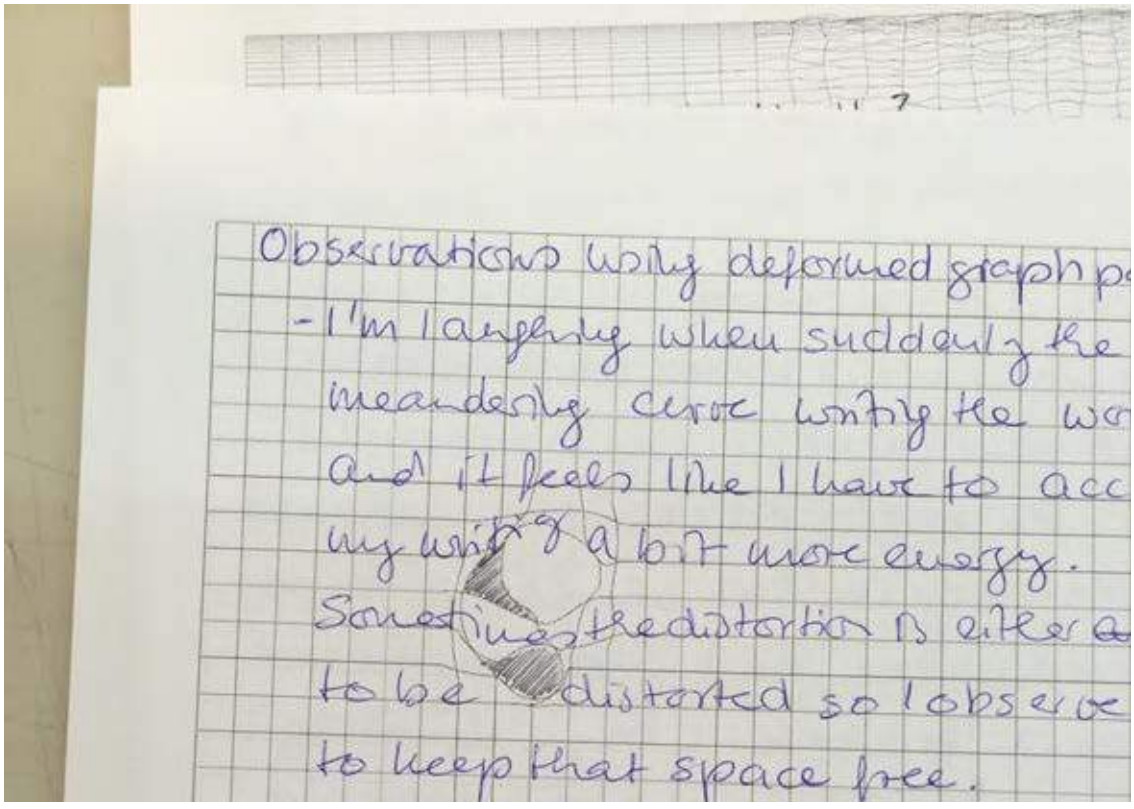

Fig. 57 Engaging with *Disorienting Descartes*, writing sample, 2016.

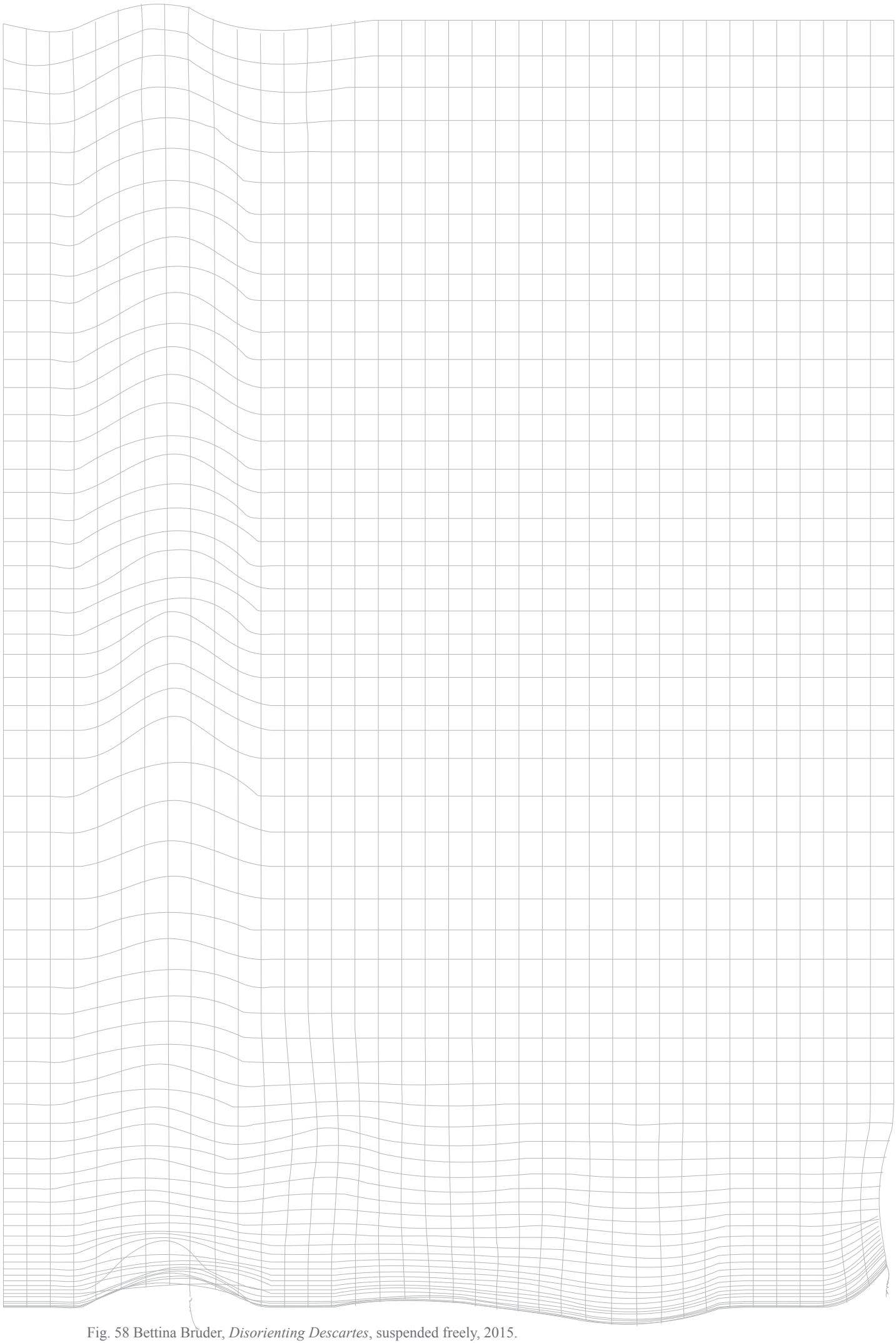

Fig. 58 Bettina Brüder, *Disorienting Descartes*, suspended freely, 2015.

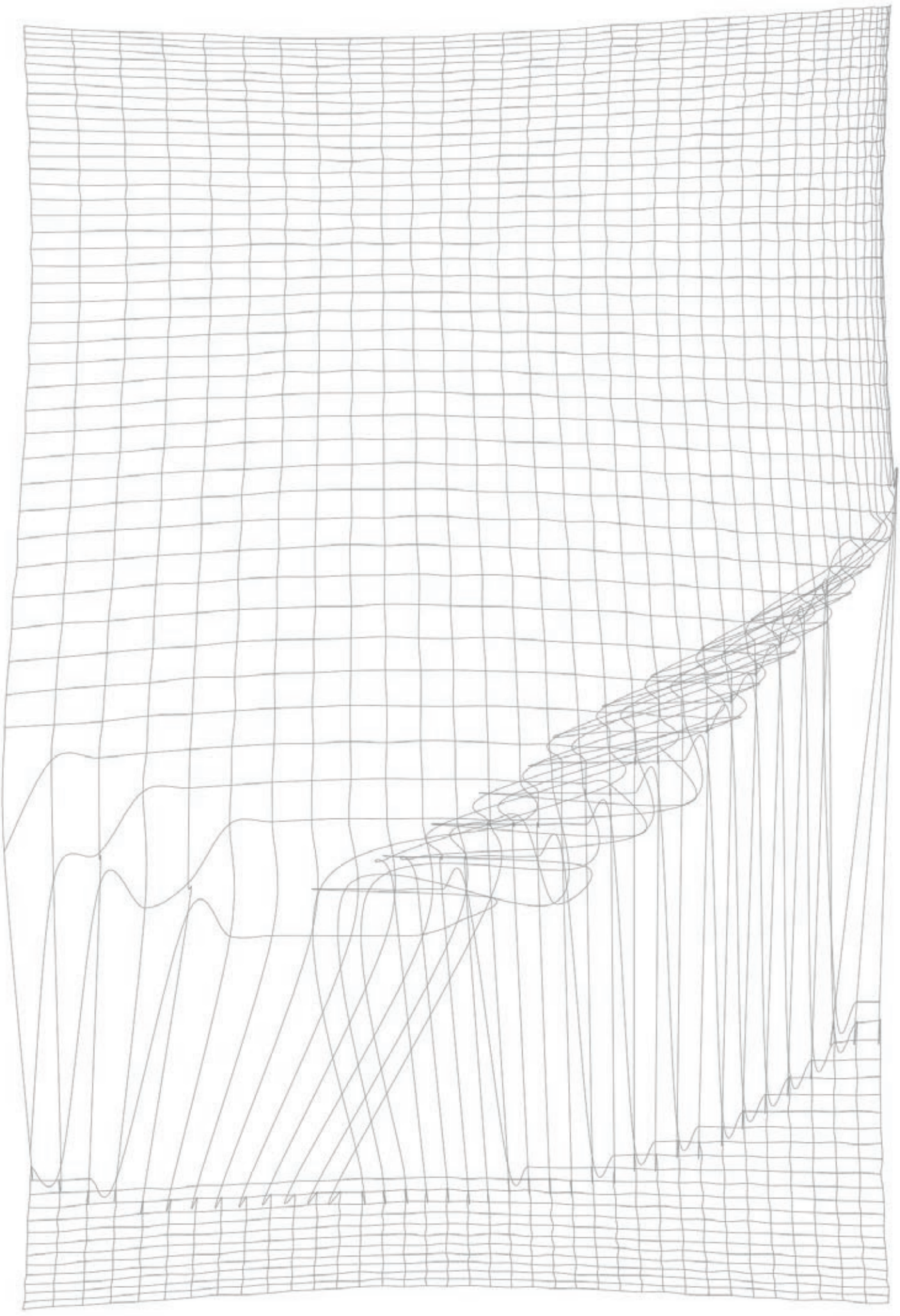

Fig. 59 Bettina Bruder, *Disorienting Descartes*, gone with the wind, 2015.

The De-control of Orientation

Such irregularity may lead to *disorientation*. A term, which indicates a confused mental state. Disorientation can also express a deviation from a clearly set direction or established location as for example a deflection 'from the eastward position'.[172] The title *Disorienting Descartes* expresses this destabilisation of Cartesian epistemology, which is associated with rational control as the establishment of logic, clarity and certainty. This rationale is linked with the desire for a particular kind of knowledge that expects to find mechanistic principles, which can render events predictable and controllable. The Cartesian grid is an expression of these mechanistic approaches in a mathematical context. It allows for the distinct description of any particular relationship within a defined *mathematical* logic offering repeatable solutions either algebraically or geometrically.[173]

The Construction of Situated Knowledges – a Performative Understanding

The Cartesian grid and the lines of graph paper serve as a subsidiary structure that assist the constructability and verifiability of diagrammed elements on paper. By compiling a typology of auxiliary lines, Ulrich Richtmeyer, philosopher with a focus on media technology and culture, assigns instrumental and argumentative qualities to graphic rulers, lines and guides describing them as *visual instruments*.[174] On the one hand, the lines disclose the constructedness of visual representations. On the other hand, the guides assist the visual interpretation, argumentation and legitimation of a representation.

Such technical and intellectual constructability of knowledge promotes the predominance of a particular expertise and authoritative proficiency. It is the hegemony of the visual effects of science that Latour describes as a 'confusion between ontology and visualisation strategies'.[175] Geometry and mathematics offered a logic that allowed the 'rationalisation of sight' and the 'mechanization of the world-picture,' as outlined by Latour in reference to the

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[172] *Oxford English Dictionary Online*, s.v. 'Disorientation, N,' http://www.oed.com/view/Entry/54880 (accessed 9 January 2016). "Orient" is a stem from Latin *oriens,* which means 'the rising sun, the east.' Walter William Skeat, *An Etymological Dictionary of the English Language*. Mineola (N.Y.: Dover Publications, 2005), 415.

[173] On Descartes' innovation of 'analytic geometry', which was the conversion between algebraic operations and geometry, see for example: Carl B. Boyer and Uta C. Merzbach, *A History of Mathematics* (New York: Wiley, 1991) and Luke Mastin, 'Descartes - 17th Century Mathematics - The Story of Mathematics,' http://www.storyofmathematics.com/17th_descartes.html (accessed 11 January 2016).

[174] Richtmeyer, Ulrich. 'Vom visuellen Instrument zum ikonischen Argument: Entwurf einer Typologie der Hilfslinie,' in *Welten schaffen: Zeichnen und Schreiben als Verfahren der Konstruktion*, ed. Jutta Voorhoeve (Zürich: Diaphanes, 2011), 112.

[175] Bruno Latour, *What Is the Style of Matters of Concern?: Two Lectures in Empirical Philosophy*. Spinoza Lectures (Assen: Koninklijke Van Gorcum, 2008), 42.

writings from William Ivins, art historian, and Eduard Jan Dijksterhuis, historian of science.[176] This hierarchical conception of space led to the systematization and segmentation of knowledge as a disciplinary and categorical structure, which could be *represented* and projected onto reality. The sovereignty of representationalism is a side effect of Cartesian epistemology that is criticised by Barad as a culturally conditioned mental disposition.[177] She states:

> The asymmetrical faith we place in our access to representations over things is a historically and culturally contingent belief that is part of Western philosophy's legacy and not a logical necessity; that is, it is simply a Cartesian habit of mind. It takes a healthy scepticism toward Cartesian doubt to be able to begin to see an alternative.[178]

Disorienting Descartes counters this pre-set dualism of reality and representation. The wrinkled lines of the manipulated graph paper propose a *performative understanding* – a term used by Barad to describe an alternative cultural and scientific practice of knowledge production that aims to be more agile and dexterous as conventional approaches.[179] Similarly, Donna Haraway had already criticised technoscientific forms of visualisation as being a constructionist perspective that only provides an approximate or a totalized view of reality. In contrast to a Cartesian rationality, she claimed for *situated knowledges* proposing a multidimensional subjectivity – an alternative vision and a "view from somewhere" that offers a partial, dedicated and positioned rationality.[180]

Both notions of situated knowledges and performative understandings undermine the claims of representationalism, that events, matter or correlations in the world can be discovered, measured and adequately described as separate and controllable entities. In contrast, performative and non-representationalist approaches draw attention to the processual and experiential qualities of knowledge making practices aiming for an immediate, material and first-hand engagement with the world.[181] These concepts of situatedness and performativity

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[176] Ibid., 36-43.
[177] Barad, *Meeting the Universe Halfway,* 28.
[178] Ibid., 49.
[179] Ibid., 49.
[180] Haraway, 'Situated Knowledges,' 590.
[181] Non-representational theory is a concept developed by Nigel Thrift. It aims to attend the momentary qualities of practices and processes and does not focus on representable outcomes. On an overview of performativity and non-representational theory, see for example, Peter Dirksmeier and Ilse Helbrecht, 'Time, Non-Representational Theory and the "Performative Turn" - Towards a New Methodology in Qualitative Social Research'. *Forum Qual. Sozialforschung Forum Qualitative Sozialforschung* 9, no. 2

shift the focus to non-textual and non-visual encounters expanding the production of knowledge by experimental, provisional and participative qualities. The irregular lines of *Disorienting Descartes* integrate and invite these unstable sources of potential error within the practice of inscription and construction. The fabrication of knowledge becomes a sociodynamic undertaking as a formerly ordered space is now opened up for reconfiguration inviting ungovernable participants, irregular qualities and surprising encounters. Hierarchical arrangements are literally undermined so that fixed allocations start to wiggle. Disturbing the regularity of writing and plotting slows down any intended action as every planned operation is subverted, corrupting a straightforward handling and flawless reproduction. Using the graph paper from *Disorienting Descartes* spurs reflection and imaginative interaction. Barad articulates this as a *conjoined material-discursive* practice that accounts for constraints, conditions and methods within a particular situation, revealing its inherent interdependency while offering just a limited and situated efficacy, which does not strive for absolute Cartesian validity.[182]

Expanding the Default Configuration

Using the irregular graph paper for an engineering drawing or a mathematical operation seems irrational as the displayed regular ratios are distorted. Every engagement with the deformed graph paper constricts writing, drawing and drafting. This is an exercise in destabilisation, unsettling a balanced structure to evoke doubts and reflection and provoking alternative interpretations about what is represented (Fig. 60).[183] Thus *Disorienting Descartes* is designed to bring about a performative understanding through its capacity to trouble and intermingle conventions of usage. A user's attention might be drawn to the frayed margins that compete with the marks on the disturbed graph paper so that a clear differentiation between grid and graphics or form and content no longer exists. This may provoke the viewer to examine what does or does not belong to the "representation" instigating the reconsideration of an underlying (visual) order or disorder.

(2008).

[182] Barad, *Meeting the Universe Halfway,* 152.

[183] The presentation of alternative ratios and relations with a grid is for example utilised in logarithmic paper. Mode two of the online application of *Disorienting Descartes* slides and tilts the horizontal and vertical lines producing irregular intervals and implying a logarithmic scale. Logarithmic representations show different mathematical relations and distributions than the linear functions that underlie traditional graph paper. Logarithmic scales in statistical diagrams are used to attend to finer details, nonlinear proportions and exponential data displaying changes over time, which are not detectable on regular graph paper with an arithmetic scale and equal increments. Log paper is used for example, to visualize earthquakes, sound waves or share performances at the stock exchange.

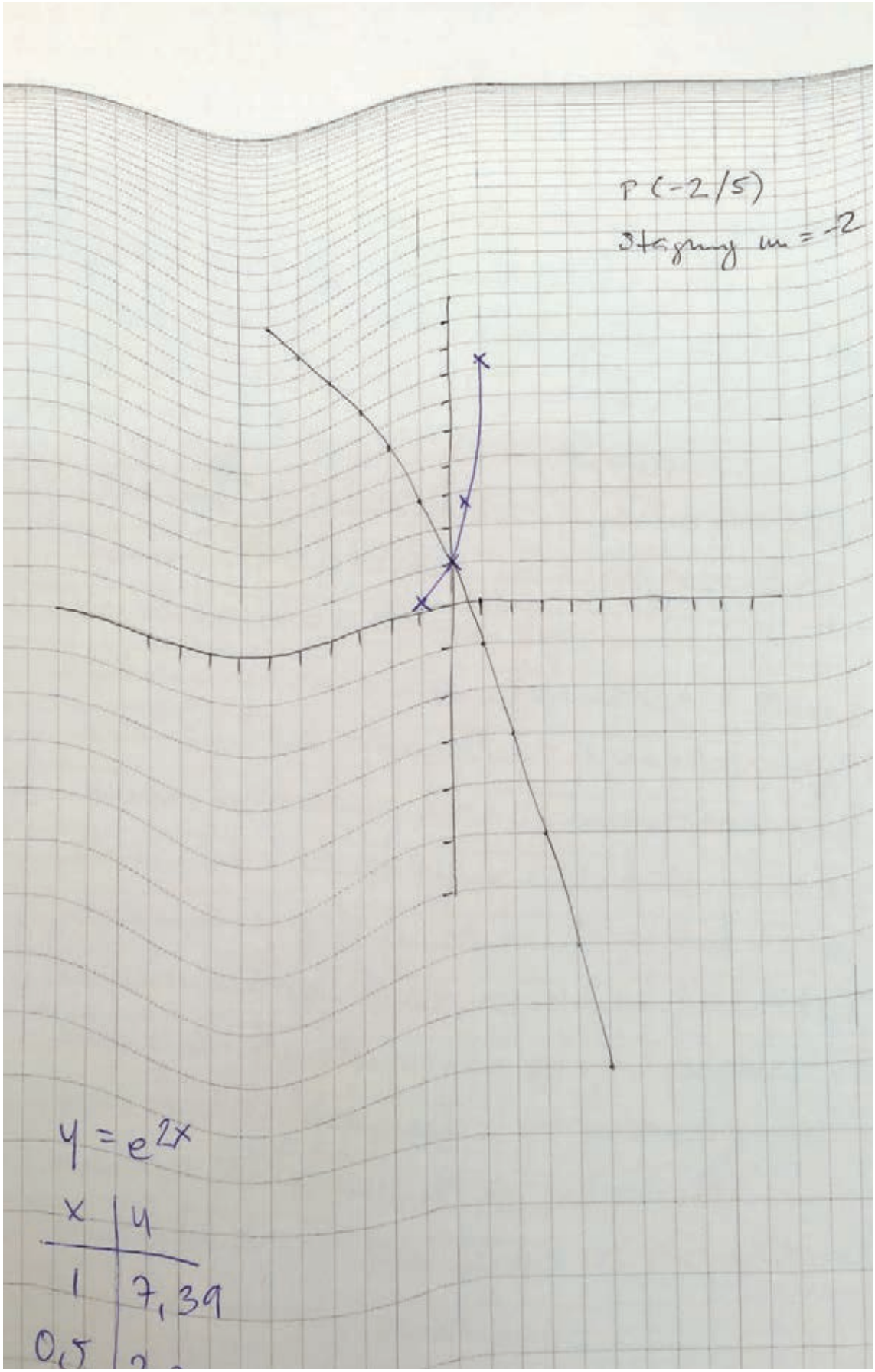

Fig. 60 Bettina Bruder, engaging with *Disorienting Descartes*, maths sample, 2016.

The ambivalent arrangement of information holds an automatic process of reading and interpretation in suspense, decelerating efficiency and the moment of meaning making as any attempt for explanation withdraws its clear representation and straightforward definition. The parafunctional feature of *Disorienting Descartes* is exactly this moment of hesitation and re-examination triggering a playful interruption of the ways in which a problem is usually approached.[184] This derangement may open up alternative constructions of reality, shifting economic and scientific default settings and disturbing visual conventions, which maintain a particular utilisability and an efficient course of action. *Disorienting Descartes* reorients this focus and promotes, through its imperfection, a genuine and thorough engagement with reality as more attention, time and care is required to work with its irregularity.

The curly lines of *Disorienting Descartes* execute agential cuts in the form of permeable demarcations in contrast to the rigidity of Cartesian cuts. Instead of distinct positions and fixed separations, an agential cut enables the situated making of a temporary boundary enacting 'a local causal structure'.[185] The softened boundaries advance a situational and considerate encounter in opposition to habitual interactions, which aim for predictable conditions. The loopholes, curls and waves of the disturbed Cartesian grid are visualisations of intra-actions while they also provoke intra-actions, which are the ungovernable influences and subtle intensities that disturb an ideal scenario. As described earlier in relation to the online-application of *Disorienting Descartes*, I associated these unsettling factors with uncontrollable incidents and non-quantifiable qualities like bacterial infestations, molecular transformations or atmospheric conditions. However, they could likewise be of a subjective nature, depicting intuitive, emotional or unintentional stimuli. Thus the engagement with the disturbed grid addresses a more subtle sensitivity that induces imaginative encounters with different viewpoints and alternative interpretations.

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[184] *Parafunctionality* introduced in Chapter One is a term coined by Dunne and Seago describing the creation of a poetic alienation through a product or a concept in order to inspire contemplation and a different awareness.
[185] Barad, *Meeting the Universe Halfway,* 175.

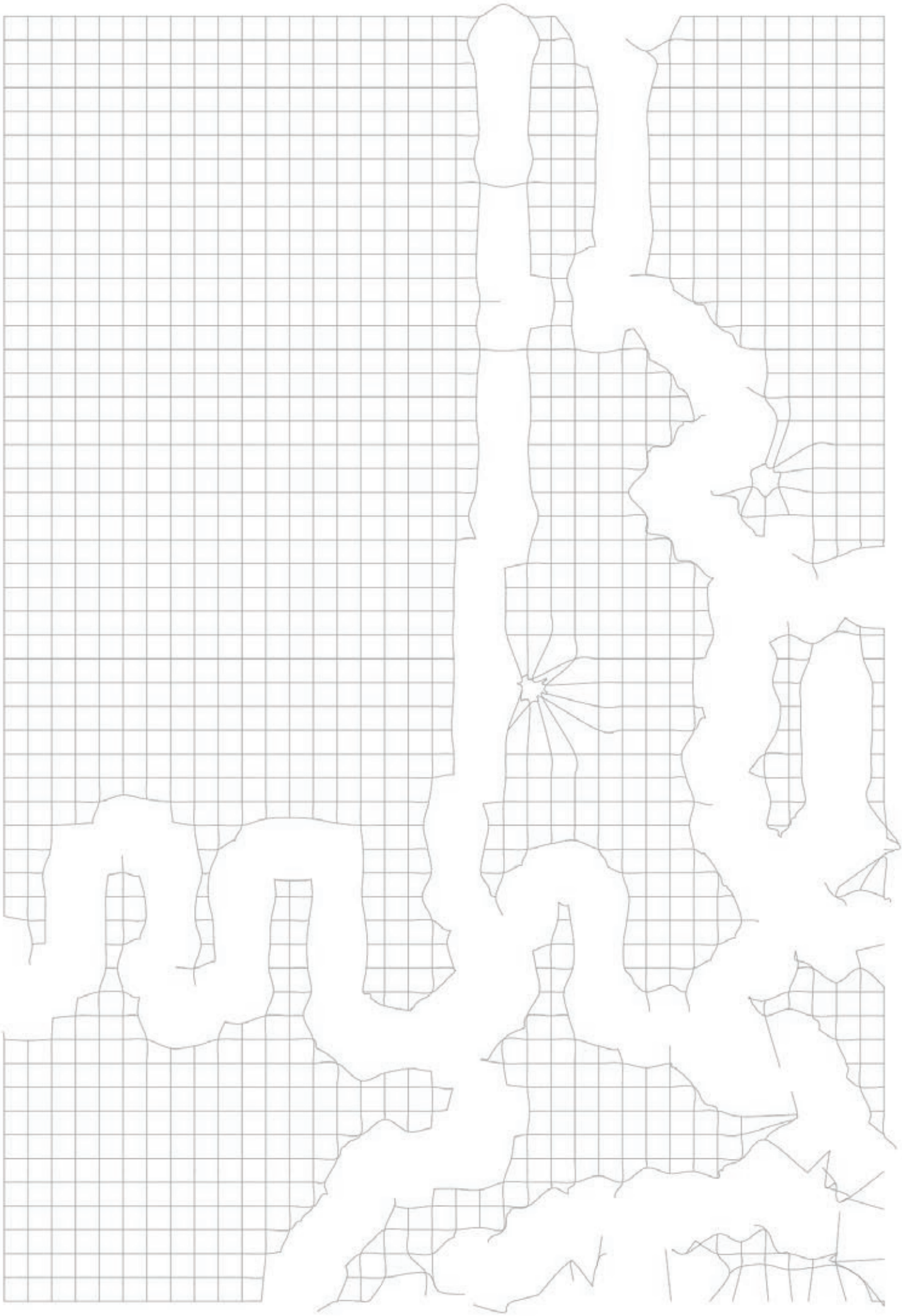

Fig. 61 Bettina Bruder, *Disorienting Descartes*, bacterial infestation, 2015.

Unhinging and Unfolding

Disorienting Descartes attempts to unhinge a perfect world by injecting alternative spaces for thought into a dualistic fallacy, contesting ideas of distinctiveness and definability through its catalysing agency that is exemplified by the performative capacity of the grid. *Disorienting Descartes* is not only about the destabilisation of the constructed space of the Cartesian grid but also about the enabling of an explorative attitude that may allow the discovery of additional correlations and delicate linkages, which are not prescribed or predictable. Rather, the irregular lines provoke surprising, aberrant and whimsical encounters. The permeability and morphologic transformability of the grid shifts a user's focus from a regular conception of space (materially and intellectually) to more nuanced interrelations outside Euclidian order and Cartesian regularity. The wavy auxiliary lines and loopholes are active facilitators of an alternative understanding that may bemuse a familiar operation provoking a change in how things are perceived and experienced. Different questions and conversations arise and adventurous, playful encounters may lead to unforeseen outcomes.

The mutable topology created by *Disorienting Descartes* deviates from the preconfigured structure of fixed relations and thereby softens regular arrangements. The elastified grids give form to a *dynamic and ever-changing topology* – a term that Barad employs to describe the unstable situatedness of measurement in quantum mechanics.[186]

Such *relational ontology* forms the basis of Barad's agential realism.[187] Similarly, Blok and Jensen describe the situational topology of networks and assemblages as *relational ontology* in reference to the project of Latour.[188] These dynamic ideas are deployed to account for the irregular and heterogeneous nature of interrelations in view of the "wicked" and non-linear complexities within knowledge production and everyday life. The shift from quantifiable geometry to relational topology provokes a different kind of literacy and imagination.

Barad explains:

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[186] Barad, *Meeting the Universe Halfway,* 177.

[187] Ibid., 93.

[188] Blok and Jensen. *Bruno Latour:* 49. Outlining networks as a key concept within ANT, Latour states: 'The use of the word comes from Diderot. The word "réseau" was used from the beginning by Diderot to describe matter and bodies in order to avoid the Cartesian divide between matter and spirit. ... [It] is a change of metaphors to describe essences: instead of surfaces one gets filaments (or rhyzomes in Deleuze's parlance …). More precisely it is a change of topology. Instead of thinking in terms of surfaces - two dimension - or spheres - three dimension - one is asked to think in terms of nodes that have as many dimensions as they have connections'. Latour, 'On Actor-Network Theory. A Few Clarifications,' 370.

> Geometry is concerned with shapes and sizes ... whereas topology investigates questions of connectivity and boundaries. Although spatiality is often thought of geometrically, particularly in terms of the characteristics of enclosures (like size and shape), this is only one way of thinking about space.[189]

Topology provokes a deviation in narratives and conceptions proposing different explanations and ideas.[190] In *Disorienting Descartes,* the rigid Cartesian grid turns into a responsive topological layer evoking different forms of engagement than the mechanised operations with which preconfigured gaps are usually completed following a Cartesian logic. A user is now challenged to "read between the lines" and to "fill in the blanks" unassistedly in order to analyse the context-dependent information more substantially.

This situated and flexible autonomy expands conceptional spaces, so that contradictions and indeterminacy as well as difference and continuity can be considered together. Thus, set agendas are opened out in order to facilitate versatile approaches inviting uncontrollable and surprising constituents in the construction of realities. Mechanistic operations and utilitarian conceptions are diverted giving rise to agile and unscheduled encounters.

Artistic Anti-Instructions

The regularity of grids and the monotony imposed by rigid conventions were also the starting point for the work of artists and designers who explored controversial issues in society, such as intellectual control, authority, individuality or proprietary rights. These boundaries were tested through processes that comprised seriality and iteration injecting irregularity and provoking variation.

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[189] Barad, *Meeting the Universe Halfway*, 436.

[190] Topology contributes next to its original fields of mathematics and physics as a methodological and conceptual tool in social sciences, architecture, art and creative practices. Through topology non-metric relationships, intensities, morphologies and transformations can be thought and described differently by focusing on continuity and contextuality instead of spatial information in a three-dimensionally fixed Euclidian space. The Oxford English Dictionary lists amongst other entries for the term topology: 'The branch of mathematics concerned with those properties of figures and surfaces which are independent of size and shape and are unchanged by any deformation that is continuous, neither creating new points nor fusing existing ones; hence, with those of abstract spaces that are invariant under homœomorphic transformations.' *Oxford Online Dictionary Online*, s.v. 'Topology, N,' http://www.oed.com/view/Entry/203426 (accessed 27 November 2015). Topological concepts are for instance manifolds, non-Euclidian and Riemannian space, wormholes, strings, the non-orientable surface of the Möbius strip or ideas of the doughnut-shaped and *pretzel-shaped universe*. On the possible shapes of the universe see for example: Starkman, Glenn D., and Dominik J. Schwarz, 'Is the Universe Out of Tune? - Observations of the 'Music' of the Cosmos Mysteriously Differ from Theory. Either the Measurements Are Wrong or the Universe Is Stranger than We Thought.' Scientific American 293, no. 2 (August 2005): 48–55. doi:10.1038/scientificamerican0805-48.

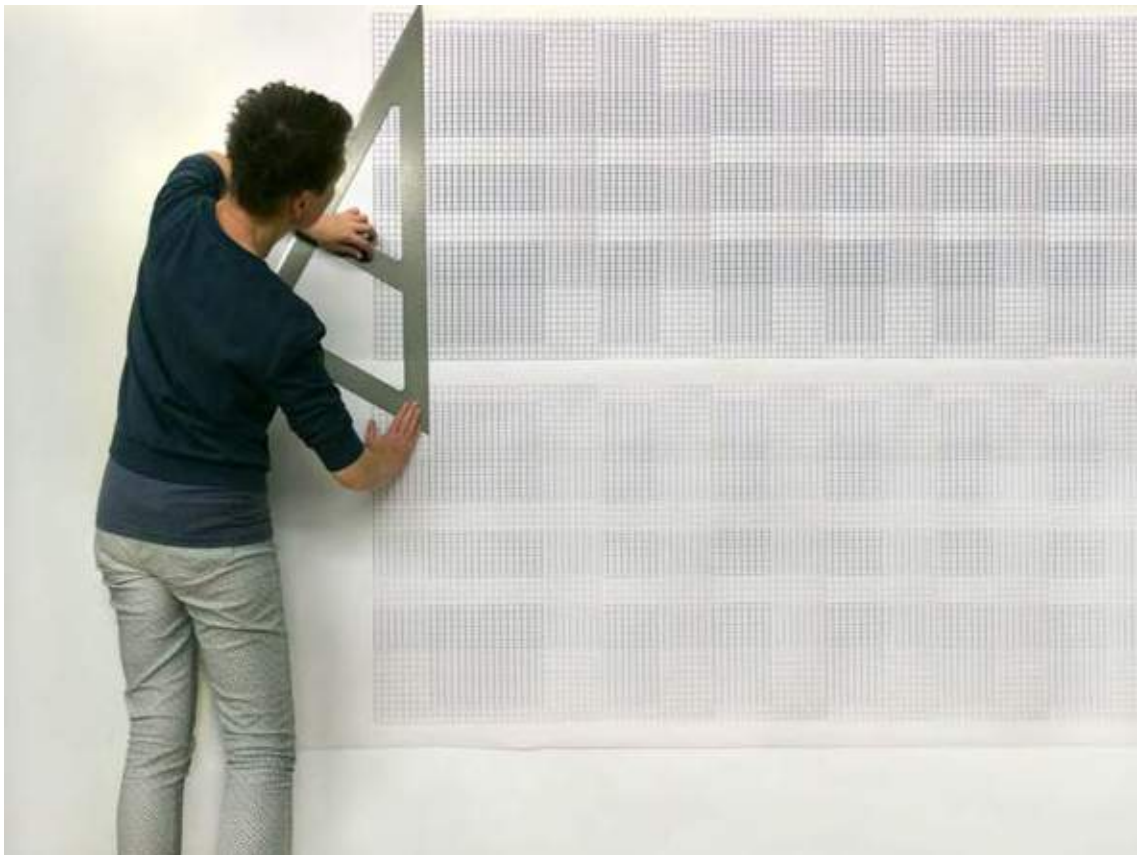

Fig. 62 Bettina Bruder, own exploration, pencil drawing to demonstrate the idea of wall drawings, 2016.

For example, Sol Lewitt systematically examined grids in the form of wall drawings to explore how alternative spaces could be generated (see my example in Fig. 62). The artist borrowed operating principles from industrial mass-production and reapplied this systematic workflow in an art context. His paradoxical systems playfully imposed a scheme of liberating irrationality undermining notions of efficiency, logic and conformity, which are prevalent in an economical, military or governmental perspective. That way, the artist indented to change political concepts that aim to regulate questions about the authorship, originality and ownership of an artwork.

To do this, Lewitt removed any authoritative voice and subjective decision-making from the production process of his art: Lewitt withdrew himself as the controlling artist by specifying precise instructions of how his art had to be reproduced by commissioned draftsmen who installed the work on a given site at a particular institution. Such approach opened up space for idiosyncratic interpretations. The open-endedness of each installation was achieved through the absurdity of exhaustive and detailed directives, which still left room within the execution so that each instalment resulted in a slightly different outcome. Consequently, identical reproducibility was never achieved through the unpredictable nature of each individual location and the variable interpretations of the installers. Thus uselessness and

serial ineffectivity represented *systemic anti-systems* as described by art historian Mette Gieskes.[191] Lewitt turned the rigid system of the grid upside down—instead of calculable and reproducible outcomes, he generated unpredictable differences.

The French artist Yann Serandour exploited the potential of grids and graph paper in a different way. In cooperation with the stationer Clairefontaine, Serandour produced a series of school notebooks titled *Cahier Clairefontaine* (2006) based on the hand-drawn graph patterns of children in primary schools. As part of Serandour's art practice, the pupils were asked to trace the lines of graph paper that are provided in notebooks in order to learn how to write and to do mathematical calculations. Their hand-drawn, instructional patterns were not evenly perfect in contrast to industrially produced graph paper. But this was exactly the reason for Serandour to use these irregular grids as templates for the industrial reproduction of 1500 notebooks in offset printing (Fig. 63, 64).[192]

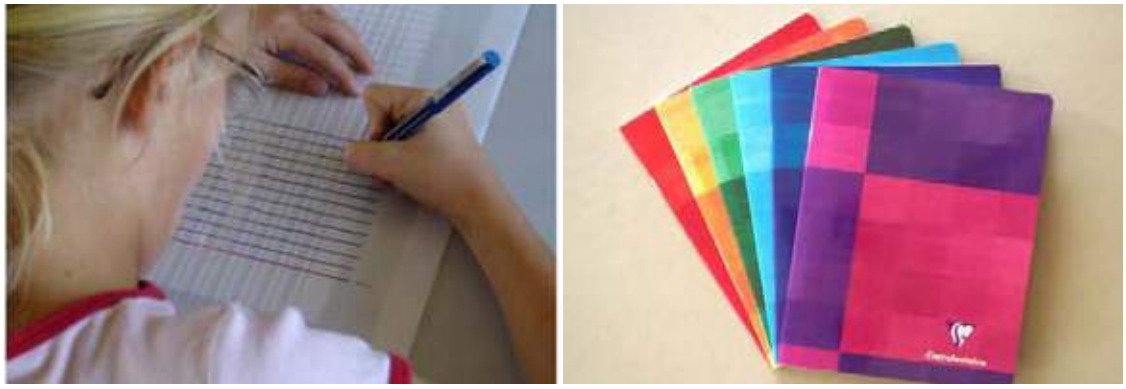

Fig. 63, 64 Yann Serandour, *Cahier Clairefontaine*, 2006, © Yann Serandour.
The CC license does not apply to this picture.

On the one hand, these students still learned the skill of tracing lines, which they did imperfectly because of their age. But instead of acquiring the knowledge of how to write letters, they reproduced the *guidelines* that prescribed the shapes of these letters. On the other hand, these inexact lines served as the template for the industrial reproduction of exercise books, which would then be used by other pupils. Obviously, such notebooks with irregular graph paper would generate idiosyncratic and erratic outcomes. However, to encourage young students to use these imperfect grids as guidelines has also educational implications.

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[191] Mette Gieskes, 'The Politics of System in the Art of Carl Andre, Sol LeWitt, and Vito Acconci, 1959-1975.' (University of Texas, 2006), 195.
https://www.lib.utexas.edu/etd/d/2006/gieskesm47606/gieskesm47606.pdf (accessed 30 December 2015).
[192] The notebooks were published by the contemporary art museum CNEAI in Chatou, France.

It could mean continued confusion but also increased imagination in the development of literacy. *Cahier Clairefontaine* was an exercise in originality and the acceptance of imperfection as expressive diversity was given a wider space to emerge. Filling in gaps sketched-out by an adult might have invigorated a sense of co-writing and co-production beyond a mechanistic discipline and mindless imitation fostering a sense of togetherness, immediacy and tolerance for diversity. With his work, Serandour reversed the idea of instruction by proposing new forms to learn reading and writing – a way that would allow for jagged, imperfect and sketchy letters.

Subversive Representations in *cahiers d'école*

At first sight, the socio-political relevance of such projects that subvert graphic representation might appear insignificant and ineffective. However, the power of representation—scientific, conceptual and political—and the intricate relations between diagrams and political suppression is rendered more acute in the context of the dictatorship in Argentina (1976-1983). During the totalitarian regime of Jorge Rafael Videla, particular areas of modern mathematics were censored and excluded from school curricula due to their subversive and rebellious potential. In an article from 1980, Mauricio Schoijet, social scientist, reported on this issue and described the situation as a form of ideological prosecution and intellectual suppression. He quotes a passage from the weekly magazine *Extra*:

> Modern mathematics introduces procedures different from those taught by Aristotle ... this makes doubts arise on this [Aristotelian] logic and promotes lack of confidence in our guiding and traditional figures, therefore encourages and gives comfort to subversion. ... Some themes of mathematics use words such as vector and matrix, which are typical of a Marxist or typically subversive vocabulary. The same happens with set theory [*teoria de conjuntos, conjunto* also means ensemble in Spanish] which evidently tends to *massify* [*masificar* in Spanish] and to evoke multitudes.[193]

[193] An additional section of Schoijet's report explicates the irrationality of the argumentation of the Videla regime. Schoijet states: 'One most important reason [for the ban of 'modern mathematics'] was apparently the presumed subversive nature of a statement attributed to the French mathematician Dieudonné – "down with Euclid" – that Dieudonné was to have shouted at a meeting held at Royaumont in 1959. [The weekly magazine] *Confirmado* wrote that "the thesis of the Córdoba authorities is that with this statement mathematics could lose its well known ideological neutrality and value-free character and become a weapon at the service of insurrection." It also mentioned that someone wrote "down with Parmenides, Heraclitus comes back" on a wall of the University of Paris in May 1968 and asked whether Heraclitus should be banned.' Mauricio Schoijet, 'Who's Afraid of a Vector?' *Bulletin of the Atomic Scientist* 36, no. 6 (June 1980): 61.

Amalia Pica, a contemporary artist from Argentina addresses this controversy in her work where she juxtaposes diagrammatic thought and logical relations with the irrational laws imposed by the tyrannous state. Her work *Venn Diagrams (under the Spotlight)* (2011) is an interactive light installation representing a logical set (see my interpretation, Fig. 65).

Venn diagrams are used in set theory to explain mathematical relations with overlapping areas, which illustrate the intersecting set of at least two parties. Pica's work shows two differently coloured light circles that overlap in the area in-between generating an additive colour as a new zone suggesting the combinability of two disparate views. Under the oppressive political system governing Argentina, the idea of mingling aspects or different viewpoints was considered rebellious, as any representation of a mixed set might have suggested an illegal conspiracy of irregular and subversive forms of a group collective. Such diagrams were considered to foster revolutionary thought and divisionary forces that could threaten the political and social system of the nation.[194] Pica's work on the Venn diagram demonstrates the material-semiotic scope and significance of simplified graphs and representations with effects in the real world revealing the intertwining of matter and meaning. The suggestive, metaphorical language of scientific diagrams is contrasted with notions of control and oppression emphasizing the political dimensions of scientific knowledge.

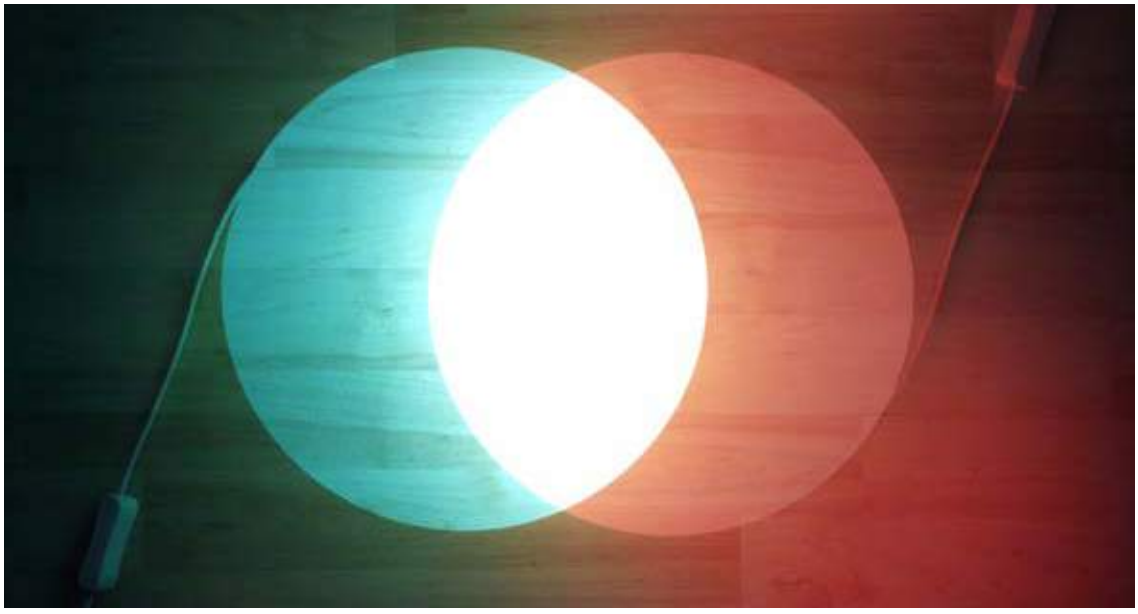


Fig. 65 Bettina Bruder, photographic sketch (2016) to illustrate the idea of a Venn diagram generated by light. The CC license does not apply to this picture.

[194] E-Flux. 'Amalia Pica | E-Flux,' http://www.e-flux.com/announcements/amalia-pica-3/ (accessed 17 March 2016).

Lewitt and Serandour both preserved the visual linearity but allowed for the variability of the rigidity of the grid while Pica expanded the diagrammatic representation through the deployment of light. While these artists remained in the area of conventional representations reproducing existing structures and diagrams, *Disorienting Descartes* aimed to transform and subvert such hierarchical arrangements dynamically by providing opportunities to develop and apply idiosyncratic structural arrangements as pedagogical inspirations within an educational, constructional and organisational context, which may lead to different outcomes.

The mutable grids of *Disorienting Descartes* showed both, the regular grid as well as patches of imperfection. This tension was employed productively to provoke doubt and curiosity and thus to demonstrate a possible flexibility of traditional conceptions and habitual models of thought. *Disorienting Descartes* challenges assumed authorities as well as formations organising production, distribution and instruction. As it is possible to individually interfere with the grid, the pattern is not imposed on a user by some unknown authority. For example, I observed how one user explored the possibilities of the online application of *Disorienting Descartes* playing with the parasite mode (Fig. 66) and taking great pleasure in destroying the grid. First, she drew symbols and shapes and used the openings within the grid to express different meanings. When she realised that it was possible to delete the grid completely, she saved the blank page as her final graph paper as an act of liberated self-determination and independence.

Disorienting Descartes interfered with infrastructural patterns within representation, production, distribution and education. The rigidity of Cartesian patterns of thought and arrangement was perforated and made available for inappropriate handling. Hence, *Disorienting Descartes* rearranged the social practice of learning, writing and understanding to cultivate an increased sensitivity towards alternative realities.[195]

[195] The online application is still at the prototype stage. By relating the different modes for manipulation to natural phenomena like bacteria, wind or flooding, I attempted to elucidate uncontrollable elements that may cooperate or interfere in the construction of realities. An extended convolution might be achieved by connecting the application to an external data service, for instance, www.xively.com. Examples for such art works associated with extended forms of data visualisation and located at the intersection of art, science, ecology and engineering are projects from Natalie Jeremijenko or Tega Brain. Even though the underlying digital technology is based on binary code, these multiplied possibilities for data visualisation may expand the complexity of intra-actions and co-productions broadening the scope how different realities could be understood.

Fig. 66 Bettina Bruder, *Disorienting Descartes*, deleted by a user, 2015

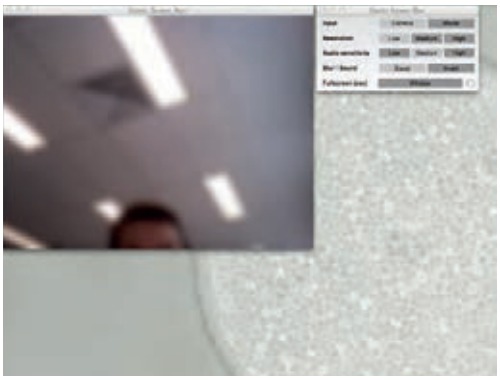
Open-end(ed)

In this chapter I have argued that elasticity can be introduced as a material and conceptual component in order to emphasise the modifying capabilities of measuring devices, industrial standards and instructional arrangements. The flexible reconfigurations and enhanced functionalities allowed to break open dissecting and analysing approaches, which usually aim for economical efficiency and scientific objectivity. By doing so, I criticized the operational blindness that economic and scientific practice may impose on us, thus limiting our potential to engage more inclusively and thoroughly with the world. By disrupting and twisting these knowledge making practices it was possible to uncover points of possible intervention. Alternative encounters with contingent, unpredictable and volatile qualities may be fostered to instigate a change in conventional means of engagement. Through gentle subversion and minimally invasive interventions these experiments were designed to instigate a reconfiguration of patterns of thought translating unconventional ideas into objects and instigating a change in behaviours and actions. The experiments aimed to demonstrate how cultivating a broader sensitivity might induce a shift in values, mindsets and practices. This use of elasticity may spark ethical insights and cultivate different social values. This flexible disposition might exist in current epistemological toolsets, but as I argue in this chapter, this has not yet been fully revealed and applied.

In the following chapter I continue this exploration of the link between bodily experience and intellectual engagement driven by the relationship between matter and meaning that is influenced by technologies of inscription and visual representation through displays of digital devices. I look into possibilities for the tactical *détournement* or rescription and the diffraction of such conditioned ways of bodily engagement in order to change respective attitudes and behaviours through reconfigured screen-based inscription devices.

CHAPTER THREE

Rescripting Readymade Experiences



CH 3.1

Fig. 6 B. Bruder, *Elastic Screen,* 2016

CH 3.2

Fig. 8 B. Bruder, *Ortho,* 2015

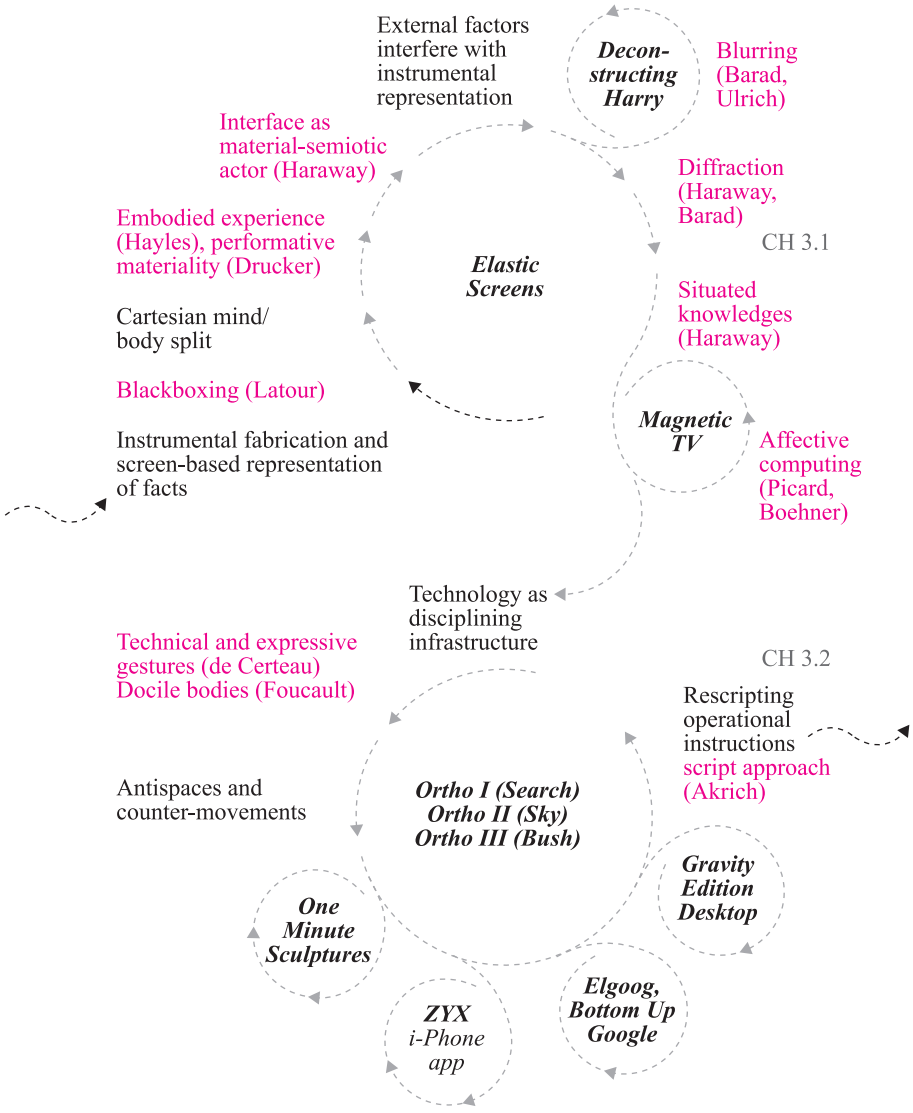


Fig. 67 Diagram with the leading concepts, explorations and projects for each experiment.

Introduction

This chapter examines the interplay between the ubiquity and permanence of instructional information on screen-based devices on the one hand and a user's interpretation of this data on the other. I argue that a more flexible presentation of visual information may influence how a user perceives and experiences reality, thereby altering a user's attitude and understanding to disrupt predominant expectations of usability and consistency of screen-based visualisations. The conditioned relationship between a user and screen-based information is explored on the basis of two experimental projects that run on digital devices. *Elastic Screen* is a MaxMSP-application for desktop computers and laptops.
Ortho can be experienced via smartphones. Both projects are formal interventions using bodily experiences of viewing and handling screen-based devices as their platform. In both works, technical parameters, such as image stability, width to height ratio and framing were manipulated resulting in an "elastic" image rendition.

I have chosen screen-based appliances for these experiments, as they are inscription devices representing (scientific) facts and visual data. The devices administer knowledge and guide a user's engagement with a technical system operating in certain machinic logic.
Thus, interfaces preconfigure information so that a user can make sense of it and interact with it in the most efficient way. In contrast, *Elastic Screen* and *Ortho* challenge this "efficient" visualisation of data by interfering with the parameters how information is technically mediated disorganising conventional modes of visual representations.

The display of *Elastic Screen* reacts to environmental noise deforming and blurring the information presented. With *Ortho,* data and images are only detectable in particular gestures of the user and positions of the phone. In both projects, the usual functionality of a screen as a flawless and inert surface for the representation of imagery is overturned and expanded in such a way that this parafunctionality may shift the attitude of a user (mentally and physically) by provoking new viewing patterns and different forms of engagement.
The displays give physical forces (gravity), or non-quantifiable aspects (feelings) a platform to unfold so that the screen itself becomes an agent for transformation: together with theoretical ideas such as *diffraction* (Barad), *situated knowledges* (Haraway) and *docile bodies* (Foucault), Madeleine Akrich's *script theory* is useful here, as it allows to map out the

inherent functions of screen-based devices offering ways to inscribe new encounters.[196]

3.1 *Elastic Screen* – Inscribing Uncertainty

Elastic Screen is an onscreen application that was designed as an overlay and potential extension for conventional processing software and operation systems such as Microsoft Word, Apple Pages or Mac OS.[197] The application serves merely as a prototype and conceptual model to experiment with certain assumptions that are at work when interacting with screen-based inscription devices. I argue that a certain kind of ignorance pervades our interaction with these interfaces, which are rendered partly "invisible" and remain unrecognised because of their ubiquity and invariance. This illiteracy is exploited within the elastifying screen-based experiments as the content on the screen is activated and mobilised. *Elastic Screen* works metaphorically with the terms *core area, focus, dimension, ratio* and *scale* as they imply physical and visual properties as well as indicating abstract ideas. For example, the focus (of the camera) may refer to a technical operation, (also in an abstract sense) and the centrality particular to a subject matter; the term dimension can be used to describe the physical proportions of a screen as well as the aspects of a context.
The awareness of this contextual ambiguity is activated through flexible visualisations in order to foster visual and digital literacy.

Industry standards determine aspect ratios, screen formats and resolutions of digital media. The aspect ratio of standard TVs, computer displays and projections is pre-set and ranges from 4:3 to 16:10 (with some rare exceptions). Such standardisation of technical formats facilitates the reproducibility and transmissibility of digital content, data and imagery. *Elastic Screen* tampers with these standard views and technical specifications to shift attention from the perfectionism of displayed visual information to its artificial constructedness and short-term nature. By doing so, I explore ways to change practices of viewing, writing, reading and meaning making within this experiment.

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[196] Madeleine Akrich, 'The De-Scription of Technical Objects', *Shaping Technology / Building Society*, eds. Wiebe E. Bijker and John Law (Cambridge: MIT Press, 1992).
[197] The application is available on the USB-stick as part of the *Tools for Alternative Understandings* and it can be downloaded on www.unexplic.it in the TAU section. The program is at prototype stage. A technical preparation to such an extent that *Elastic Screen* could function as an extension for an operating system or a processing software would have been beyond the scope of this project.

Rocking the Black Box

Elastic Screen displays visual data in constant motion being blurred, warped or squeezed switching between irregular aspect ratios. Such flexibility exposes the technical contingency of visualisations unsettling their apparent stability. The mutability in the visual representation is triggered by noise, for example, incidental remarks like the groaning or the strained respiration of a user, keyboard typing sound or environmental noise.[198]

These acoustic interferences have an impact on the size, shape, resolution or focus of depicted content. The project employs plasticity of the digital image to challenge the assumption of a user expecting a stable representation of visual information on displays.

Elastic Screen breaks with the conventions of presentation in digital media capitalizing on McLuhan's statement 'we shape our tools and thereafter our tools shape us'.[199]

This conditioning through technology and media informs the present experiment where the key factor is the relationship between formal and technical specifications of media, machine technology and automatic control on one side and a user's behaviour, subjectivity and associative abilities on the other. Relationship implies conceptual constraints as a *particular* reality is *technologically* enabled, shaped and constructed through usage.[200]

Facts, scientific data and measurement results are only accessible via inscriptions and visual representations on interfaces in the form of imagery, diagrams and texts. In a digital context such data is compiled following certain technical conventions and the operational codes of a programming language. Inscription devices present data on screens suggesting constant controllability and availability. It is the mechanisation and rationalisation of factual representation which frame a user's views and which present facts as stable evidence.

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[198] The visual distortions of *Elastic Screen* are triggered by sound while they awaken memories of technical interferences from an earlier electronic age. For example, fog, snow or rain interfered with analogue TV signals generating noise, streaks and dropouts. Such interferences offered an immersive connection with the world through atmospheric phenomena situating a viewer in a wider context. The interferences of *Elastic Screen* undermine the prevalent ubiquity of current technologically perfected visualisations aiming to show traces of unpredictable events. Digital glitches on screen-based inscription devices today are merely faulty settings of the screen resolution or the operating system displaying a textbox that reports a technical error code.

[199] The quote is attributed to Marshall McLuhan in Marshall McLuhan, *Understanding Media: The Extensions of Man* (Cambridge: MIT Press, 1994), xxi. Other sources cite Father John Culkin, a Professor of Communication at Fordham University in New York and friend of McLuhan as author of this quote.

[200] Scholars who address the topic of technological conditioning are for example, Katherine N. Hayles, 'Unfinished Work: From Cyborg to Cognisphere,' *Theory, Culture & Society* 23, no. 7–8 (2006). Edward R. Tufte, *The Cognitive Style of Powerpoint* (Cheshire, Conn.: Graphics Press, 2003). Sherry Turkle, 'How Computers Change the Way We Think,' *The Chronicle of Higher Education*, The Chronicle Review, 50, no. 21 (January 30, 2004).

Such process of stabilisation or *blackboxing* indicates that data and scientific facts presented on screen or paper are unquestioned and widely accepted. The term blackboxing is derived from computing, describing a technical device that can be used without the understanding of its internal technical operations. Technical instruments as well as undisputed facts are considered black boxes. The term is used by Latour to emphasise that complex and disputable arguments were settled and simplified so that certain inputs cause predictable outputs.[201] Blackboxing delineates processes of solidification in the (instrumental) production of knowledge. Standardised information indicates potential blind spots in the understanding of complexity due to its unchallenged acceptance.

Blackboxing produces immutable mobiles, so that for example common concepts of time, measurement or technical formats are generally accepted as undisputable facts.[202]
In contrast, the manipulated screen-based projects of the TAU—*Elastic Screen* and *Ortho*—disrupt established ways of representation and habits of engagement by integrating qualities that are disputable or that appear irrelevant. A user's imaginative space that is literally framed by electronic circuitry and algorithmic logic is "unhinged" and activated provoking a change in thinking and doing when handling displays and devices.

Breathe Softly, Type Gently

When starting *Elastic Screen*, the displayed image on the interface (in full screen) does not sit fixed and immobile on the screen. Instead it shivers slightly as if it lies in wait.
The image reacts with nervous twitches to each acoustic signal that the application detects. Breathing, typing, the noise from the street, the sound of the air-conditioning system or a phone ringing – each sound triggers a response on the display. *Elastic Screen* reacts with three different behaviours upon registering an audio signal: In mode one, the application blurs the visual information (Fig. 72). Mode two distorts the rectangular arrangement of the interface resulting in oscillating warps and irregular shapes (Fig. 71). Mode three distorts and squeezes an image either horizontally or vertically depending on the sound level subverting pre-set aspect ratios of industrial screen formats (Fig. 68-70). All deformations gradually relax and resume to their earlier state when no further audio signal is detected.

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[201] A glossary of concepts within ANT states for blackboxing: 'An expression from the sociology of science that refers to the way scientific and technical work is made invisible by its own success. When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become.' Latour, *Pandora's Hope,* 304.
[202] Ibid., 306-307.

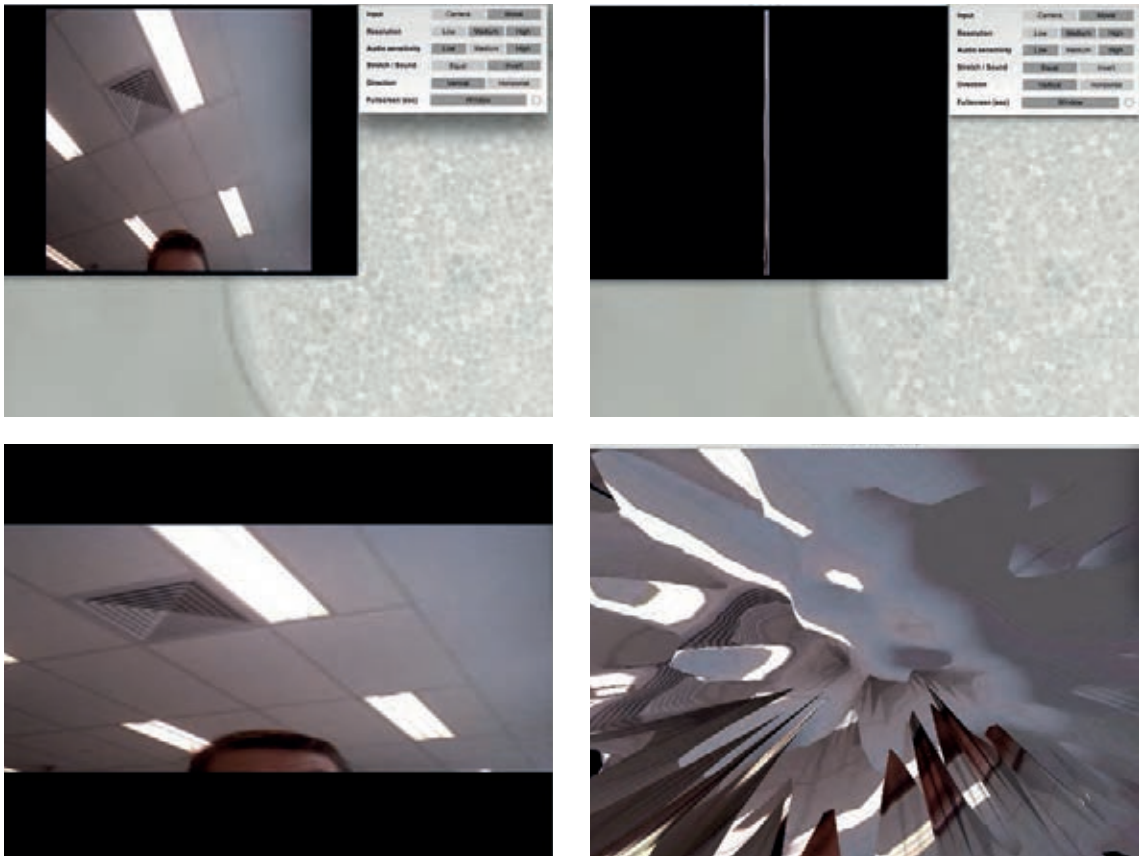

Fig. 68 - 71 Bettina Bruder, *Elastic Screen*, mode two and mode three, 2016.

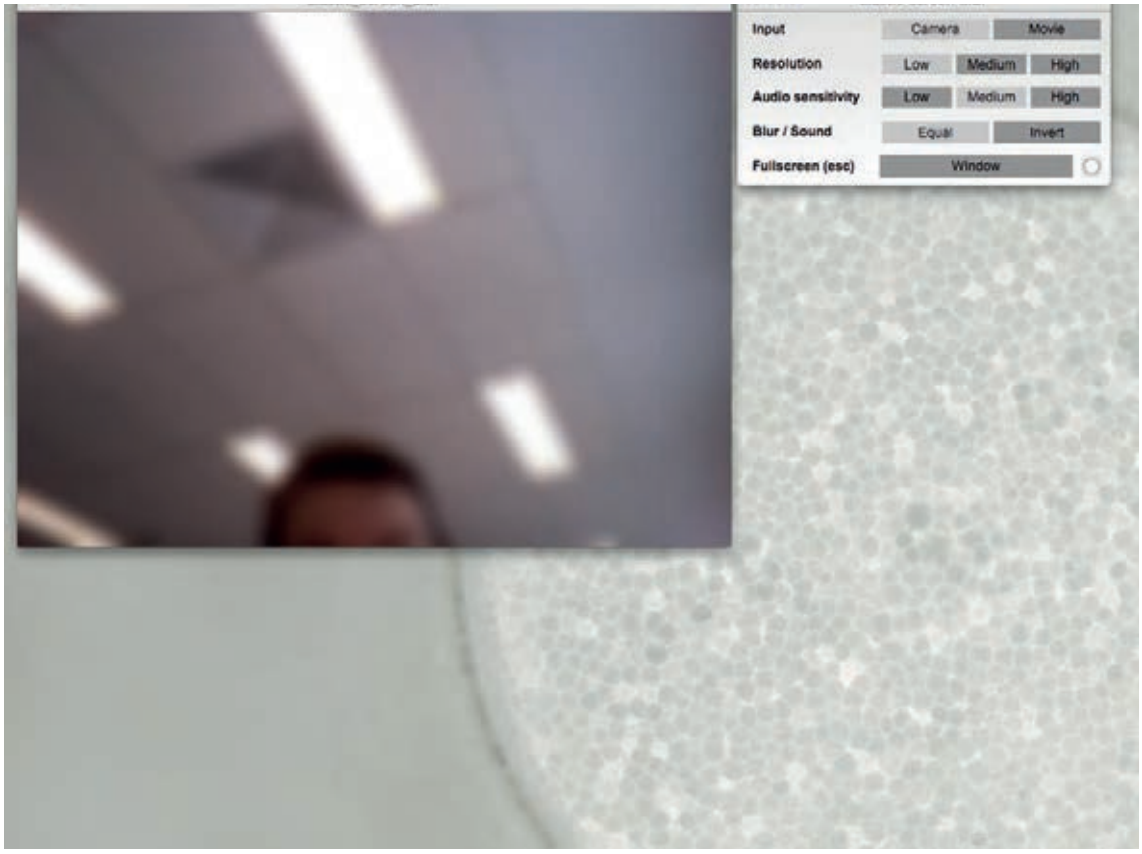

Fig. 72 Bettina Bruder, *Elastic Screen*, mode one, 2016.

Operating the application in the attempt to execute a regular task such as using a word processor or editing software or just simply watching a presentation, interferes with the orderly use of screen-based devices. Every mouse-click, keystroke or breath is registered and influences the reproduction of the image on the display. Such sensitivity of the screen renders a user more attentive as s/he becomes conscious of factors that are usually neglected or dismissed. For example, humming, snorting or swearing while working with the computer obscures and dazes the representation on screen so that figures and letters appear cloudy, faces turn into distorted grimaces or windows start trembling. Normal workflow is interrupted and any operation is only possible when the user breathes softly and delicately attempts to push the buttons.[203]

The Agential Interface

Displays and interfaces render facts and images of a reality within pre-set screen-formats thus stabilising the user's world-view. Hence, a user's attention and gaze is directed, gestures dictated and postures are set. Interacting with a screen-based instrument enrols a user in a particular arrangement where the user's body, behaviour and perception are specifically configured in order to absorb the visual information. Thus, viewers might sit immersed in front of a screen as if they are physically paralysed, hypnotically focusing on the processes on the interface. Screen-based technology isolates and fastens the attention, the action and the physical position of a user. This conditioning is described by Jonathan Crary, scholar in modern art and theory, as an 'operation of non coercive forms of power' which generates 'antinomadic procedures that fix and striate'.[204] The interface itself becomes an actant with agency not only through its enabling and informative capacity, but also through constraining and directing a user's experience. As such, an interface is not a neutral surface that simply depicts immaterial information as a visual representation. On the contrary, the interface implies the apparent separability of matter and meaning.

This separation infiltrates our contemporary worldviews accomplishing once more the Cartesian mind/body split as problematised by Katherine Hayles emphasising the material qualities of (digital) information. She draws attention to the disposition to neglect the material reality of information in communication technologies as 'for information to exist, it must

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[203] The screen behaviour can be inverted as programmed in a recent update. In the reverse mode a user is forced to make noises or to be in a noisy work environment in order to gain an undistorted or unblurred image.

[204] Jonathan Crary, *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, Mass.: MIT Press, 2001), 74-75.

always be instantiated in a medium'.[205] Hayles describes the disembodiment of information being conceptualised as a separate entity criticising the postmodern understanding that considers information only as a discursive and linguistic construction. Instead, data and facts belong to embodied experiences and they cannot be abstracted and simplified as separate entities or pieces of information. Thus, information is always contingent and enfolded within a larger context.

Similarly, Johanna Drucker, visual theorist in digital humanities, draws attention to the screen interface as 'a space of affordances and possibilities' by emphasizing the technical rules, formats and algorithms that constraint and enable particular actions, behaviours and interpretations expressing the material dimensions of an interface. She describes this capacity to influence a user's experience as the *performative materiality* of interfaces arguing, 'that what something is has to be understood in terms of what it does, how it works within machinic, systemic, and cultural domains'.[206] Drucker, like Hayles, considers visual representations on interfaces such as graphics, texts and imagery not only from their functional point of view facilitating a particular technical operation (calculating, watching, text processing etc.), but also in terms of interpretative and performative forms of engagement. From this perspective, meaning making is considered an active and situated construction within and through technical assistance while also cultural contexts and ideological systems of belief, for example, a trust in numbers, facts and data are taken into account.

Elastic Screen aims to break open these prearranged constraints of technology by intervening in the ways how visual representations on screen-based devices are perceived handled. A felt separation between screen, device and user is compensated and rather materialized as a direct and tangible connection in the form of the responsive display. The elastified application interferes with the conventional modes of perceiving an interface by literally bending and blurring the visual representation of data and imagery.

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[205] Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago, Ill.: University of Chicago Press, 1999), 13.

[206] I draw from Drucker's analysis of performative materiality and theoretical approaches to interface in digital humanities. Drucker bases her investigation on Matthew Kirschbaum's concepts of forensic and formal materialities: 'The forensic elements of a document might include ink, paper, stains, fingerprints, other physical traces, while the formal elements would be the organization of the layout, design, or the style of literary composition, relations between image and text and so on.' Johanna Drucker, 'Performative Materiality and Theoretical Approaches to Interface,' *DHQ: Digital Humanities Quarterly* 7, no. 1 (2013), 2. http://digitalhumanities.org/dhq/vol/7/1/000143/000143.html (accessed 20 August 2014).

Thus, twisted views and experiences are technically generated changing the way in which screen-based devices are used and digital representations are understood.

Diffractive Practice

The warping and twisting of light in a scientific context is described by the term *diffraction*. In physics, diffraction patterns are caused through the bending of waves (for example, light, water, electromagnetic, x-ray or radio waves), which pass through slits or apertures.
For instance, the double-slit experiments in quantum physics bent a ray of electrons through the apertures of a plate creating a particular pattern. A normally straight light ray is spread and bent so that shades of darker and brighter areas occur. Instead of distinct dark and light fields, a wave is dispersed so that various gradations appear.

Haraway and Barad use the term diffraction metaphorically to describe the creation of new perspectives how facts and information might be perceived. The method deviates from conventional approaches that "reflect" a respective topic in a linear and undistorted manner. In contrast, diffractive practice is an interpretative approach that is described by Haraway as a 'metaphor for another kind of critical consciousness'.[207] Haraway and Barad both use a diffractive practice in their work as a conceptual tool to think, read and interpret differently. Diffraction contrasts reflection. Unlike reflection, which depicts a situation undistorted mirroring stable outlines and distinct entities, diffraction expands and unfolds a fact.
A single issue is imagined to spread out like a wave inducing different interpretations, finer differentiations and potential entanglements with unnoticed factors. Barad outlines this approach as a method of 'reading diffractively for patterns of differences that make a difference'.[208]

Elastic Screen renders the practice of diffractive writing, reading and seeing as a constructive and associative process. It does this by visualising information on-screen blurred, shifted and displaced. Such diffracted information evokes different associations that allow the disordering and reordering of previously fixed ideas and stable components of visual representations. A diffractive practice and its erratic effects can result in constructive disruptions inducing the potential for variable realities. Diffraction inserts unanticipated

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[207] Haraway as quoted by Karen Barad in Dolphijn and van der Tuin. *New Materialism*, 51. Donna Jeanne Haraway, *ModestWitness@Second-Millennium. FemaleMan-Meets-OncoMouse: Feminism and Technoscience*. (New York: Routledge, 1997), 273.
[208] Dolphijn and van der Tuin. *New Materialism*, 49.

possibilities for the reconfiguration of conditions for meaning making. Such alternative construction of reality is an ideological undertaking. Diffracted perspectives may disclose interdependent and contingent qualities within a situation, provoking a user to re-consider what is significant, what is excluded or not recognized as relevant information. Hence, the diffractive method is not a process of discrimination, devaluation or segmentation executing a Cartesian Cut. Instead, diffraction is a relational practice as it is 'about making connections and commitments'.[209] Decoding visual information through *Elastic Screen* requires interpretive, associative and combinatory skills. Rather than depicting facts and imagery as clearly set data that are represented as stable and independent from other effects and influences, visualisations on *Elastic Screen* appear incidental and enriched inviting interferences and deformations. Diffraction, deformation and blurring are used as formative elements, undermining the perspicuity and explicitness of conventional modes of visual representation.

Fig. 73 Bettina Bruder, *Elastic Screen,* early version of mode two, 2013.

[209] Ibid., 69.

Blurring the Lines

Blurred and softened images depict a moment in tension appearing unstable and undefined thus challenging explicitness. Painting and photography may use blurred and foggy imagery to point to a different mode of existence, illustrating an escape from everyday reality into dreams and fantasies, implying a state of transition. Wolfgang Ullrich, art historian, explains the withdrawal from focused and detailed representations as a counter-movement within art and photography: while sharp and technically enhanced visualisations claim to depict reality accurately and objectively using technoscientific equipment for visualisation, the blurred quality of an image adds another layer of information to a picture.[210] A softened mode of visualisation may be a quest for the reconsideration of the visible and the invisible, where blurriness explicates uncertainty, discontentment or the desire to see things differently.[211] As Ullrich points out glitches, low-tech imagery and the purposeful distortion of representations express a rebellion against preconfigured visual standards. For example, the autofocus of a camera or the perspective dictated by the 50mm camera lens are accepted standard settings in photography that shape a user's view. Thus, visual effects like blur and distortion are used to counter conventional concepts of accuracy, perfection and beauty.[212] In cinematography, distortion and blur are deployed as visual devices to articulate different layers of meaning.

The movie *Deconstructing Harry* (1998) from Woody Allen used blurring as a stylistic tool to represent the psychological condition of an actor (Robin Williams as Mel). One day, Mel appears physically blurred due to his mental issues. He is no longer able to perform as an actor within the film and he cannot be photographed as he is out of focus. As Mel's condition does not improve and he refuses to change, technical devices like glasses and lenses are employed to get the actor "focussed". The dilemma is illustrated in a key quotation of the movie when a psychoanalyst attests unhappy Mel: 'You expect the world to adjust to the distortion you've become'.[213] This scene epitomizes human dependency on technology while it underlines the fact that we interact and engage with technology only in limited ways. Our epistemological toolset is based on technoscientific devices, instrumental logic and binary default settings, which distort our conceptual capacities and undermine our ability to understand and cope with complex realities. The partial blurriness of *Deconstructing Harry* reveals different modes of existence – a conventional world in focus and the confused

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[210] Wolfgang Ullrich, *Die Geschichte der Unschärfe* (Berlin: Wagenbach, 2002), 16.
[211] Ibid., 79
[212] Ibid., 91.
[213] Marcus A. Doel, '1a. Qualified Quantitative Geography,' *Society and Space* 19, no. 5 (2001), 559.

condition of Mel. Such visual compositions give rise to speculative *What-if* scenarios, suggesting ambiguous situations, contexts and correlations that cannot be imagined or depicted in a standard approach with a technological mindset. Instead, imaginative skills are required, which may provoke alternative perspectives.

Fig. 74 Bettina Bruder, photoshop sketch demonstrating the out-of-focus effect used in Woddy Allen's movie *Deconstructing Harry* from 1998 as a stylistic tool to express the instability of an actor. The CC license does not apply to this picture.

Under-standing In-between

Elastic Screen uses blurring and deformations to enable ideas about the entanglement of different states or viewpoints, expressing the creative interplay *in-between* a simplified, idealised world and contingent realities. Through its softened and displaced visualisations, the project suggests transitional states of various probabilities so that the moment between focused and blurred becomes conceivable, thus enriching our imagination.

Barad refers to *blurring* in reference to the *Schrödinger's cat* paradox—a *Gedanken-experiment* executed by Erwin Schrödinger with the intention to offer an interpretation for

the inexplicable particle behaviour in quantum physics.[214] Instead of a binary resolution, the blurring depicts the vacillation between two possible states. For example, the two possible states in the double-slit experiment describe a particle's behaviour to move through the left or the right slit of the test apparatus. Similarly, Schrödinger's thought-experiment imagines if a cat is dead or alive when being exposed to the randomness of a subatomic event, which cannot be predicted. Both experiments ask us to imagine a state of probability in-between—neither left or right nor dead or alive. It is the simultaneous and overlapping entanglement of various possibilities or in other words the *superposition* of potential states of a particle *shortly* before a measurement or observation. Schrödinger describes this situation as a blurring—an indeterminacy that is ultimately resolved and sharpened by the measurement resulting in a definitive value.[215] Thus, traditional concepts of stability and focus become in a quantum conception only a transient moment in time. Now, the conditions of reality continuously change through on-going intra-actions and entanglements.

Elastic Screen toys with stability and indeterminacy in a naïve but conceptual way. Through blurriness a viewer's attention is drawn to the short-term nature of imaged data on the interface. The sensitivity of the screen meditates the processual, transient nature of a *moment* of truth, its spontaneous transformability, entangledness and non-fixity that comprises various alternatives and possibilities. *Elastic Screen* turns the interface into an agential boundary: it is a changeable and shifting surface that does not only reflect visual content directly. Rather, the experiment blurs and diffracts visualisations opening up space to expose a dynamic, responsive tension. Such visual representations may disrupt a conventional logic with traditional perspectives, controlled reproductions and stable viewpoints. The mutable visualisations of *Elastic Screen* may generate a change in conceptualisation and imagination indicating implications on a socio-political and cultural level that I discuss with the projects in the next section.

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[214] Barad describes the term Gedankenexperiment: '(/g*-dahn'kn/adj.) *Gedanken* is a German word for 'thought.' A thought experiment is one you carry out in your head. In physics, the term *gedanken experiment* is used to refer to an experiment that is impractical to carry out, but useful to consider because it can be reasoned theoretically—The Jargon Dictionary.
'Gedanken experiment: An experiment carried out only in imagination or thought; an appeal to imagined experience; a thought experiment—Oxford English Dictionary.' Barad, *Meeting the Universe Halfway,* 287-288.

[215] This brief description does not do justice to the complexity of the topic and the elaborated discussion from Karen Barad. For her detailed explanation, see Barad, *Meeting the Universe Halfway*, 254-289.

Deviating Rays of Light

An early example of electronic art experimenting on a material level with flexible visualisations undermining traditional notions of technical distribution and representation is the work of Fluxus artist Nam June Paik. *Magnet TV* (1965) and *Electronic Blues* (1966) display imagery distorted by an electromagnet that directly interferes with the image rendition through the television (see my experiments in Fig. 75). The magnet deviates the straight cathode ray and warps the broadcasted image as the flow of electrons is diverted. In *Magnet TV,* the light ray depicts abstract patterns when the magnet is moved. *Electronic Blues* deforms imagery so that faces of politicians undergo 'rubbery transformations', which may reveal their real motivations such as fear, grief or self-indulgence reminding us of the blur used in *Deconstructing Harry* to express the mental state of an actor.[216]

Fig. 75 Bettina Bruder, experiment to deflect the image transmitted by an old cathode-ray-tube (CRT) television set with a magnet, 2013. The CC license does not apply to this picture.

[216] Art Gallery New South Wales, 'Art Gallery of New South Wales - Archive - Charlotte Moorman and Nam June Paik,' (accessed 19 August 2015), available at http://archive.artgallery.nsw.gov.au/exhibitions/archived/2010/kaldor_projects/artists/moorman_and_paik

With this work, Paik sabotages the technical authority of broadcast and television by introducing the possibility of unauthorised manipulation. The technically produced image is rendered mutable through an external intervention (the magnet itself, and the audience's control of the magnet) that contests the assumption of an autonomous art object while technological perfection is disrupted. Paik's works count as early examples for interactive and participative art where the audience was empowered to actively cooperate in the meaning making by manipulating the image and influencing the interpretation of a work.[217] Such art projects demonstrate the relationship between materiality, representation and the respective social and cultural meaning implicating that a certain social reality is transformable and might change.

Dunne outlines conceptual strategies of artists like Paik who revamped fixtures and technical devices of everyday life in order to provoke alternative interpretation and engagement. In speculative design, the misuse of objects and the corruption of commoditised experiences reveal new functions and applicabilities. Conceptual models that are ingrained in the design of objects and technical systems are altered through the malfunction of a device. This critical engagement with material culture may have destabilising consequences and discloses potentially new communication means of objects and media by revealing irregular and illicit qualities. Dunne states:

> The subversion of function relates to a breakdown of order; something else becomes visible, unnameable, unable to find a correspondence in the material world. This subversion of function is related to not being able to find the right word, creating neologisms that bend language to accommodate something new. Desire leads to a subversion of the environment creating an opportunity to reconfigure it to suit our "illegitimate" needs, establishing new and unofficial narratives.[218]

Thus, the speculative approaches that are provoked by *Elastic Design* generate such unofficial narratives and alternative interpretations through a diffractive practice on a material and conceptual level. The ambiguity created through blurring and diffraction stretches, bends and expands a linearly oriented conception. It is a strategy to express critique on established conventions but also to trigger the discovery of disparate, illogical differences beyond

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[217] Christa Sommerer and Laurent Mignonneau, 'Cultural Interfaces: Interaction Revisited,' *Imagery in the 21st Century*, eds. Oliver Grau and Thomas Veigl (Cambridge, Massachusetts: MIT Press, 2011), 204.
[218] Anthony Dunne, *Hertzian Tales. Electronic Products, Aesthetic Experience, and Critical Design* (Cambridge, US; London, UK: MIT Press, 2005), 73.

traditional approaches and binary arrangements providing space for alternative interpretations and implying the opportunity for a change of conceptions.

Enhanced Responsiveness

Paik's material interventions deflected the electrons sabotaging the linearity of the cathode ray and subverting the regulations, which organise technical distribution and standards for broadcasted information. Likewise *Elastic Screen* subverts the functionality of an interface. In contrast to the obvious interferences through the magnet in *Magnet TV* and *Electronic Blues*, *Elastic Screen* is connected through its sonic sensitivity to subliminal influences, for example, environmental noise, body sounds and unsubstantiated signals like the transmissions from mouse or keyboard clicks. *Elastic Screen* aims to integrate such sensitivity for non-quantifiable, emotional and concealed influences in the functional scope of an interface enriching the visual and intellectual experience of a user. This reconfigured interaction may interrupt habitual viewing patterns that are based on utilitarian interfaces maintaining ordered stability and economic efficiency.

The enhanced responsiveness and reconfigured functionality of the screen-based TAU is related to affective computing. This is an interdisciplinary research area within Human Computer Interaction (HCI) bridging computation, psychology and cognitive sciences. Rosalind Picard, a professor at MIT, initiated this field of research with the intention of linking human emotions with computer systems and electronic devices.[219]
Affective computing works with speech, facial or gestural recognition as well as physiological factors such as blood pressure, pulse or skin conductivity in order to detect a user's emotional condition in the development of enhanced communicative technologies that are used in the context of health and safety, gaming, education and advertising.

Scholars in communication and media, Kirsten Boehner, et al., criticise aspects of Picard's research program as being based on a rationalized and informational model with cognitivist underpinnings of human activity. The authors contend that such traditional approach renders emotions as computational signals, which are represented measurable, observable and computable. In contrast, Boehner et al. suggest an interactional perspective that attempts to integrate social and cultural aspects of emotions diverting from a solely functional approach.

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[219] Rosalind Wright Picard, 'Affective Computing'. In *M.I.T. Laboratory Perceptual Computing Section Technical Report No. 321* (1995), available at http://hd.media.mit.edu/tech-reports/TR-321.pdf.

This perspective includes undetermined irrational qualities with poetic and subjective factors within machinic interpretation with the aim to expand the capacities of affective computing.[220] *Elastic Screen* operates on this broadened perspective of affective computing, offering a richer experience as it deflects traditional interests of functional efficiency that come with the notion of stability and quantifiability. The enhanced responsiveness of the screen and the elastification of visual representations is an act of deprogramming and reconfiguration to alter the experience of a user who interacts with a screen-based device. In the following section I broadened a user's radius of operation by exploring possibilities of screens and displays in mobile devices.

Depicting and Discovering Situated Knowledges

The variability of visual representations providing a wider range of possible interpretations and subsequent action, is explicated in Haraway's concept of *situated knowledges*.[221] Haraway examines the conditions for human knowledge with the aim to reveal the variability of standpoints, positions and perspectives. She proposes a revised interpretation of how knowledge is produced and how a user makes judgements by putting an emphasis on vision and visual representations. Haraway asks:

> How to see? Where to see from? What limits to vision? What to see for? Whom to see with? Who gets to have more than one point of view? Who gets blinkered? Who wears blinkers? Who interprets the visual field? What other sensory powers do we wish to cultivate besides vision? Moral and political discourse should be the paradigm of rational discourse in the imagery and technologies of vision.[222]

Haraway's project is a critique of technoscientific objectivity, which is meant to be achieved by the deployment of machinic vision, instrumental perspectives and preconfigured projections. The screen-based projects *Elastic Screen* and *Ortho* take up her challenge considering the *object of knowledge* – whether an idea, visual representation, fact or data – 'as an actor and agent'.[223] Thus, a screen or display is not considered to be a passive surface for projections; rather it is an active operator, or in the words of Haraway, a 'material-semiotic

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[220] Kirsten Boehner, Rogério DePaula, Paul Dourish, and Phoebe Sengers, 'How Emotion Is Made and Measured,' in *International Journal of Human - Computer Studies* 65, no. 4 (2007).
[221] Haraway, 'Situated Knowledges,' 581.
[222] Donna Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (London: Routledge, 1991), 194.
[223] Haraway, 'Situated Knowledges,' 592.

actor' through which meanings are materialized with respect to context-dependent influences and a user's interactions.[224] Hence, the notion of (total) control over and through visual representations is dissolved. Meaning making becomes a critical, context-dependent and distributed undertaking where not only a user is considered in the process of interpretation but also further factors and influences (for example, noises, moods or ambience) are recognised and included.

The technoscientific construction of "objective" reality is manifest in the functionality of interfaces, which simplify and standardise visual information in order to facilitate a sleek and efficient workflow. To achieve this, design conventions for interfaces aim to eliminate ambiguity in favour of clarity, usability and efficiency.[225] The screen-based projects *Elastic Screen* and *Ortho* contest this inscribed notion of order and standardisation that supposedly guarantees such efficacy. Thus, a change in perception is provoked by literally dismantling the framework of vision pointing towards the areas *beyond* the frame.
Readymade perspectives imposed by media are disturbed and unhinged so that a reconfigured perception may be inscribed as the (im)material dimensions of visualisations become observable. The interface itself and a user's perception become sites for diffractive inscription.

3.2 *Ortho* – Detoured Detection

Ortho evolved from *Elastic Screen*. It is a series of websites especially designed for smartphones, with inbuilt positional sensors such as the gyroscope and the accelerometer.[226] The image rendition of the websites depends on the particular position of the phone as detected by these sensors. Depending on how a phone is held by a user (upside down, right or left, or tilted), the websites are deformed and displaced. Three different scenarios play with the relationship that is determined by a user's handling, posture and the position of the device—*Ortho I (Search), Ortho II (Sky)* and *Ortho III (Bush)*. The impulse for the project was the observation that particular gestures and attitudes are imposed on a user when using a phone. Usually this is a constrained posture—a numbed person with a lowered head performing small wiping gestures while staring at the screen. Tools and instruments prescribe

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[224] Ibid., 595.
[225] See for example, Jakob Nielsen, '10 Heuristics for User Interface Design: Article by Jakob Nielsen,' *Nielsen Norman Group*, January 1, 1995. http://www.nngroup.com/articles/ten-usability-heuristics/ (accessed 20 August 2015). Edward R. Tufte, *Visual explanations: images and quantities, evidence and narrative* (Cheshire, Conn.: Graphics Press, 2010). Tufte, *The Cognitive Style of Powerpoint*
[226] Available at http:// www.unexplic.it/sky, http:// www.unexplic.it/bush, http:// www.unexplic.it/ortho

a particular handling in order to be used effectively. This standardisation of movements and attitudes is subverted and deflected in *Ortho*.[227] The project disrupts the conditioning of body and perception through screen-based devices and aims to unfasten a framed vision.

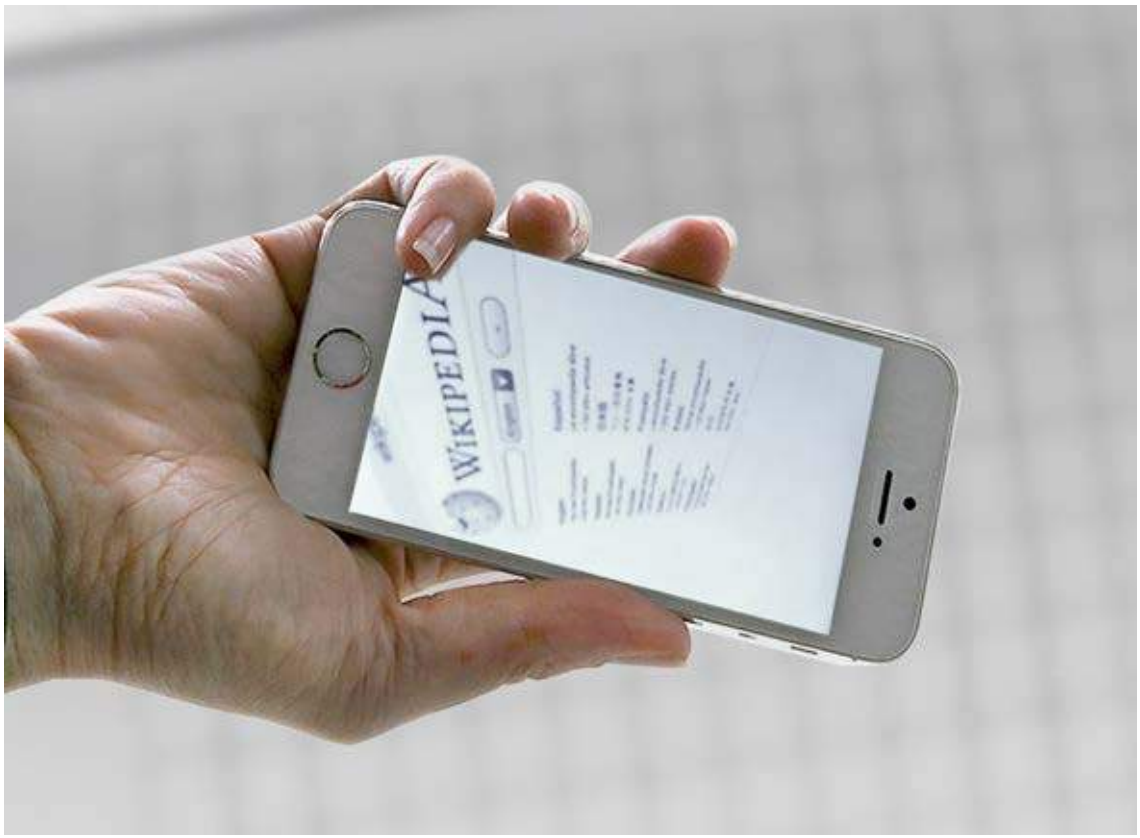

Fig. 76 Engaging with *Ortho I (Search)*, 2015.

Sighting Unstable Knowledge – *Ortho I (Search)*

Ortho I (Search) displays non-functional copies of the entry masks of search engines such as Google, Yandex, Baidu or the online lexicon Wikipedia.[228] When accessing these websites

[227] The relevance and complexity of these issues is apparent when considering following example: 2013 Apple claimed patent rights for several touch-screen gestures such as *Over-Scroll Bounce* or *Rubber-Banding*. The company sued Samsung due to patent infringements. The claims were considered valid but patent disputes are not settled at this stage. The regulation of user behaviour by technical devices and associated litigations may affect the repertoire of human movements in the future. A critical article on rhizome.org states: 'Apple has filed patents for Pinch-to-Zoom, Slide-to-Unlock, Multifinger Twisting, Double-Tap-to-Zoom, and Over-Scroll Bounce, aka Rubber-Banding, among other functional finger gestures. The company is indisputably striving to corner the market on how we move our fingers across screens, how we scan and massage images.' The controversial issue questions if we are programmed by our devices explicating patenting as an example for a capitalist boundary-making practice. Rhizome. 'Rhizome | Apple's Patent on the Pinch-and-Zoom Falls.' http://rhizome.org/editorial/2013/jul/30/all-i-wanna-do-pinch-and-zoom/ (accessed August 19, 2015)

[228] The selected websites were chosen as they present knowledge in the form of orderly arranged encyclopaedic entries and search results. Search engines and online lexica are generally the most accessed

through the specific URLs from *Ortho* with a mobile device, the sites are not presented in the familiar manner where the content is aligned in a rectangle inside the frame of the display. Instead, the websites appear floating in virtual space (Fig. 76). Rather than a ubiquitous presentation that guarantees the display of websites independently from the tilt angle of the phone, the web pages in *Ortho I* are shown as drifting planes in a different sphere. Here, the traditional laws of gravity still apply and interfere with the orthogonal representation. A user has to "catch" the lingering websites in order to perceive them as correctly aligned. Instead of weightless and omnipresent projections, the webpages turn into flat objects with a particular orientation. As a result, a user might need to perform a 180-degree turn, shift the body or the position of the phone to see the information correctly. Otherwise the information might be turned upside down, tilted or disarranged: as the visualisations do not rest solid and reliable in their predefined frame, information is rendered restless and unstable.

The engagement with this technical device and the operative instructions, regulate a user's gaze and posture, enroling the body and perception in a predefined, automatic arrangement. This recalls the conditioning and disciplining of the body through technology. The impact of disciplining infrastructures is subject of the work of Michel de Certeau and Foucault. Both authors describe the constraining of gestures and bodies through technology.

In the *Gestures Sequences* of *The Practice of Everyday Life,* de Certeau differentiates between *technical* and *expressive* gestures.[229] Technical gestures are performed when operating an automatic machine or a household appliance. Such action is governed by practical and functional objectives while expressive gestures convey emotional aspects, feelings and meanings. Technical gestures describe practices that execute a particular task most efficiently. These instructed operations enforce the most economic relationship between a body and a device. This ubiquity and intensity of technology's control and discipline appears to be inescapable––a regime of 'exhaustion rather than use' in the words of Foucault specifying our connection with reality where our minds and our 'docile bodies' are ruled and disciplined by efficient technology.[230]

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websites. See for example, Wikipedia, s.v. 'List of Most Popular Websites,' (accessed 14 August 2015) https://en.wikipedia.org/w/index.php?title=List_of_most_popular_websites&oldid=676098005

[229] Michel de Certeau, Luce Giard, and Pierre Mayol, *The Practice of Everyday Life,* 199.

[230] Michel Foucault, *Discipline and Punish: the birth of the prison* (New York: Vintage Books, 1995), 154, 135.

The name of the project *Ortho* is derived from an orthogonal body position that must be executed in order to discover the content of a webpage. For example, a webpage is only detectable if a user holds the phone above the head (Fig. 77). The title *Ortho* alludes to the area of orthopaedics, which is a field in medicine concerned with the optimization of the body that is rectified and straightened.[231]

Fig. 77 Engaging with *Ortho*, rectification, 2015.

All modes of *Ortho* disarrange these disciplining instructions of using screen-based devices by prescribing absurd gestures and postures requiring the user to perform irregular or idiotic movements when interacting with the phone. Now, the docile bodies of the users that were subjected to technology are released to discover new spaces and movements. Thus *Ortho* implies a reconfiguration or better *re-rectification* of mind and body. Behavioural patterns and movements are dismantled so that alternative attitudes and perspectives might emerge.

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[231] *Oxford English Dictionary Online*, s.v. "Orthopaedics | Orthopedics, N:" 'The treatment and prevention of physical deformities, esp. in children. Later: the branch of surgery that deals with the correction and prevention of abnormalities of the musculoskeletal system; orthopaedic surgery.' htp://www.oed.com/view/Entry/234072 (accessed 28 January 2016).

Floating In-between – *Ortho II (Sky)*

When calling up the website for *Ortho II (Sky)* the application first detects the cardinal direction of a user. After a brief tuning phase, the system displays: 'Always try to keep a patch of sky above your life.' The sentence is positioned in an infinite, black space and a user can recognise that the verse is not fixed in the frame of the screen. By fiddling, wobbling or shaking the phone, it appears as if the phone itself is a window revealing the text fixed on another plane. A user can pan the phone around in space to detect the sentence in four different locations – left, right, ahead and behind a user. If the sentence is taken literally and a user moves the phone above the head, an area of clouds in front of blue sky appears. Scanning the space above shows that the patch of sky has blurry borders offering a peephole that places a user's view in the centre of the application ironically affirming a presumptuous, anthropocentric position.[232] The blue sky fades into black infinity after one minute revealing its ephemerality.

Fig. 78 Discovering clouds of condensation, areal shot in *Ortho II (Sky)*, 2015.

[232] This position is attacked in new materialism, STS and critical theory troubling the human/non-human divide with the objective to move beyond those pivotal arrangements.

'Always try to keep a patch of sky above your life' is a quote from Marcel Proust's *Swann's Way*.[233] It is said by the snobbish gentleman Legrandin, who seems to lead a double life – that of an upright engineer working in Paris during the week while spending dissolute weekends on the French countryside in Combray. Proust implies a clandestine fondness for homoerotic encounters of Legrandin so that the "patch of sky" can be read as an escape or a window to another world where different laws might apply. *Ortho II (Sky)* reverses the view of the sky so that on inspection the image depicts an areal view of an industrial site where the condensation of factory smokestacks evaporates to give the appearance of clouds (Fig. 78). This ironical visualisation transposes earth and sky and keeps a user unstable and uncertain as to which is top and bottom. The discovery of the factory shot is only possible with attentive interest and observation. This metaphoric representation of reality works with ambiguity and allusions demanding increased attentiveness and imagination from a user to notice such implicit and delicate qualities. When observing other users interacting with the application, I noticed a certain reluctance to look up. I read this as the physical manifestation of a particular operational blindness and conceptual stiffness when engaging with technical devices. Maybe habitual constraints dictate a certain rigidity and inflexibility when engaging with screens. Thus, technical devices may cause a resistance to playfulness leading to the failure to "see" unexpected distractions and subtle indices.

Reverse Reading - *Ortho III (Bush)*

Ortho III (Bush) toys with the predominance of the cultural habit to read from left to right and a supremacy of right-handedness.[234] In order to experience the site, a user is asked to pan around the phone in wide searching movements as if to find a network signal. When the device is held to the right it reveals the first fragment of a sentence 'the left hand'.

By panning the phone around in a 360-degree turn a user can discover the remaining three fragments 'now knows what', 'the right hand' 'is doing'.[235] As the text fragments constantly

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[233] Marcel Proust, *Swann's Way*. Transl. C. K. Scott Moncrieff. (Mineola, N.Y.: Dover Publications, 2002), 58.

[234] Latin, Cyrillic, (Modern) Greek, Hindi and Southeast Asian languages are written in left to right, which is the predominant writing direction. See 'W3C I18N Q&A: Which Languages Are Written Right-to-Left (RTL) or Bidirectional (bidi)?' http://www.i18nguy.com/temp/rtl.html. (accessed 28 March 2016)

[235] The quote is an excerpt of a speech that was held by George W. Bush on September 10, 2003 at the Federal Bureau of Investigation Academy in Quantico, Virginia. This particular sentence was expressed in a paragraph outlining the establishment of a 'Terrorism Threat Integration Centre to merge and analyse in a single place all the vital intelligence on global terror'. Bush underlined the improved collaboration between different governmental agencies with his gestures and by mistake mixed up the left hand and the right hand. *Ortho III* makes a user playfully re-enact this scene. Gerhard Peters, and John T. Woolley, 'George W. Bush: Remarks at the Federal Bureau of Investigation Academy in Quantico, Virginia,'

drift and float, a user follows their circular movement. The directions of left and right or top and bottom are disordered so that a user is constantly in motion getting a sense of mental and physical latitude.

Left or right-handedness as well as the sovereignty of a particular reading direction point to a specific preference of linear directionality and binary segmentation within a user's perception. *Ortho III (Bush)* raises awareness to this twofold prevalence of (spatial) arrangements that imply a degree of discernability. Interchanging left and right reveals the predominance of dichotomous models of thought, dualistic structures and a user's implicit conditioning that divides the world in opposing poles. Engaging with *Ortho III (Bush)* may spur reflection and provide the absurd encounter of alternative ways of reading and experiencing textual information (for example counter-clockwise from right to left). This may indicate an irrational exchangeability and endless loopability explicating the potential reversibility of sentence structures and linguistic order. Such amended encounters may provoke a different reading and understanding – even one which does not analyse, separate and differentiate but one that is inspired to synthesise and correlate different directions, viewpoints and possibilities.

Ortho III (Bush) is extended in such a way that panning the phone upwards may reveal the message 'the website is down' while pointing the phone downwards discloses 'the website is up'. Such directional orientation uncovers the spatial experiences that underlie linguistic systems and conceptual models of thought assigning specific values such as good or bad to a physical position.[236] This attribution of values is culturally conditioned and one intention of the TAU is the softening of such ideological assumptions in order to extend and reconfigure the rigid frameworks for evaluation and judgement. Traditional frameworks position positive, valuable and functional qualities at the top while depreciated properties associated with negativity and dysfunction are considered inferior at a lower position. Thus, the homogenizing ubiquity of displayed information on screens is circumvented through *Ortho* as subliminal structures of directional orientation and hierarchical arrangement are revealed and potentially reconfigured. Moreover, alternative spaces may be discovered by unconventional exercises and behaviours.

The American Presidency Project. http://www.presidency.ucsb.edu/ws/?pid=62725 (accessed 29 January 2016).

[236] See for example, Daniel Casasanto, 'Embodiment of Abstract Concepts: Good and Bad in Right- and Left Handers,' *Journal of Experimental Psychology. General* 138, no. 3 (2009).

Anti-spaces and Counter-movements

Such anti-spaces and counter-movements are the heart of *Ortho* where information on screens is accessible only in particular postures. It seems irrational for interface design to contest the rectilinear and stable alignment of visual information aiming for functional efficiency, clear visibility and simple technical reproducibility of information on interfaces. In contrast, cinematography can account for other qualities than functional efficiency. For example, footage filmed with a tilted camera angle (also called Dutch Angle Shot) expresses a feeling of unease evoking the sensation of instability and disorientation. Slanted camera angles and distorted perspectives create a feeling of turbulence indicating a particular transient and precarious situation that might change within seconds.[237] The use of angled framings in cinematography strategically addresses intuitive and emotional aspects through the ways in which visual information is presented and perceived. As the imaged data escapes established linearity and perpendicularity the solid basis for conventional interpretations is unhinged and expanded. *Ortho* deploys this augmented mobility of displayed imagery and injects an enhanced responsiveness into the screen.

Ready-to-be-made Experiences

The aim of *Ortho* is the disruption of familiar data representation and the disturbance of accustomed ways of handling screen-based devices. *Ortho* changes the perspective and attitude of a user not only intellectually but also physically. Through *Ortho* the mutual entanglement of matter and meaning can be bodily experienced. Engaging with the application challenges the fabricated framing of information (on screens), its ubiquitous availability and its unquestioned validity.

Initially, the project was inspired by Erwin Wurm's *One Minute Sculptures* (1998). Wurm operates with sketches and instructions suggesting unusual, short-term body sculptures whilst banal objects such as oranges, chairs or toothbrushes must be counterbalanced in an absurd, foolish position. By following the artist's directions, 'anybody can become a work of art'.[238] Wurm humorously contests the conventional concept of sculpture being a motionless and immutable object. Instead, he invites his audience to carry out his commands and thereby complete the artwork through their participation (Fig. 79, 80).

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[237] See for example, Christian Mikunda and Alexander Vesely, *Kino spüren: Strategien der emotionalen Filmgestaltung* (Wien: WUV-Universitäts-Verlag, 2002), 133. Daniel Chandler and Rod Munday, *A Dictionary of Media and Communication* (Oxford; New York: Oxford University Press, 2011), 115.

[238] 'DB Artmag - All the News on Deutsche Bank Art / Db Artmag - Alle Infos Zur Kunst Der Deutschen Bank,' http://www.db-artmag.com/archiv/2006/e/7/1/ (accessed 28 January 2016).

As the poses represent a slightly uncomfortable and awkward position, the moment of delicate balance is recommended to be executed for the duration of one minute. Kathrin Herzog from *ArtFacts* emphasizes the transient nature of Wurm's work: 'Contrary to Duchamp, Wurm designs not ready-mades, sculptures fixed into an unchanging form, but works that are constantly ready-to-be-made'.[239] *Ortho* unhinges the "readymade" views and unleashes a user's posture suggesting different modes of encounter. Such alternative experiences can be discovered in a self-initiated, explorative performance asking the user to actively engage and "dance" with the objects and devices by changing a user's attitude and perspective.

Fig. 79 Erwin Wurm, *One Minute Sculptures* – Double Bucket, mixed media (1999), performed by the public. Performing for the Camera, Tate Gallery of Modern Art, London, UK (2016). © Erwin Wurm. The CC license does not apply to this picture. Fig. 80 Bettina Bruder, exercise inspired by One Minute Sculptures, 2016. Photographer: Dorothee Stickling. The CC license does not apply to this image.

Similarly, the art-collective Jodi developed a phone application that interferes with the regular usage of a mobile device asking the user to perform comical exercises.[240]

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[239] Suzanne Stein, 'Erwin Wurm: The Trap of the Truth,' *San Francisco Museum of Modern Art,* Open Space SFMOMA. http://openspace.sfmoma.org/2009/01/erwin-wurm-the-trap-of-the-truth (accessed 18 August 2015). Kathrin Herzog, 'artfacts', *Erwin Wurm – One Minute Sculptures – Fotos, Sculptures, Performance, Photographers' Gallery, 2001*, n.d. http://www.artfacts.net/index.php/pageType/exhibitionInfo/exhibition/7304.

[240] Jodi are Joan Heemskerk and Dirk Paesmans. Works from Jodi critically address contemporary media usage as they artistically reframe and sabotage conventional internet and computer technology. Jodi's

Their humorous approaches facilitate different user experiences that are outside the usual modes of operation when interacting with technical devices. Jodi's *ZYX* (2012) is a playful iPhone app that encourages users to execute a series of awkward movements, which are monitored by the motion-tracking function of the device using the data gathered from the inbuilt gyroscope and accelerometer. Gestures are for example, turning in circles ten times, jumping on the spot or balancing the phone on one's head for a particular duration (Fig. 82). When the prescribed actions are accomplished, the device rewards the user with a celebratory sound.

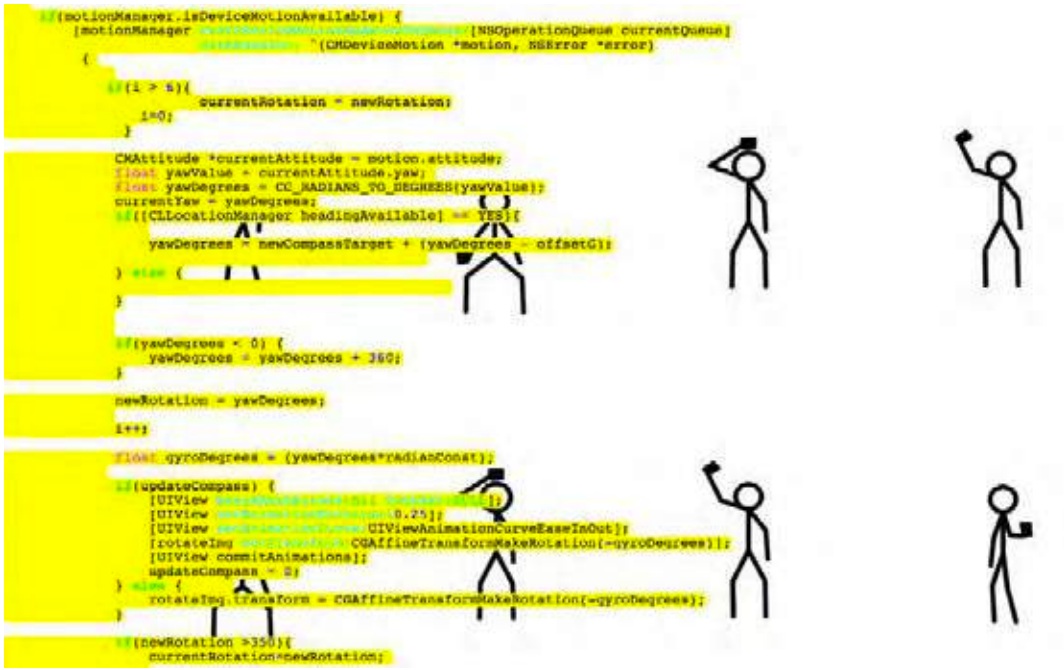

Fig. 81 Jodi, *ZYX* (2012), programming code, screenshot from website http://zyx-app.com, © Jodi. The CC license does not apply to this picture.

Jodi's associated website for *ZYX* discloses the source code of the application made available for the appropriation by other users (Fig. 81). Thus, the audience gains open access to the artists' work-material and thereby the possibility for subsequent adaptation of the code.
The website also shows the mail exchange between the *Apple App Store* and the artist duo.[241] This e-mail communication reveals that the application was initially rejected, as it did not comply with the App Store requirements for "intuitive usability", which should ensure a particular level of user experience.

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projects are idiosyncratic websites, applications and computer games where computer logic and technological functionality is scrutinised. The vocabulary of Jodi's art practice comprises a glitch and code aesthetic with interface elements such as error and command messages. Jodi proposes alternative forms of communication through a subversive handling of technology.

[241] JODI, 'ZYX,' http://zyx-app.com/ (accessed 29 January 2016).

Both applications, *Ortho* and *ZYX*, question and expand the notion of intuitive usability, undermining the technical limitations of encounters through the irrational engagement with the appliances. Both applications playfully make aware a viewer's position ironically playing with prescripted experiences, biased anticipations and notions of efficient usability. While *ZYX* requires users to perform a prescribed script, which is rewarded upon successful execution, *Ortho* spurs an explorative engagement stimulating processes of self-motivated discovery, reflection and interpretation.

Fig. 82 Jodi, *ZYX* (2012), people using the application. Screenshot from website http://zyx-app.com. © Jodi.
The composition of the website ignores a horizontal and vertical image alignment demonstrating visual autonomy.
The CC license does not apply to these images.

Another example of an artwork exploring functional restrictions through screen-based devices is Jacob Nielsen's *Gravity Edition Desktop* (2007). This application subverts the traditional logic and spatial limitations of interfaces as the desktop elements on the Microsoft

Windows' interface fall to the ground when the computer display is moved and turned (see my sketch in Fig. 83). The icons end up in a disorderly pile accumulating somewhere in a lower corner on the screen. Materialisation and representation meet in this project as gravity influences the elements on the interface. An idealised 'narrative of order and rationalization' is undermined and entropic processes that are usually excluded on interfaces are now given a platform.[242] The work contests software and interface culture by modestly exposing the limitations and potential misconceptions about a "stable" reality.

Fig. 83 Bettina Bruder, photoshop sketch to illustrate the irrational functionality of screen-based artworks discussed in this chapter. The CC license does not apply to this picture.

In the same way, *elgooG* challenged conventions of reading and representation. This mirrored version of google.com displays the website in reverse so that letters and visual elements had to be read backwards (see my sketch in Fig. 84).[243] An article in the 'New Scientist' in 2002 reported that while official search engines like Google were banned from public use in China, the mirrored version was still accessible bypassing governmental control.[244]

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[242] 'Desktop (Gravity Edition)|Transmediale,' http://www.transmediale.de/content/desktop-gravity-edition (accessed 20 August 2015)

[243] Jacob Nielsen also developed a version called *Bottom Up Google*. 'Bottom Up Google: Exhibition.' http://udkasse.net/dokumentation/indexhibit/index.php?/ongoing/bottom-up-google/ (accessed 30 March 2016). Other websites from artists and hackers featuring different versions of elgooG are for example: 'elgooG - Google Upside Down'. http://elgoog.info/ (accessed 30 March 2016), 'Google Mirror - I'm elgooG'. http://elgoog.im/ (accessed 30 March 2016), 'moc.elgooG'. http://futurearchaeology.org/moc-elgoog/ (accessed 30 March 2016).

[244] Knight, Will. 'Google Mirror Beats Great Firewall of China | New Scientist.' https://www.newscientist.com/article/dn2768-google-mirror-beats-great-firewall-of-china/ (accessed 30 March 2016)

These projects indicate the political relevance of visual representations pointing out opportunities for creative intervention. The experiments might appear playful and irrational but they also display the possibility for change and transformation of societal conditions.

Fig. 84 Bettina Bruder, photoshop sketch to demonstrate the ludicrous layout of the websites discussed in this chapter. The CC license does not apply to this picture.

Although *Gravity Edition Desktop* and *elgooG* subvert the ubiquity and controllability of information through their irrational functionality, the projects do not affect a user's bodily experience. Using the applications still fixes a user in the prescribed position in front of a screen. Furthermore, a user would hardly turn the screen of a computer to perceive the effect of *Gravity Edition Desktop*.

Ortho works with a similar sensitivity of the interface but forces like gravity are not limited by the screen. The unconventional placement of visual elements in an indirect sphere constructs an unstable as-if space where a website is unlocked and a user is liberated.
The docile factors of users and visual data are free to bend and twist in space enabling the discovery of partial knowledges. Strategies of *détournement* and displacement activate user engagement physically and mentally to disrupt conventional meaning making when handling a technical device.

Re-focusing the Body

The aim of this chapter was the examination of the relationship between matter and meaning using screen-based devices. *Diffraction* and *situated knowledges* supported the exploration stimulating a shift in perspectives when dealing with communication technology. Interfaces, inscription devices, operational instructions, protocols and readymade experiences imply the notion of scripts and scores. In a material-semiotic approach the *script* of a technical device is outlined as a set of world-views, beliefs, and expectations. Akrich describes the script as

an interpretative pattern that is implicitly enclosed in a technical device as part of its material culture.[245] The scripts suggested by *Elastic Screen* and *Ortho I-III* were kept purposefully open and fluid to propose in a Fluxus' manner undirected, suggestive scores offering leeway for self-initiated encounters.

The script of a screen-based device and any engagement with it was rewritten through *Elastic Design* instigating circumstantial means of expression and interpretation. By doing so, the screen-based applications of the TAU re-scribed and stretched the framework of a user's vision and respective actions promoting alternative experiences for reading, writing and interpreting visual information. *Elastic Screen* and *Ortho I-III* suggested a 'positioned rationality' in Haraway's sense, asking for experimental approaches and explorative encounters while offering partial views playing with the flexibility of screens, boundaries and behaviours that were previously perceived stable and set.[246] Now, meaning materialises through the interaction between a user, a flexible screen, an environment and an elastified representation. These components become collaborators in the composition of a contingent reality.[247]

The focus on screens and visual representations as active matter with agency suggests materiality as an area for further encounters, which is explored in the next chapter.
Here, natural forces and physical qualities such as gravity, air pressure, viscosity or transformability play a relevant role in the (re-)construction of new and complex realities revealing their socio-political and cultural dimensions.

[245] Akrich, 'The De-Scription of Technical Objects.'
[246] Haraway, 'Situated Knowledges,' 590,
[247] Ibid., 595,

CHAPTER FOUR

Wicked Entanglements

CH 4.1

Fig. 8 B. Bruder, *Cups for Alice,* 2014

CH 4.2

Fig. 9 B. Bruder, *Knotted Time,* 2014

CH 4.3

Fig. 10 B. Bruder, *Organic Equilibrium,* 2014

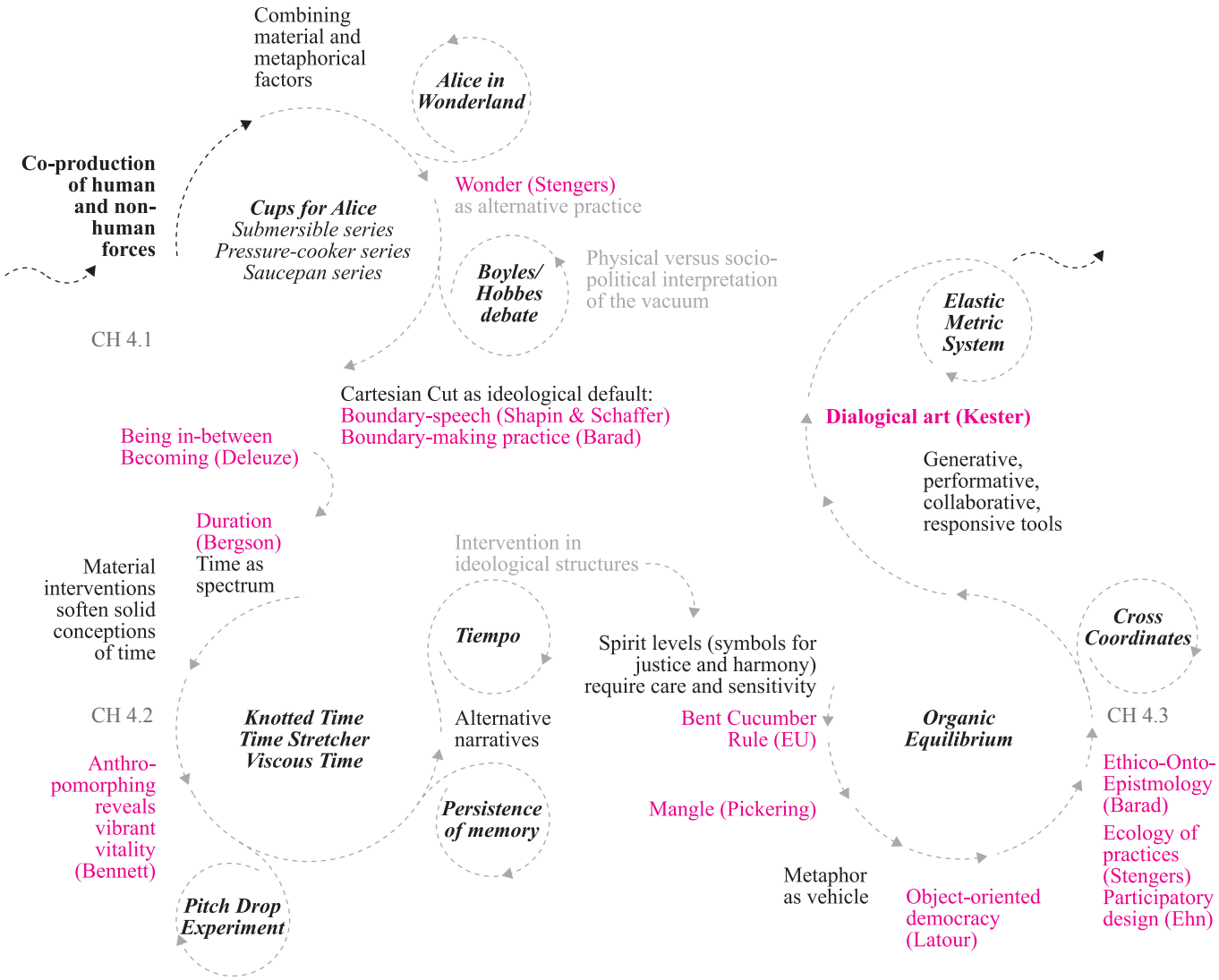

Fig. 85 Diagram showing the course of this chapter with concepts, explorations and projects for each experiment.

Introduction

The three experimental projects discussed in this chapter use material interventions and natural phenomena to reconfigure and re-entangle thought and action. Engaging with these manipulated devices may shift an analytical approach to one of experiencing and handling a subject matter differently, to consider its inherent complexity and diversity by encouraging bewilderment, inefficiency and irrationality. The experimental projects discussed – *Cups for Alice, Time Stretchers* and *Organic Equilibrium* – provide responsive sites for imagination and exploratory encounters. The projects reveal wicked entanglements, which are made apparent through irregular deformations within and through the measuring devices that demand idiosyncratic operations. Such unfamiliar experiences offer alternative viewpoints that may increase the receptivity and understanding of complexity and unpredictability.

In the discussion of these projects I use Barad's concepts of *intra-actions,* and *entanglements* drawing links to things (or objects) as *gatherings* (Latour), the *mangle* (Pickering) and *wonder* (Stengers) to explicate the notion of an *ethico-onto-epistemology* (Barad) within an *ecology of practices* (Stengers).

The pivotal interest throughout these three projects was the creation of *sensitive* measuring devices that produced absurd and illogical measurements. These experiments would cultivate an increased receptivity to the co-dependency of human and non-human interactions and intra-actions revealing the inherent ethical and political concerns.

The reconfigured measuring devices are tools for reflection as they precipitate intellectual engagement and alternative associations about complexity, participation, multiplicity and composition provoked through their practical application. Such broader notion of co-production is shown in the *Cups for Alice,* which are specially fabricated measuring cups made from Styrofoam.[248] This material changes its shape and size when exposed to increased air pressure. Multiple human and non-human factors collaborated in the production of these deformed vessels. Thus, the morphed measuring cups triggered a different form of engagement and served as sites for critical reflection about measurement, justice and the fair distribution of vital resources. Similarly, *Time Stretchers* were revamped timekeeping devices in which the conventional materials of clocks and hourglasses were replaced to affect the regular flow of time. The observance of time passing in an abnormal manner disrupted the preconditioned concept of quantifiable time and facilitated the encounter of an alternative passage of time. The final experiment—*Organic Equilibrium*—uses manipulated spirit levels

[248] Styrofoam is the trademark for polystyrene, which is foamed plastic.

in which the housing of the instruments was replaced with mutable and decomposing materials such as fruits, vegetables, frozen water or modelling clay. These irregular and transformable measuring devices were conceptualised to trigger critical interrogation about interdependency and perfection, spurring curiosity and inquisitiveness to cultivate an alternative awareness.

The manipulated tools performed irregular measurement processes through their mutable susceptibility indicating erratic values. By undermining notions of efficiency and rationality the devices may prepare and allow for a more viable world—integrating unpredictability, inconsistency and subtlety so that a reality may be constructed differently expanding classical scientific regulations.

4.1 Measure under Pressure – *Cups for Alice*

Cups for Alice uses foam cups, which are ordinarily used for drinking and measuring liquids. Volumetric measures signify the capacity of a vessel, the amount of a substance or of a solution. Early volume measures, being pivotal in the trade of substances and foodstuff, were introduced from existing containers for liquids and dry goods, such as wine and cereals. Once established, these benchmarks gave an indication about the quantity of a material in regard to its value within a transaction, the size of a portion for consumption or the amount of an ingredient in a recipe or chemical formula. The *litre* was introduced as a volumetric measure in the course of the authorisation of measuring standards through the French Academy of Sciences during the French Revolution in 1795. As described before, this metrification unified the French nation politically, facilitated trade and fostered scientific progress.[249] Today the litre is defined as the capacity of a regular cube with 10 cm side length.
These measurement specifications were determined by the General Conference on Weights and Measures.[250]

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[249] On considering volumetric measurement, David J. Hand tells an episode about the invention of the litre: Ken Woolner, a researcher from the Department of Physics at the University of Waterloo, Canada in 1978 wrote an article about a fictitious inventor of the *litre* for *Collier's Encyclopaedia* called Claude Emile Jean-Baptiste Litre. Woolner aimed to align the genesis of the litre with other units from the international system of standards that were named after their inventors. The incident shows how science and fiction appear close together. Hand, *Measurement,* 228-230.

[250] The General Conference on Weights and Measures is the international organisation in charge of the coordination of the current worldwide measurement system. The organisation is the result of 'the metre convention', which was a treaty about the standardisation of measures signed in 1875 by 17 nations.
The General Conference on Weights and Measures has currently 57 member states and 40 associated nations. 'BIPM – CGPM,' *Conférence Générale Des Poids et Mesures, CGPM*.
http://www.bipm.org/en/worldwide-metrology/cgpm/ (accessed 6 February 2016).

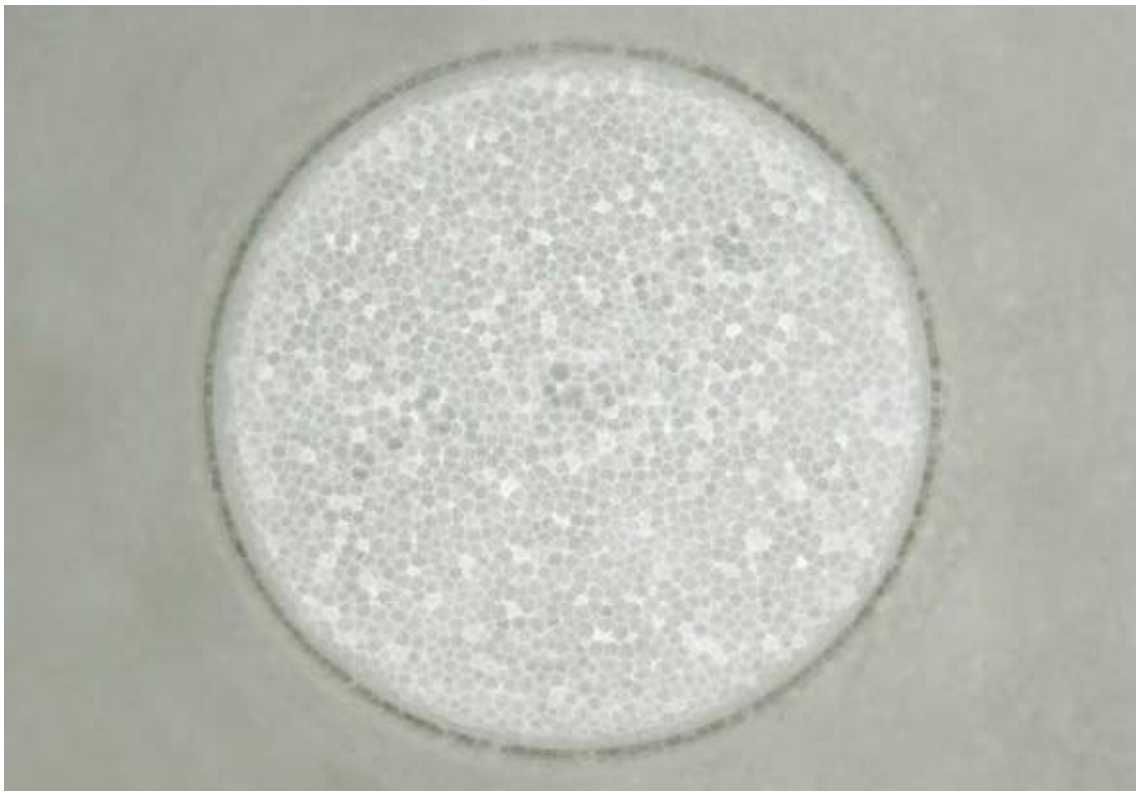

Fig. 86 Bettina Bruder, inside *Cups for Alice*, 2014.

Cups for Alice were produced from standard drinking cups made of polystyrene. This chemical substance (polymer) is synthetic foam, which is inflated with air (Fig. 86). Polystyrene is known for its damaging consequences in various ways. It is an indestructible material as it does not decompose. Furthermore, harmful substances are produced during its manufacture and recycling process, which negatively affect economic feasibility, human safety and ultimately the environment. These were the reasons for a ban on polystyrene foam containers from New York City in July 2015.[251] The advantage of Styrofoam is its lightweight and insulating property so that the material is used for packaging and padding and as building and insulation material in construction and craft.

Laboratories for Alice

For the production of the measuring cups, I conducted three experiments tampering with the material behaviour of Styrofoam. I identify these experiments by the terms "submersible series", "pressure-cooker series" and "saucepan series".

[251] Unfortunately the courts lifted the decree in September 2015. See for example, CBS News and Associated Press, 'Styrofoam Ban Ended in New York City after Ruling by Margaret Chin,' http://www.cbsnews.com/news/state-judge-overturns-ban-on-foam-containers-in-nyc/ (accessed 31 January 2016)

Submersible Series

The submersible series was the most elaborate experiment: I purchased 250 customary foam cups in a one-dollar-shop in Sydney. The cups were imprinted in pad printing with a graded measure indicating the volumetric capacity from 20-150 ml on one side of the measuring scale.[252] Additional information specifying more ambiguous units like *empty – almost – full* were added at its other side.[253] 50 of these cups were shipped to an associate in New Zealand. The collaborator was an electrical engineer on board an oceanographic research vessel of the National Oceanic and Atmospheric Administration of the United States (NOAA).[254] He had agreed to assist in this experiment.

The cups boarded the research vessel *Okeanos Explorer* of NOAA in Florida to be part of an expedition in the Gulf of Mexico. Here, on the open sea, the foam cups were stowed in a remotely operated underwater vehicle (ROV), which submerges to depths between 1900 to 2800 metres.[255] The key collaborating component in the submersible-series was the Earth's atmosphere. As air pressure increases with every metre of descent, a cup experienced 200 atmospheres at 2000 metres below sea level.[256] This immense pressure caused the foam to shrink as the air bubbles in the foam were squeezed out. The deeper the cups travelled, the more they *smurfed* and the printed measuring scale shrank (Fig. 87-91). These dives resulted in the production of several irregularly shaped mini-measuring cups (Fig. 92-95).[257]

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[252] Pad printing is a process, which allows printing on irregularly shaped objects using an elastic pad.
[253] The somewhat dubious measuring scale *empty – almost – full* was inspired by John Cage's composition *As Slow As Possible* (1985) integrating chance and uncertainty into an instruction.
[254] The objective of NOAA is the monitoring of changes in the environment in order to support economic vitality and to provide latest information for policy-makers to protect and conserve the natural resources of planet Earth. The research vessel Okeanos Explorer is specifically equipped to explore and map the sea floor. US Department of Commerce, National Oceanic and Atmospheric Administration. 'NOAA Okeanos Explorer Home,' http://oceanexplorer.noaa.gov/okeanos/welcome.html (accessed 7 February 2016).
[255] Such remotely operated underwater vehicles are robotic submersibles that are utilized for industrial and scientific research purposes offering safe and economical underwater operations in contrast to dives where humans are directly involved.
[256] Air pressure is specified as standard atmosphere, which is defined as an international reference unit representing the regular pressure of the Earth's atmosphere. With every 10 metres of descent during a dive, the air pressure increases by 1 atmosphere (atm).
[257] A video documentation is available on the accompanying USB-Stick. It is also accessible through the TAU section on www.unexplic.it. The video footage was captured and transmitted live via satellite communication during the dives via http://oceanexplorer.noaa.gov/okeanos/welcome.html

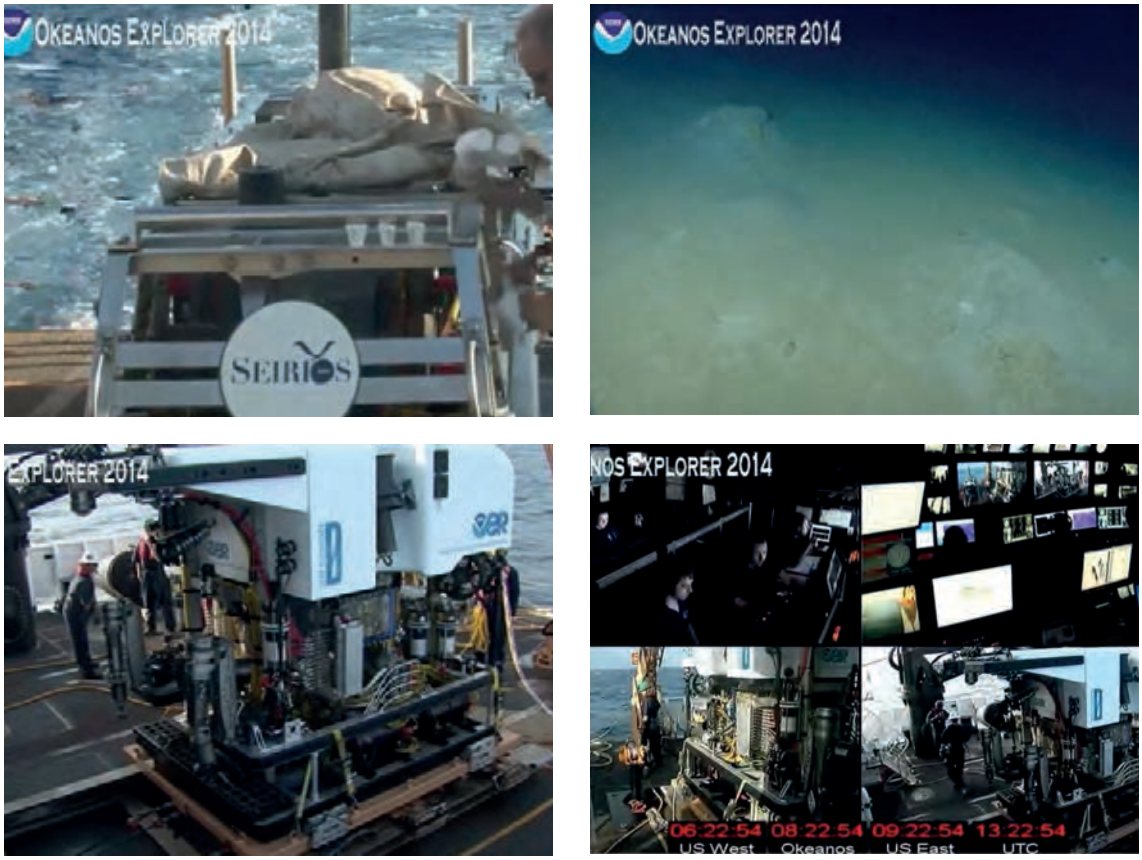

Fig. 87 - 90 Bettina Bruder, *Cups for Alice*, submersible series with NOAA, 2014. Stills from live recording via satellite communication, 24.04.2014. The CC license does not apply to these images.

Fig. 91 Bettina Bruder, *Cups for Alice*, 35 shrunken cups, submersible series with NOAA, 2014. Photographer: Jeff Williams. The CC license does not apply to this picture.

Fig. 92 - 94 Bettina Bruder, *Cups for Alice*, submersible series with NOAA, 2014. Cups from several dives.

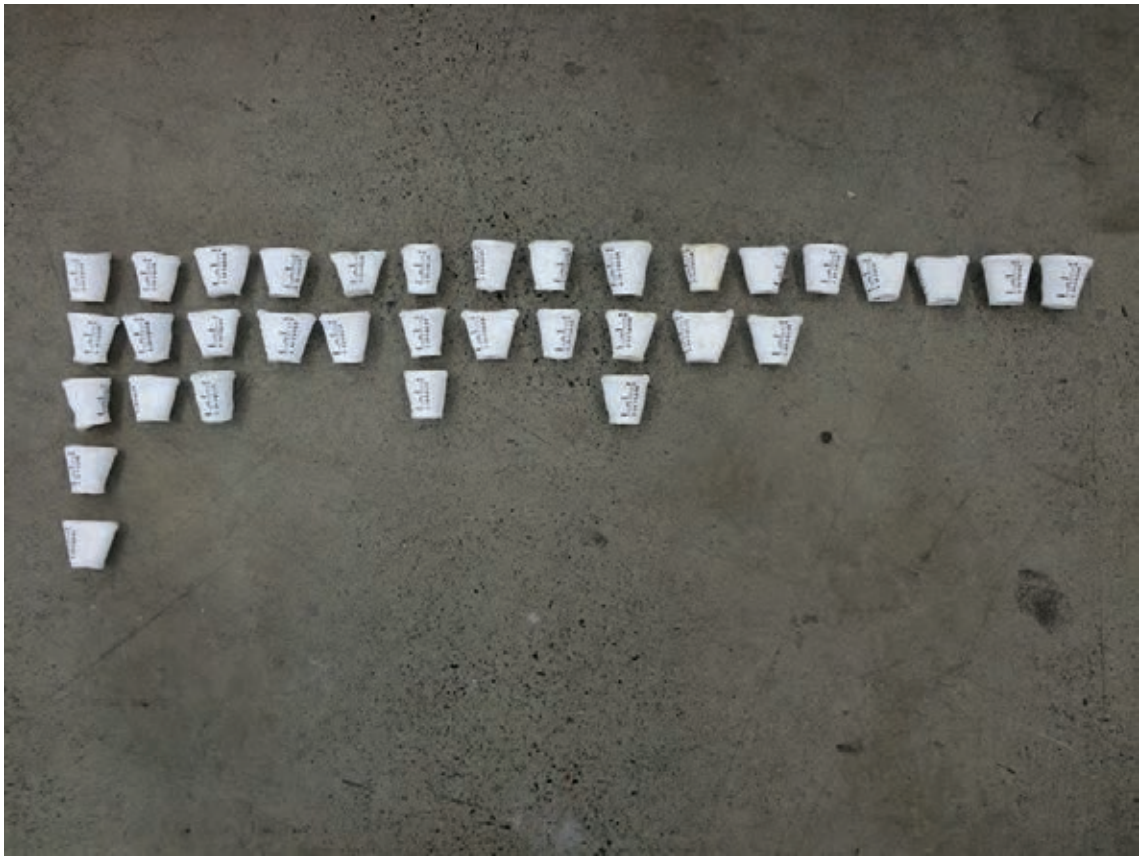

Fig. 95 Bettina Bruder, *Cups for Alice*, submersible series with NOAA, 2014. Cups from several dives.

Pressure-Cooker Series

In the second experiment, several cups were subject to a cooking procedure within a conventional household pressure-cooker.[258] Different treatments were tested to amend the time and setup of cooking (Fig. 96). As the compression inside the sealed chamber increased, the air in the foam was released and caused the cups to shrink. By filling the cups with varying levels of water, I discovered that the shrinking could be decreased in areas where water touched the surface. This technique allowed the production of measuring cups in the shape of shrunken amphorae (Fig. 99-101).

Fig. 96 Bettina Bruder, *Cups for Alice*, pressure-cooker series, 2014.

Saucepan Series

The third experiment used a normal saucepan (Fig. 97, 98) as test bed and unexpectedly the cups expanded.[259] As foam cups are industrially produced in a steam chest moulding system where polystyrene is injected into a mould with vapour pressure, the treatment in the saucepan reactivated this vaporisation process so that the cups slightly increased in size. In contrast, in the pressure-cooker series the increased air pressure made the cups shrink.

The outcome of the Styrofoam test series was a range of measuring cups with different shapes, sizes and surfaces where the variations were determined by the depth of the dives and the duration of the processes (of cooking or diving). The surface of the cups showed impact of external influences—steam, air pressure, heat and salt water. As the printed measuring scale only changed in size, the cups were more or less still usable for holding and measuring liquids.

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[258] In everyday use a pressure-cooker is deployed to accelerate a cooking process so that time and energy may be saved more efficiently.

[259] The test series with the pressure-cooker and the saucepan were executed in compliance with the requirements of health and safety by wearing a fume-graded mask.

Fig. 97 - 100 Bettina Bruder, *Cups for Alice*, pressure-cooker and saucepan series, 2014.

Fig. 101 Bettina Bruder, Cups for Alice, pressure-cooker series, shrunken amphora, 2014.

Messing with Measuring

As any other vessel, *Cups for Alice* combined several functions: although some of the foam cups lost their stable base and their pleasantly rounded rim for drinking, they still could be used as practical devices for consuming and holding liquids. The consumption of liquids may have a social purpose.[260] For example, tea drinking is an English tradition that established a particular protocol within a social group coordinating the day and respective activities according to morning, afternoon and evening teatime. The Victorian elite followed a certain etiquette that comprised dress regulations, tableware and behavioural instructions, for example, on how to hold a teacup.[261] I imagined the tea party in *Alice in Wonderland* as an appropriate scenario for these peculiar cups, which was the reason to name the project *Cups for Alice*. The cups could also be used for measuring liquids, which is practical when trading, consuming or mixing substances. But each measurement taken with the deformed foam cups would require proportional conversion and each transaction would demand particular negotiation case by case as a calibrated measurement was not given anymore. These shrivelled sculptures raised questions and caused bewilderment messing up a conventional measuring process.

Diving down to Wonderland

Cups for Alice operated on a material and metaphorical level. This conceptual flexibility was expressed through the variability of sizes, shapes and textures implying a possible plurality of contexts and meanings. Taking the wider social implications of the shrunken cups into account, the devices served as objects for contemplation, triggering creative inventiveness and imagination while encouraging questions and engaged conversations. The cups were exhibited in a group show 'The Tools' in Berlin (2014) and in the exhibition 'Experimental Thinking / Design Practices' in Brisbane (2015). At both occasions, the strangely deformed vessels provoked curiosity and fascination that could be observed when people engaged with

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[260] See for example Kristina Niedderer, 'Designing Mindful Interaction: The Category of Performative Object,' *Design Issues - Massachusetts Institute of Technology* 23, no. 1 (Winter 2007). http://www.mitpressjournals.org/doi/pdf/10.1162/desi.2007.23.1.3. Niedderer developed "social cups" as performative objects considering social and cultural aspects of drinking. In her work, she refers to vessels like the chalice used in religious rituals.

[261] Some of these rules are still valid today as this online article shows: William Hanson, 'William Hanson Reveals the Secrets of the Perfect Afternoon Tea,' *Mail Online*, 28 August 2015. Available at: http://www.dailymail.co.uk/femail/food/article-3208603/Don-t-stick-little-finger-milk-second-NEVER-serve-cupcakes-Etiquette-expert-William-Hanson-explains-rules-afternoon-tea.html (accessed 7 February 2016).

the Styrofoam sculptures.[262] Such enchantment was probably caused by the crumpled appearance of the cups. Questions were raised about how the cups were produced, where they had been and what happened to them. Recognising a familiar everyday life object that was bizarrely shrivelled and deformed while watching the video documentation about its adventures captivated and bewitched the audience and activated their imagination.

Fig. 102 Exhibition 'The Tools' at gallery Tête, project space, Berlin, 2014. Photographer: Julien Villaret.

This fascination and pleasure in discovery correlates with Stengers' claim for "wonder" when she wishes for an increased plurality and diversity within scientific practice.[263] Stengers criticizes the thought-terminating and isolating practice of rational claims for truth that are driven by a knowledge economy, which simplifies the world through idealist judgements. She argues that certain industrial parties and shareholders influence scientific research outcomes due to their interest in swift profitability and patentable results. The risk of such

[262] Julien Villaret,' Goofypress / Events / The Tools,' available at www.goofypress.com/events/the-tools/. (accessed 3 February 2016). Katherine Moline and Peter Hall, eds., *Experimental Thinking / Design Practices*. Brisbane, Australia: Griffith University Art Gallery, Queensland College of Art (QCA).
The catalogue of the exhibition is available at
issuu.com/qcagriffith/docs/experimental_thinking_design_practi (accessed 3 February 2016).
[263] Isabelle Stengers, 'Wondering about Materialism,' *The Speculative Turn: Continental Materialism and Realism*, eds. Levi R Bryant, Nick Srnicek, and Graham Harman (Melbourne, Victoria, Australia: re.press, 2011), 373.

constrained research practice is a certain blindness due to a *psychological resistance*.[264] Addressing the implicit political dimensions of scientific discoveries, *Cups for Alice* subverted reductionist approaches to knowledge in order to trigger imaginative thought, curiosity and wonder (Fig. 102, 103). Wonderment in Stengers' sense contests established categories and logical frameworks of reason propelling the openness to be puzzled and surprised. In contrast to the conventional binarism of true and false, the wondrous *Cups for Alice* provide alternative narratives that challenge a Cartesian clear-cut ideology promoting a more passionate and inquisitive engagement, which can enable us to attend more adequately to the disordered diversity of the world.

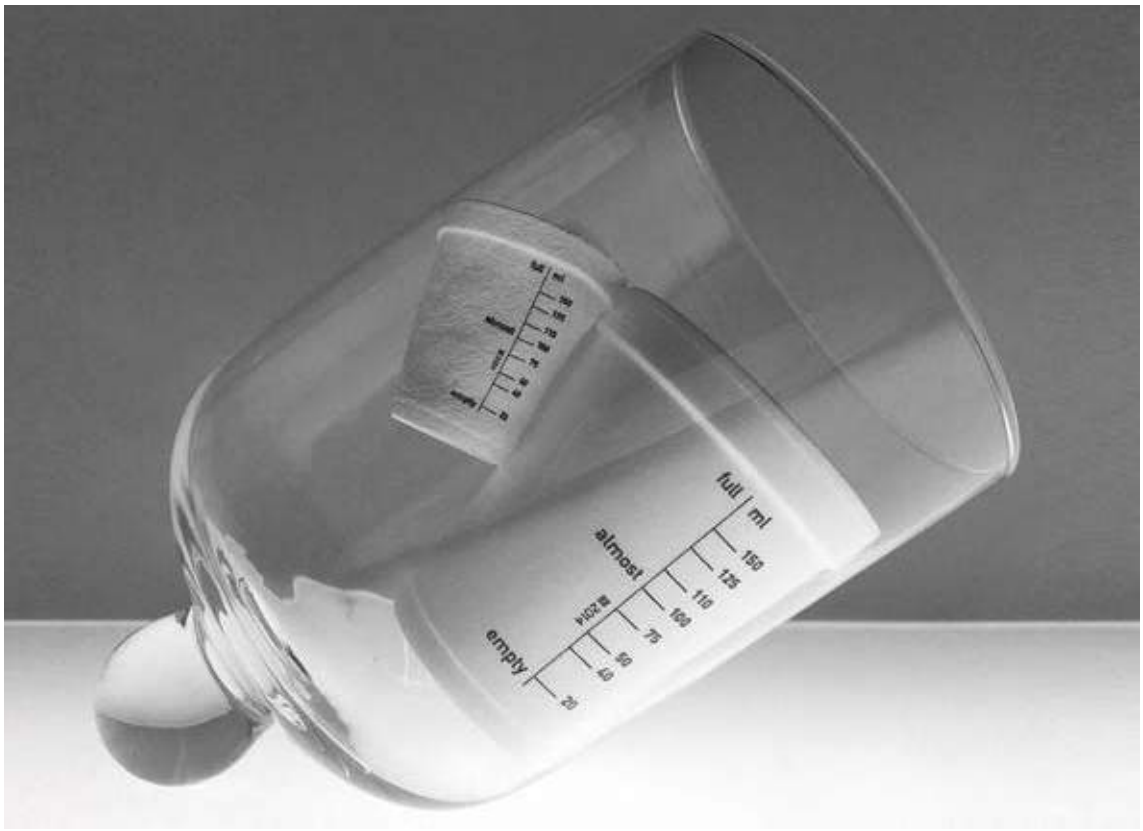

Fig. 103 Bettina Bruder, *Cups for Alice*, overturning a protected world, 2014.

Using the cups for measuring caused cognitive friction. It confused any judgement and generated doubt as a reliable usage with legitimate results was sabotaged contesting a particular ideology, which privileges control, accuracy and empirical evidence. Moreover, the crumpled surface of the cups showed traces of external impacts of atmospheric pressure, saltwater, heat and steam, affecting the material during the manufacturing process and led to

[264] Ibid., 375.

uneven, irregular shapes. These deformations were unpredictable and gave an idea of the forces that are usually undesired, eliminated or ignored in a normal measuring process. Thus, the smurfed cups made explicit the artificial fabrication of scientific criteria and knowledge that Latour described as 'matters of facts'.[265] Moreover, the cups invited these undesired forces. The experiments raised questions and revealed ignored relations, intra-actions and concerns about the polystyrene material, the Great Pacific Garbage Patch, human consumption and presumptuousness contesting the suitability of anthropological action.[266] Ultimately, the shrivelled cups interfered with any conventional social and scientific activity.

With *Cups for Alice,* I used a vessel to express the multiplicity of contents and perspectives. The project was a play on matter and meaning, challenging ideas about the fair handling of resources, their distribution and their "correct" measurability. Another example where the *content* of a measuring instrument caused conflict and controversy was the debate on the existence of the vacuum and its scientific interpretation in the seventeenth century.

Matter and Meaning under Pressure

Material agency, meaning and the correlation between matter, science and politics were the objects of a dispute between Thomas Hobbes, political philosopher and Robert Boyle, natural scientist regarding the authority to interpret the vacuum that was produced by a particular apparatus, a precursor of the air-pump (Fig. 104).[267] The Hobbes/Boyle-debate illustrates

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[265] Bruno Latour, *We Have Never Been Modern*, 24.

[266] *Intra-actions* is a concept developed by Barad emphasising the ongoing, dynamic being-in-relation of objects, humans and agencies. The dynamic is not controllable or assignable to a specific entity.

[267] Boyle, the scientist constructed a technical device similar to an air-pump with which he could produce a vacuum. The observation of a space void of air was presented as a "matter of fact" in opposition to interpretations and beliefs as "matters of opinion". In contrast, Hobbes, the philosopher, having experienced a long period of civil war in England, cared about unity, peace and social stability. With his political interest in peace and social balance, he proposed a new constitutional system for the state that was based on social agreements between its residents. Religious or monarchical claims to leadership that were typical for a medieval society, should be avoided. Hobbes proposed the Leviathan as a governmental sovereign in the form of a commonwealth or community that would be able to represent the will of all citizens guaranteeing social consensus and offering peaceful welfare. In this view, Hobbes' concern with Boyle's invention was that a self-declared expertise on knowledge would risk any social harmony by creating disagreement about how to imagine a void. In order to achieve uniformity, Hobbes advocated a form of collective rationality and logic as interpretational sovereignty whereas Boyle's strategic counter-measures pioneered scientific and empirical practices preparing the way for instrumental objectivity. Boyle responded on a technical, textual and social level: 1) he utilized mechanical technology in the form of the air-pump as an experimental apparatus that could reliably generate a natural phenomenon; 2) he produced written documentation of his experiments with details of the instrument, the laboratory and the particular procedures; and 3) he invited trustworthy experts from the research community as witnesses of the incidents attesting the plausibility and authenticity of his experiments. See: Blok and Jensen. *Bruno Latour: Hybrid Thoughts,* 57-58. The debate is fully discussed in Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985).

how competing views within scientific interpretation are challenged and how a particular standpoint and practice succeeded, implying an idea of true and false and the conceptual consequences of treating matter and meaning as incompatible and unrelated entities. Boyle's interest in the dispute was the acknowledgement of the vacuum as a physical phenomenon (matter) whereas Hobbes wished for social and political unity (meaning). Both protagonists aimed for an objective representation of truth by developing particular apparatuses with peculiar vocabularies. On the one side, Boyle's scientific practice produced experiential evidence through experimentation providing *a platform for nature to speak for itself* inside the laboratory and through the air-pump. In that perspective, natural forces and organic matter (in fact the immateriality of a vacuum) became key actants being apparently independent of human concerns, political or religious ideas.
On the other side, Hobbes being suspicious of evacuated immateriality and 'self-proclaimed knowledge-authorities' campaigned for an apparatus of social and governmental principles with the intention to exclude opinionated judgements that were based on artificial construction, personal description, observation and individual discoveries.[268] With his interest in social unity, Hobbes proposed a neutral and ministerial body as the Leviathan that could represent the sum of the interests of a society where truth was reached by consensus.[269]

On the one hand, Boyle's air-pump produced a vacuum implying that matter can be sectioned and controlled by human intervention. This is the idea of the Cartesian cut that is reproducible and repeatable at any time and any place with consistent accuracy. On the other hand, Hobbes drew attention to the wider implications of such scientific method becoming the dominant practice for deciding about right and wrong. He emphasised that the socio-political consequences could be an unbalanced power that may put any social unity to risk by creating a disparity between what counts as truth and what does not. Ultimately, the scientific inquiry about the air-pump had far-reaching implications for economy and industrialisation, recalling Stenger's critique of economic bias within scientific research.[270]

Both protagonists worked with the concept of representation—Boyle in the scientific and Hobbes in the political sense. A separation between nature and culture, between natural

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[268] Blok and Jensen. *Bruno Latour: Hybrid Thoughts in a Hybrid World*, 57.
[269] Ibid., 57.
[270] The knowledge about air pressure and airflows played a decisive role in the construction of steam engines, the beginning of modern technology, which improved transportation and manufacturing processes causing dramatic changes in society and economy with the Industrial Revolution.

phenomena and political concerns, between matter and meaning was formed and established. Using this disputation, Latour exemplifies how 'the modern Constitution' was founded and how the idea of a strict separability between politics and science was pursued.[271]

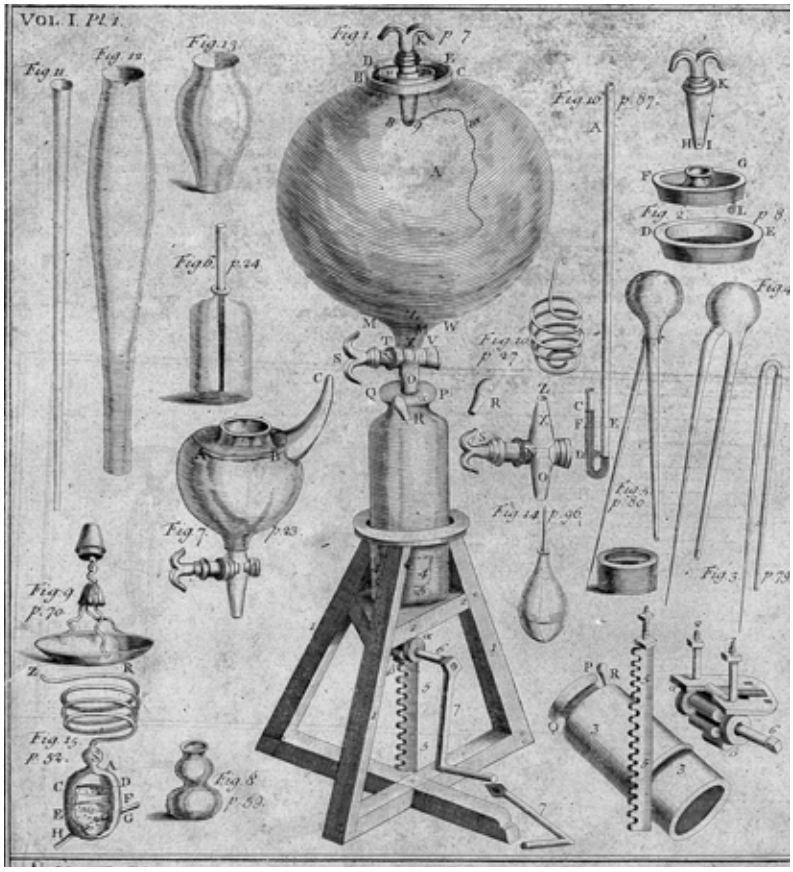

Fig. 104 Robert Boyle, "New Experiments Physico-Mechanical touching the Spring of the Air", drawing of the first air-pump, Thomas Birch, published 1777. Available via Wellcome Library, London, licensed under CC BY 4.0.

Boyle's air-pump (as an actant with material agency) produced a vacuum (representing a scientific fact) as an empirical practice demonstrating the modern division within the world where certified knowledge opposes assumptions and beliefs through measurable outcomes and verifiable results. Measurement and scientific experimentation established the scientific discourse with a certain "boundary-speech" creating the conditions for a "boundary-making practice", here in the classical Cartesian sense, which directed current modern ways of

[271] The *modern Constitution* as outlined in my introduction is described by Latour as the guiding foundation of modernity on a philosophical, scientific and political level. These principles establish and maintain dichotomies between society and nature, politics and science and between pre-modern and modern. In contrast, Latour proposes the non-modern constitution as a *parliament of things* where the politics of science and technology merge with society and nature in hybrid constructions and unruly entanglements. Bruno Latour, *We Have Never Been Modern*, 13.

thinking.[272] Boyle's vacuum shows the ambiguity of the term "representation" as it can be considered either politically or scientifically, indicating a diversity of positions and interests, which require innovative re-negotiation.

I interpret this controversy as an example for an ideological default setting that aims to separate matter and meaning. It illustrates Barad's critique of representationalism where matter can be neatly partitioned, controlled and classified driven by classic scientific principles and economic interests.[273] In contrast to the notion of scientific evidence and measurability that was imagined as a clear-cut separability between matter and meaning (implied by the vacuum in the air-pump), *Cups for Alice* reveal and re-entangle the context-dependency of a situation through their imperfection and irregularity. Thus, the cups actively intertwine matter and meaning by addressing material, socio-technological and political entanglements in a constructive irritation jeopardising ideas of clarity, control, precision and ultimately, empirical evidence.[274] The purpose of *Cups for Alice* was the incitement of alternative meanings, which were generated through ambiguous measuring results that required careful reassessment. Unlike conventional measuring cups that deliver straightforward values, *Cups for Alice* undermined assumptions about a verifiable reality. This uncertainty provoked questioning, reflection and possibly the reconsideration of certain ways of engagement with matter and reality.

Dynamic Boundaries

As the cups were produced in conditions that could not be controlled – atmospheric pressure, saltwater, heat and steam—no bowl turned out to be exactly the same as another. Each cup showed a different degree of deformation so that the series of cups expressed a changeful diversity, which challenges requirements for reproducibility and repeatability, as they exist in classic scientific experimentation and industrial mass production. The shrivelled cups undermined these stipulated relationships and subverted abstract concepts with prescribed regulations, routines and practices. Similarly like Wonderland, the cups represent a flexible, imaginative space beyond conventions and regulations instigating speculative thoughts and

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[272] *Boundary-speech* is a term that Shapin and Schaffer used to describe the conventions of intellectual discourse in the search for truth in a social and scientific context. Shapin and Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, 342. For measurement as 'boundary-making practice' see Barad, *Meeting the Universe Halfway,* 93.

[273] Ibid.,150.

[274] Similarly, such variability of measurement results and visual representations was created by the *Elastic Standard Metre* and the screen-based devices *Ortho* and *Elastic Screen* that registered accidental or irrational data as input and reflected this in their measuring/displaying output.

ideas. Volumetric information shrivelled and expanded, contesting the familiar logic of a regulated world while enriching scientific facts with unrefined concerns and natural irregularities. Just as Alice shrank and grew between infancy and maturity, between emotional ambiguity and established rationality, the material flexibility of the cups and the deformed measuring scales represented multiple viewpoints and concerns as materialized moments of an ongoing interplay in the negotiation of meaning. I associate this dynamism being traceable but also unpredictable with Deleuze's concept of becoming as a state of probability and of being in-between when he says:

> This is the simultaneity of a becoming whose characteristic is to elude the present. Insofar as it eludes the present, becoming does not tolerate the separation or the distinction of before and after, or of past and future. It pertains to the essence of becoming to move and to pull in both directions at once: Alice does not grow without shrinking, and vice versa.[275]

How to imagine such a dynamic intra-actions between entangling and unfolding? This question was the catalyst for further material experimentation to develop models of thought that could provoke alternative conjectures about impermanence, time and duration. In the following section I discuss how to actuate such thoughts and speculations through interfering with the concept of time.

4.2 Viscous Timespacematter

Henri Bergson used the perplexing image of an elastic band being stretched to convey his idea of duration as a kind of immeasurable flow and intuitive sense of time in contrast to mechanised clock-time that is based on regular units (hours, minutes and seconds).
He imagined an elastic band with static marks being stretched. The process of stretching the tape allows envisioning continuous tension. The idea implies temporal flexibility and potentiality, which can neither be divided nor represented. Imagining such elastic flow of time appears troublesome. Bergson states:

> And yet that image will still be incomplete, and all comparison furthermore will be inadequate, because the unrolling of our duration in certain aspects resembles the unity of a movement which progresses, in others, a multiplicity of states spreading out, and because no metaphor can express one of the two aspects without sacrificing the other. If I evoke a spectrum of a thousand shades, I have before me a complete thing, whereas duration is the

[275] Gilles Deleuze, *The Logic of Sense* (London: The Athlone Press, 1990), 1.

> state of completing itself. If I think of elastic being stretched, of a spring being wound or unwound, I forget the wealth of colouring characteristic of duration as something lived and see only the simple movement by which consciousness goes from one shade to the other. The inner life is all that at once, variety of qualities, continuity of progress, unity of direction. It cannot be represented by images. But still less could be represented by concepts, that is abstract ideas, whether general or simple.[276]

The quote reflects the challenge and constraints for human imagination, which is even more conditioned by mechanistic assumptions and technoscientific devices. With the projects presented within this section I propose revamped timekeepers – *Knotted Time*, *Time Stretcher* and *Viscous Time* – that employ the irregularity and uncontrollability of matter in order to induce an elastic and transformative sense of time by literally softening the concept's rigidity. The regularity and uniformity of clock time represents a predominant organisational structure that rules human experience and life. A clock is supposed to be an accurate instrument to order time, which is organised in timetables, time zones and itineraries. Such standardised and regulated experience is disrupted and reconfigured by the revamped timekeeper experiments.

Knotted *Time Stretcher*

One strategy to soften the solid conception of time was the manipulation of a clock's face, hands and mechanism. I exchanged and tampered with these elements by remodelling luggage scales, wall clocks and travel alarms. These revamped timekeepers conveyed an idea of nostalgic instruments from the *fin de siècle* (around 1900) but on closer examination the clocks revealed their subtle modifications. For example, the *Time Stretchers* (Fig. 106, 108) were reconfigured fish scales indicating hours and minutes in kilograms and grams. Time became individually adjustable as the position of the clock hands depended on pulling the spring of the revamped measuring scale. For *Knotted Time* (Fig. 109-113), I purchased a range of conventional off-the shelf products and replaced the clock hands with flexible rubber. The simple amendment (extending, shortening or widening of clock hands) confused any habitual reading of time. Furthermore, the deployment of bendable and flexible material made the clock hands more responsive. Instead of being rigid sticks, these flexible hands were ensnarled, ending up in knots, spinning, whirling and nestling up against each other.

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[276] Henri Bergson, *Creative Mind: Introduction to Metaphysics* (New York: Greenwood Press, 1968), 194-195.

Time jammed at particular moments when all clock hands reached a position on top of each other. While a nervous sweep hand - wobbly - turned its rounds and curled up slowly, the minute hand was stuck, so that the time displayed was always five minutes too late.[277]

Such anthropomorphising interpretations evoke emotive images of a tired, saggy or relaxed course of time. On the one hand, these descriptions reconfirm the human-centric position within an explanation. On the other hand, it is a subjective interpretation that can provide alternative narratives to an analytical understanding of time. Jane Bennett, political theorist, emphasises the anthropomorphising of objects as a strategy to expand the idea of agency, not only of humans but also of objects and materials, to open up different avenues for reflection. It is a method to bypass mechanical and impassive descriptions. Bennett states:

> In a vital materialism, an anthropomorphic element in perception can uncover a whole world of resonances and resemblances—sounds and sights that echo and bounce far more than would be possible were the universe to have a hierarchical structure. We at first may see only a world in our own image, but what appears next is a swarm of "talented" and vibrant materialities (including the seeing self).[278]

Anthropomorphising spurs imagination and may allow to find more adequate expressions for the subtle variations and irregularities that elude conventional grasp. Acknowledging the *vibrant vitality* of passive matter as suggested by Bennett correlates with concepts of performativity, processuality, elasticity and intra-actions. Such ideas help to cultivate and increase a sensitivity about the non-representability of entanglements that happen in the course of events and that are usually straightened out and excluded by regular measuring devices and conventional evaluation. *Knotted Time* aimed to provoke an increased sensitivity through material intervention. Formerly rigid clock hands gained an elastic liveliness as they appeared relaxed, worn-out, bent or crumpled like human limbs giving in to gravity. Their absurd behaviour linked form, function and meaning so that the clocks became active constituents, humorously refusing their designated purpose to indicate a regular flow of time. The clock hand's flexibility expressed lethargy and ease utilising gravity as a productive and emotive force to destabilise conventional ways of interpretation that target expedience and regularity.

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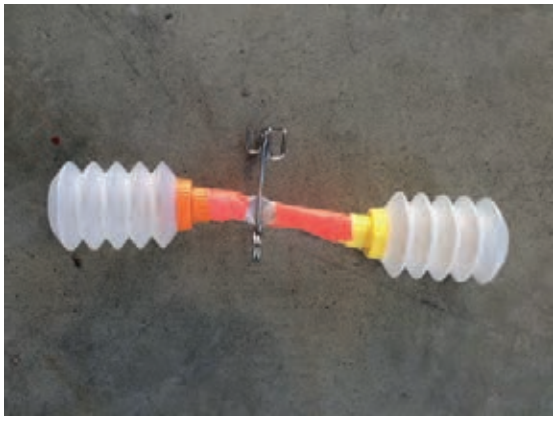
[277] Documentation of the timekeeping experiments is available as short video clips on www.unexplic.it in the TAU section and on the USB-stick.
[278] Bennett, *Vibrant Matter*, 99.



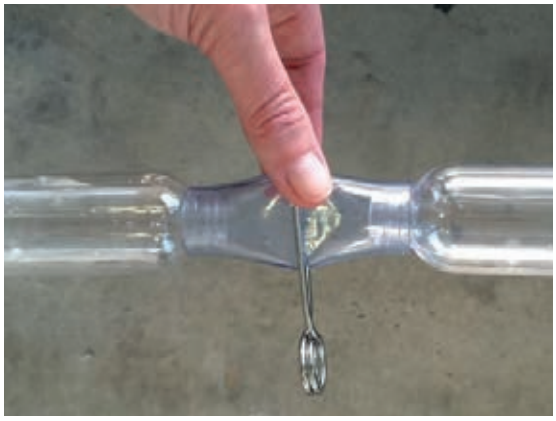


Fig. 105 B. Bruder, *Knotted Time*, alarm clock, 2013.
Fig. 106 B. Bruder, *Time Stretchers*, luggage scale, 2013.

Fig. 107 Bettina Bruder, prototypes hour glasses, 2013.

Fig. 108 Bettina Bruder, *Time Stretchers*, fish scale, 2013.

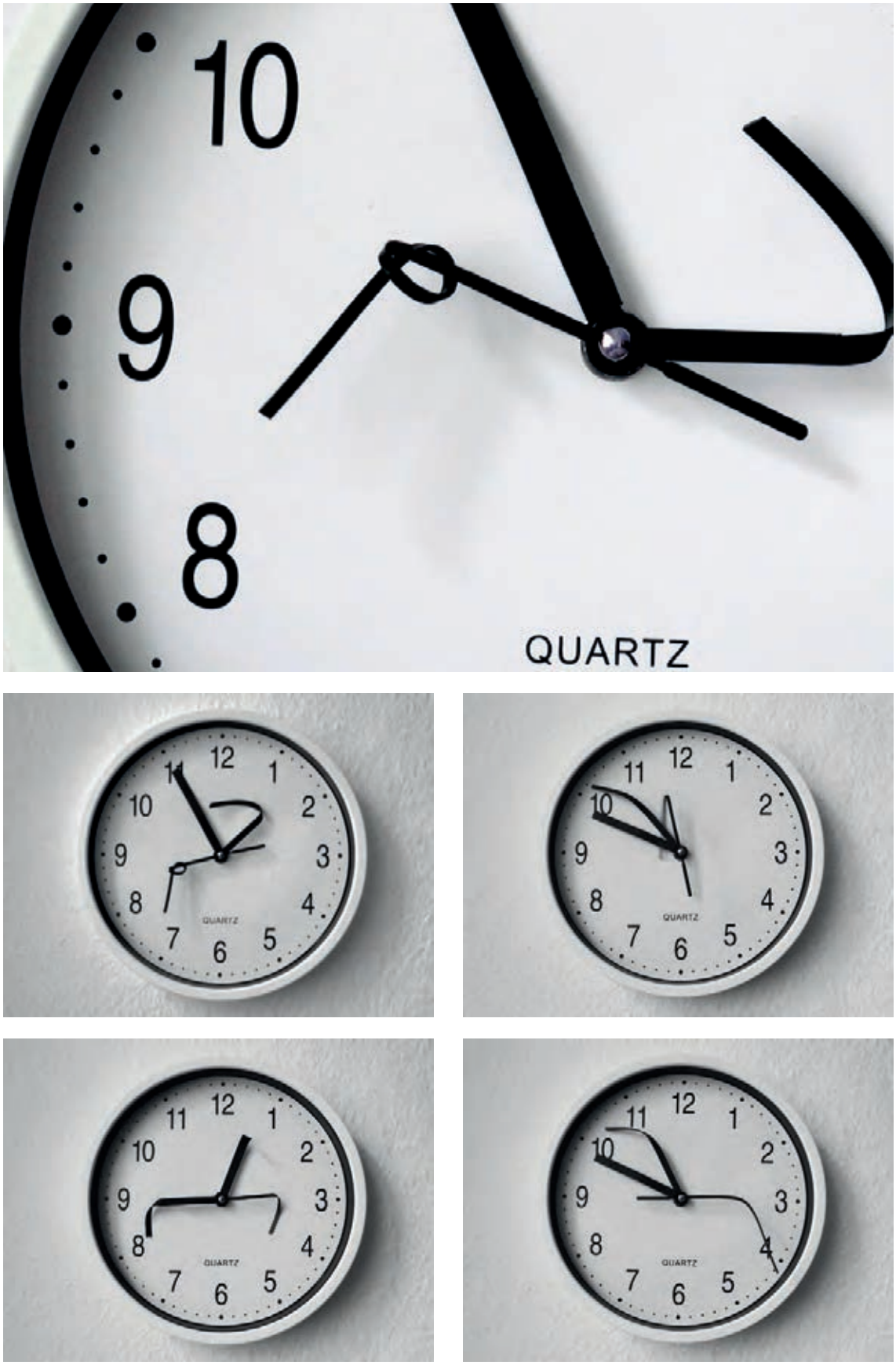


Fig. 109 - 113 Bettina Bruder, *Knotted Time*, 2014.

Viscous Time and *Bubble Timers*

Viscous substances were used as tenacious materials in a series of reconstructed hourglasses that expressed a gelatinous material agency. The impetus for these revamped hourglasses arose from the *Pitch Drop* experiment initiated in 1927 by Thomas Parnell, physicist, to show that materials, which appear to be firm and stable, are actually viscous: he poured a heated amount of pitch into a plugged glass filter. After the substance settled for three years, the seal was broken and the pitch could now percolate (Fig. 114). One droplet appears to fall within time intervals between seven and thirteen years. This experiment is still continuing.[279]

Fig. 114 Pitch drop experiment, setup 1927. Image used with the permission of The University of Queensland. The CC license does not apply to this picture.

Instead of sand or water as the fluid material, the reconfigured hourglass of the TAU called *Viscous Time* uses transparent hand sanitizer gel. Ironically, this gel is a "boundary-making" substance due to its sanitizing capacity to kill microorganisms.

The gel mixture comprises active ingredients such as alcohol or ethanol and a thickening agent like polyacrylic acid for its viscous texture.[280]

This thickener stabilises the consistency of the substance and leads to a higher viscosity, which interfered in my experiments with the nature of a smoothly flowing fluid in an hourglass.

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[279] The test arrangement was launched in 1927 at the University of Queensland in Brisbane, Australia and indexed as the longest executed experiment in the *Guinness Book of World Records*. The extreme variation between the time intervals is explained by the installation of an air-conditioning system in the building in Brisbane in the 1980s. See for example: University of Queensland, Australia. 'The Pitch Drop Experiment | School of Mathematics and Physics.' http://smp.uq.edu.au/content/pitch-drop-experiment (accessed 21 September 2015).

[280] Pharmaceutical formulations use terms like *agent* and *active ingredient* to express the quality of a substance to have 'a physiological or chemical effect on something.' *Oxford English Dictionary Online*, s.v. "Active, Adj. and N." http://www.oed.com/view/Entry/1953 (accessed 21 September 2015). In contrast, thickening agents are called excipients or inactive substances due to their supporting, mediating quality. They serve as a kind of vehicle to achieve a particular outcome. Pharmaceutical Business Review, 'Excipients - Function From "Inactive" Components - Pharmaceutical Business Review,' *Pharmaceutical Business Review*. http://specialitychemicals.pharmaceutical-business-review.com/suppliers/spectrum-chemical/products/excipients---function-from-inactive-components (accessed 01 March 2016).

Fig. 115 - 119 Bettina Bruder, *Viscous Time*, 2015.

Such material interventions led to a substantial elongation of the course of time, as the gel needed more time to travel from the upper to the lower bulb (Fig. 105-109). Moreover, differences in temperature and moisture inside the bulbs affected the flow inside the bulbs. The gel hardly traversed the neck even over a period of several weeks. Furthermore, the substance turned gelatinous and opaque after a few months as the solvents evaporated interfering even more with a regular passage of time.

In another series of experiments to develop unconventional hourglasses, I tried to integrate mechanisms with flexible tubes and clamps between the two bulbs so that a user would be able to vary the flow rate of the filling substance traversing the narrow neck (Fig. 107). These prototypes turned out to be instable and not functional. For *Bubble Timer*, I worked with a glassmaker who produced according to my specifications reclosable hourglasses, which I filled with different liquids (Fig. 120-124). As hand sanitizer gel was too tenacious for the small neck of these vessels, dishwashing detergent seemed to be more suitable.
This substance produced many bubbles when the device was turned so that both bulbs were soon filled with globules of air. *Viscous Time* and *Bubble Timer* did not present the course of time as a solid, measureable stream. Instead, unpredictability and ephemerality were displayed vividly inviting a user to contemplate and observe the flow of time or maybe even to count with fascination the amount of bubbles passing through the neck.[281]

The revamped timekeepers took the idea of an automatically operating clockwork *ad absurdum* as manual intervention, external forces and material disobedience influenced the course of time. The linear passage of time was knotted, stretched or turned viscous, challenging any idea of a controlled flow of time with a universal validity and applicability. The devices required a different form of engagement and stimulated reflection about the variability and potential alterity of viewpoints (about time) by redirecting an observer's awareness and provoking unfamiliar associations. Usually, material forces and physical processes such as gravity, friction and flow rate are kept stable and regulated within a precision device. Now, these physical forces were invited and given a platform in such a way that matter became an agile and responsive substance revealing its undisciplined nature. Regular clocks turned into "disobedient timekeepers" that elicited new thoughts and experiences through their entangling capacity.

[281] Approximately 45 to 60 bubbles per rotation.

Fig. 120 - 124 Bettina Bruder, *Bubble Timer*, 2016.

Viscous Substances and Potato Time

The notion of time as a viscous substance and vicious concept is evoked by artworks such as Salvador Dalí's painting *Persistence of Memory* (1931). There, he expressed the difference between chronological time and alternative conceptions as softened watches hang down from dead trees melting in the desert while insects crawl over the clock faces expressing change and volatility. Conventional clock-time collapses and a predominant modernistic perception of time dissolves calling its durability into question. Such "materialised" images challenge conventional conceptions by expressing the ambiguous relationship between measurement, materiality and meaning.

Similarly, the work of conceptual artist Victor Grippo operates ideologically as well as secularly and scientifically. At first sight, his work *Tiempo* (1991) is reminiscent of a scientific experiment. The artist, who was trained in chemistry, powered a digital clock with the energy of four potatoes that were wired with copper and zinc electrodes (see an example in Fig.125). As the potatoes were organic, they decomposed challenging the idea of a steady flow of energy that is required to power the clock. Thus, the use of organic matter, like potatoes, implied an idea of variation and interdependency challenging the orderly representation of time. Moreover, one imagines that the clock would display an irregular course of time, as it may seem to tick more slowly as the potatoes decay.[282]

Grippo, like Pica, was an artist from Argentina. Conceptual art from "peripheral societies" such as Latin America is often associated with the notion of *ideological conceptualism*, political controversies and the desire to change existing conditions.[283] The impetus for making art in a climate of political dictatorships and societal change is the experience of repression, censorship and authoritarianism as explained by Mari Carmen Ramírez, curator of Latin American Art. She states:

> Translating this experience artistically in a significant way could proceed only from giving new sense to the artist's role as an active intervener in political and ideological structures.[284]

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[282] In this case the display of the clock faded and the clock ceased to function.
[283] Mari Carmen Ramirez, 'Blue Print Circuits: Conceptual Art and Politics in Latin America,' in *Latin American Artists of the Twentieth Century*, ed. Waldo Rasmussen, Fatima Bercht, and Elizabeth Ferrer (New York: The Museum of Modern Art, 1993), 156.
[284] Ibid., 158.

This form of doing art out of a controversial context aims to change and to uncover a particular social reality while it instigates the potential for transformation intellectually as well as practically.

Subverting Ideologies

In that sense, Grippo's potato clock intervened in ideological structures expressing critical ideas metaphorically, as they could not be expressed openly due to political repression. Products of everyday life were chosen in Grippo's work for their social and political implications. For example, the potato represents the life of a human being; the labour of a factory worker and the food of poor people. Furthermore, it is an indigenous plant from South America that was introduced to Europe changing eating habits worldwide, and ironically, representing a reversed form of colonisation. Hence, the potato is a metaphor for energy, change and transformation.

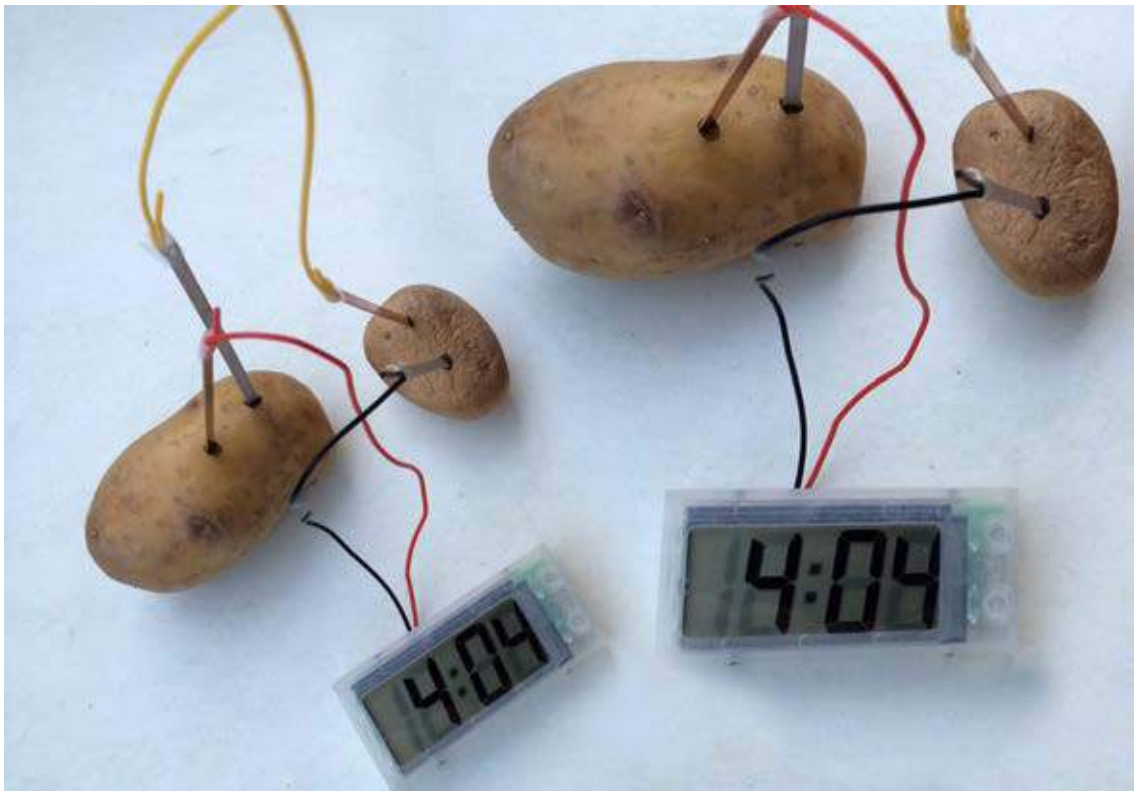

Fig. 125 Potato clock, scientific assembly kit for children, here by Funtime Gifts Ltd., London, 2016. The CC license does not apply to this picture.

Grippo's work is an institutional critique of the system of values and of socio-political conditions that keep the industrial production and the ideological foundations for any kind of supremacy valid. In this sense, the potatoes represented the energy that was needed to

preserve this particularly unbalanced and unethical system in Argentina—in a political, social and ideological sense. In an interview titled *Change Habits, Modify Consciousness* Grippo stated:

> Mankind further approaches greater knowledge all the time. The problem lies in its application, in its instrumentalization. The problem is that there is so little ethical development.[285]

Tiempo represents an alternative draft for future societies and ideologies. Intervening in the ideological separation of nature and culture, a belief that was set by the scientific positivism of modernity, *Tiempo* was part of the exhibition 'Animism' in Berlin.[286] Here, animism was proposed as an idea to challenge a predominant mindset of control and efficiency that conceptualises matter as innate and passive substance, which can be dominated and exploited. In contrast, the exhibition presented things and inanimate objects as active co-producers of quotidian reality. Such understanding puzzles Western epistemology and its reconfiguration has far-reaching consequences that affect politics and reality in an epistemological and ontological sense. The curator of the exhibition Anselm Franke states:

> Far from being a matter of abstract considerations, this is a battleground at the frontier of colonial modernity, and in the context of contemporary politics and aesthetics, it concerns the urgent question of the transformability and negotiability of ontologies, where claims to reality and the ordering of the social world are at stake.[287]

Here, colonialism is considered conceptually emphasising the imposition of a particular ideological framework with certain beliefs, standards and conventions. As the idea of quantifiable time is an ideological convention that depends on human imagination, it has the potential to change its relevance challenging the conventional construction of reality.

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[285] Alicia Chillida, 'Transformation: Becoming Aware,' Exhibition of Víctor Grippo's Work Deciphers the Hidden Meanings Found under Primary Objects. http://artdaily.com/news/64189/Exhibition-of-V-ctor-Grippo-s-work-deciphers-the-hidden-meanings-found-under-primary-objects#.Vf-W_M47Tn1 (accessed 21 September 2015).
[286] 'HKW | Animism - Exhibition 2012' Haus der Kulturen der Welt, Berlin, available at http://www.hkw.de/en/programm/projekte/2012/animismus/start_animismus.php (accessed 21 September 2015).
[287] Anselm Franke, 'Animism: Notes on an Exhibition | E-Flux,' available at http://www.e-flux.com/journal/animism-notes-on-an-exhibition/ (accessed 21 September 2015).

Both projects, *Tiempo* and the revamped timekeepers, disrupt the traditional concept of time by uncovering its transformability and respectively, its understanding. Both experiments work materially and metaphorically to cultivate a different sensitivity that may be able to account more adequately for subtle qualities and complex correlations that are not detected or reflected by conventional measuring devices.

Grippo's *Tiempo* is the precursor for a scientific experimental assembly kit for children that can now be purchased commercially (Fig. 125).[288] Such toys are used as educational tools in a learning context to explain the conversion of chemical to electrical energy. However, the conceptual possibilities implying the potential for a rigorous shift in human understanding are still not realized and used to their advantage. It appears as a "quantum leap" that is needed to overcome the deeply ingrained perception of a world that can be controlled, exploited and designed according to human-centric viewpoints. Such a shift would entail registering the need for radical change in what it may mean to think and act rationally, objectively and efficiently in a very different manner.

While *Tiempo* exemplifies organic matter in the form of potatoes that power an existing infrastructure (conceptually in regard to the idea of time and practically in the context of everyday life within a society) and thus reveal the inherent interdependency between socio-political, material and infrastructural concerns, measuring time with the TAU take the concept a step further. The reconfigured timekeepers *transform* inherent structures, which organise chronological time, societal order and ideological concepts. Thus, the timekeepers of TAU propose an intellectual playground for the experimentation with the time scale itself as a human made structure that rules scientific explanations and organisational processes in everyday life. As such, the reconfigured timekeepers encourage creativity and imagination in order to instigate an idea for change and improvement even of firmly set *mis*conceptions and established viewpoints. This radical shift I am asking for entails the ongoing re-configuration and re-negotiation of implications through amended meaning making devices and practices.

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[288] See for example: Industrial Development Limited, 4M, '4M Industrial Development Limited,' *4M INDUSTRIAL DEVELOPMENT LIMITED*, available at http://www.4m-ind.com/product_details.php?id=152 (accessed 6 March 2016). 'How to Make a Potato Clock,' *wikiHow*, available at http://www.wikihow.com/Make-a-Potato-Clock (accessed 6 March 2016).

The final experiment—*Organic Equilibrium*—explores ways how to communicate and foster such different understandings that do not aim for firmly set entities, clear causality or distinguishability. Instead, I aim to emphasize the notion of emergent change and interdependency by evoking a sense of care, verve and reconsideration to allow for a more dedicated engagement with the world.

4.3 *Organic Equilibrium*

The experiment *Organic Equilibrium* examines transforming spirit levels to become devices that may communicate and encourage the active renegotiation of current ruling concepts, which render the world organisable and manageable.[289] These reconfigured devices allow for wicked intricacies that cannot be marked and mastered and more importantly that cannot be ignored.

In ordinary usage, spirit levels are precision instruments, which are deployed to determine perfectly flat planes, either vertically or horizontally. Spirit levels comprise an air bubble that swims in liquid inside a small round tube (Fig. 128). When the bubble is in the centre of the tube it indicates the surface measured is flat. The filling substance is alcohol instead of water as it offers a higher frost resistance and lower viscosity maximising the applicability of the device. The substance minimises surface tension and other potential interferences that otherwise may occur due to low temperatures or dirt particles within the tube. The tool is called "spirit level" because of this spirit solution. Thus, the bubble moves freely in this fluid to detect straight and even surfaces.

Straight surfaces and rectangular shapes offer increased stability with controllable and expedient conditions. Hence, spirit levels are used in industrial, scientific and medical contexts for construction and orientation to provide a solid and stable reference level for balanced adjustment. Symbolically, spirit levels and weighing scales represent the balance between different interests implying themes of justice, order and harmony. The level and the scale exemplify tension and equity between two opposing poles (thesis and antithesis) aiming for a balanced order that becomes effective through a higher, impartial and unbiased power.[290]

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[289] The work of photographer Kevin van Aelst inspired me in the development of this range of balancing devices. Kevin van Aelst, 'Kevin Van Aelst.' http://www.kevinvanaelst.com/photoperfectstates.html (accessed 5 April 2014)

[290] For instance, Lady Justice personifies fairness and equity by representing judgements based on rational assessment and defeating partial or subjective evaluations. She is depicted with a weighing scale, often

In a figurative sense, the spirit level facilitates the validation of a just statement. In other words, the measurable factuality of a certain truth is measured and constructed on the basis of a binarism discriminating between angled and straight levels or between right and wrong answers. Balancing the bubble with a regular spirit level excludes values that do not comply with a well-balanced uniformity.

I have chosen to revamp spirit levels for this last experiment as they explicate the potential for solutions outside the binary paradigm of conventional meaning making, which is usually maintained through technoscientific objectivity. Spirit levels exemplify the need for on-going care and advocacy balancing out wicked conditions of unpredictability, change and complexity that cannot be grasped, addressed or explained with those measuring devices that deliver adjusted results according to a rigid logic. To do this, I purchased spirit levels off-the-shelf in a one-dollar-shop in Sydney and disassembled the individual parts – the vial, the housing and some screws. I embedded the vials into organic materials, such as fruits, vegetables, ice or clay as these substances have the capacity to decompose, melt, and transform (Fig. 126). Thus, the concept of one ideal, exact and clear judgement remains undetermined allowing alternative angles and ideas to emerge outside of the classic understanding of linearity and the idea that stability and fair objectivity could be established effortlessly.

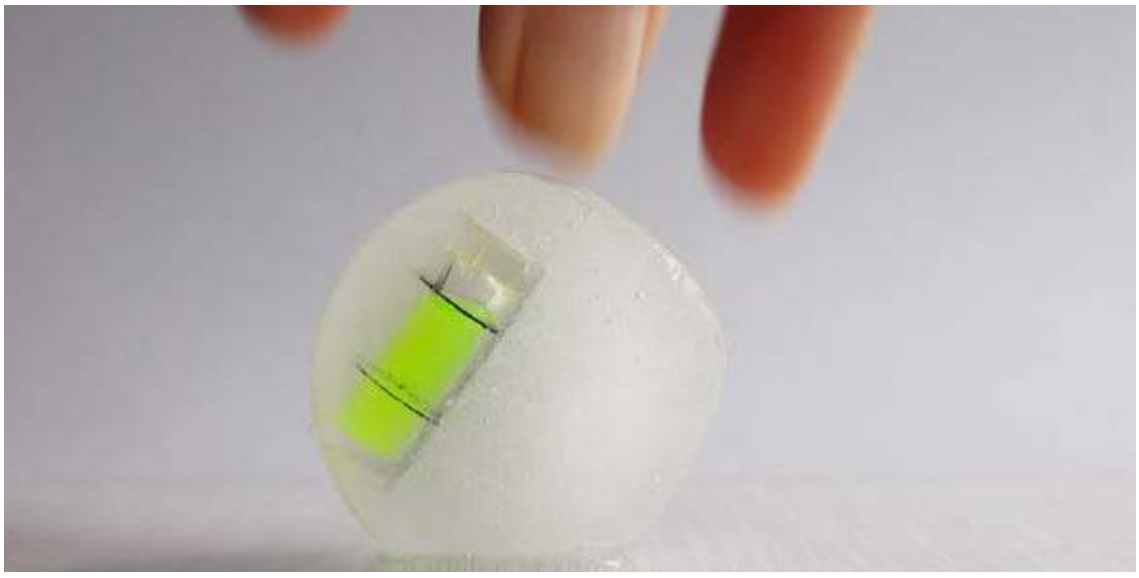

Fig. 126 Bettina Bruder, *Organic Equilibrium* with frosted spirit level, 2014.

blindfolded, suggesting objectivity according to a divine law. On symbolic interpretations for justice, see for example: Li-Fen Ke, *Poetische Gerechtigkeit?* (Frankfurt am Main: Peter Lang, 2008), 40.

Organic Equilibrium does not strive for a balance to indicate stability. Instead, a permanent requirement for manual intervention and adjustment is built into these devices as they are irregularly shaped and change over time. By using these devices, well-balanced stability and reconciliation are no longer a matter of durability and impartiality, but, on the contrary, a question of care, awareness and sensitivity that must be continuously invested in order to balance out the delicacy and on-going changeability that is reflected in the mutable spirit levels.

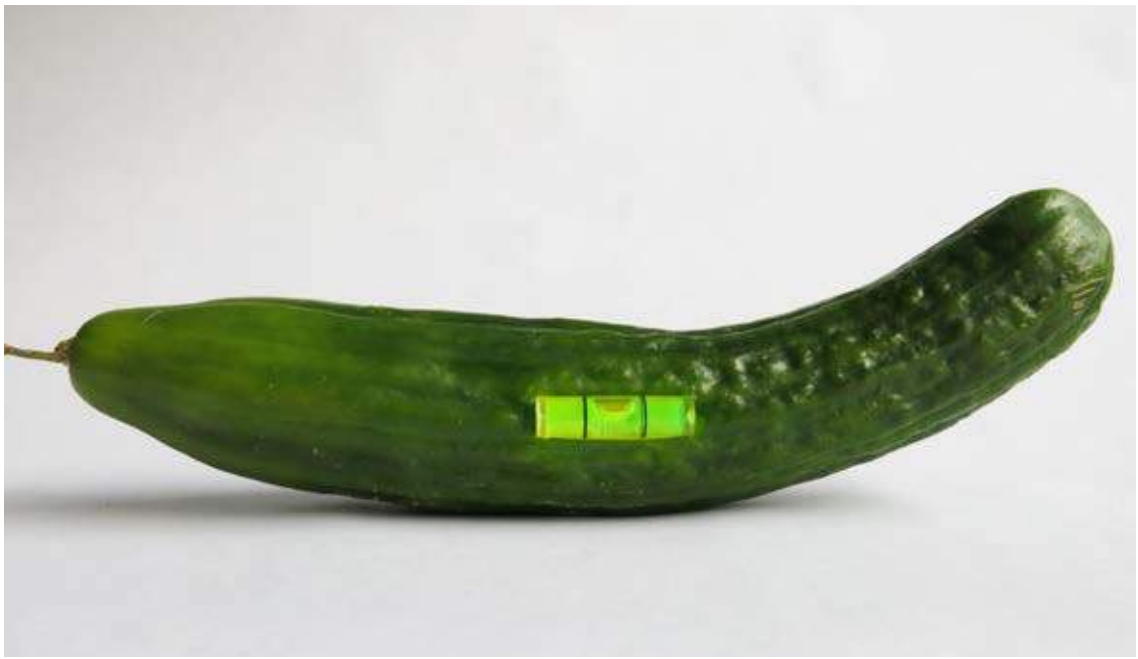

Fig. 127 Bettina Bruder, *Organic Equilibrium*, 2014.

In a statutory context this conflict of organic and instable reality versus human-made constructions became explicit in the *bent cucumber rule* – a series of laws passed within the European Union since the 1980s that determined the categorisation of fruits and vegetables in different trading classes according to their degree of curvature, skin colour and other quality factors.[291] Certain shapes and forms of agricultural products were prescribed by law leading to a selective preference for certain features, which ultimately fostered a particular monoculture.[292] TAU sought to subvert this selective approach by injecting alternative shapes

[291] SPIEGEL ONLINE, Hamburg. 'European Bureaucracy: Should the EU Sell Bent Cucumbers?' *SPIEGEL ONLINE*. http://www.spiegel.de/international/europe/european-bureaucracy-should-the-eu-sell-bent-cucumbers-a-562064.html (accessed 14 February 2016).

[292] These regulations were implemented to facilitate efficient procedures for harvesting, cleaning, packaging, storage, transportation and processing, thus ruling out irregular shapes and defective spots on vegetables or unripe fruits. Ultimately, this standardisation limited diversity and prescribed particular applications excluding potential other shapes, sizes and forms of processing and consumption. The laws exemplify the predominant focus on economic interests of efficiency and control within an agricultural production instead of considering the wider implications for society as these economically driven decisions

provoking different conditions and applications. *Organic Equilibrium* used decomposing and transforming materials that provoked imaginative reflection with the aim to change habits of perception. The parafunctionality of the revamped spirit levels may instigate a reconfiguration of meaning making. Instead of considering meaning as a stable and transferable information, dynamic interdependency being inherent in the concept of elasticity is communicated through *Organic Equilibrium*. The mutable spirit levels demonstrate a context dependence and continuous change that is explicated through organic and flexible materials requiring ongoing adjustment (Fig. 130).

The Bubble in the Mangle

The need for ongoing modification and adaptation within scientific practices is compared by Andrew Pickering with a *mangle* that operates in the relationship between human and material agency. Both sides are mutually 'engaged by means of a dialectic of resistance and accommodation'.[293] His concept outlines scientific practices as a 'dance of agencies' and emphasizes the emergent and performative qualities within knowledge production, describing science not as a straightforward undertaking but as 'a field of powers, capacities, and performances, situated in machinic captures of material agency'.[294] In a conventional approach, scientific experiments take place in carefully secured laboratories with the objective to obtain reliable, reproducible and repeatable results. Thus, in the case of a spirit level, space inside the tube is carefully secured and constructed as any mechanical resistance is diminished by the usage of alcohol maintaining seamless and efficient functionality. Increased surface tension and dirt inside the vial would reveal material interferences in the dance of agencies.

Pickering explains the mangle with the example of the elementary-particle detector in high-energy physics—the bubble chamber. He traced its development and the attempts of several research teams to enhance its functionality.[295] The intertwinement between material and

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negatively affect markets, farmers, consumers and the environment. The spirit levels built into organic fruits and vegetables exemplify this predicament.

[293] Andrew Pickering, 'The Mangle of Practice: Agency and Emergence in the Sociology of Science, *American Journal of Sociology* no. 99/3 (1993): 559.

[294] Andrew Pickering, *The Mangle Of Practice* (Chicago: University of Chicago Press, 1995), 7.

[295] Bubble chambers were used in particle physics to detect and document radioactivity. Radioactive substances left behind trails of their trajectories in a type of chamber filled with hot liquid. These trails could be photographically registered. Donald Glaser, a young assistant professor in physics in Michigan initiated first tests in the early 1950s. Luis Alvarez, a physicist at the Laboratory in Berkeley and a third team at the University of Chicago started a few years later with their experiments. On behalf of the various mechanical adjustments and further experiments with different liquids, Pickering examines the

human agency became apparent when one technician disregarded the requirement for structural purity of bubble chambers, which usually guaranteed their optimal functionality. The technician built a "dirty" chamber mixing metal and glass joints. This *mis*construction delivered surprisingly acceptable results. Pickering described the technical directive as a constraint that 'was discontinuously mangled – it disappeared – in material practice'.[296]

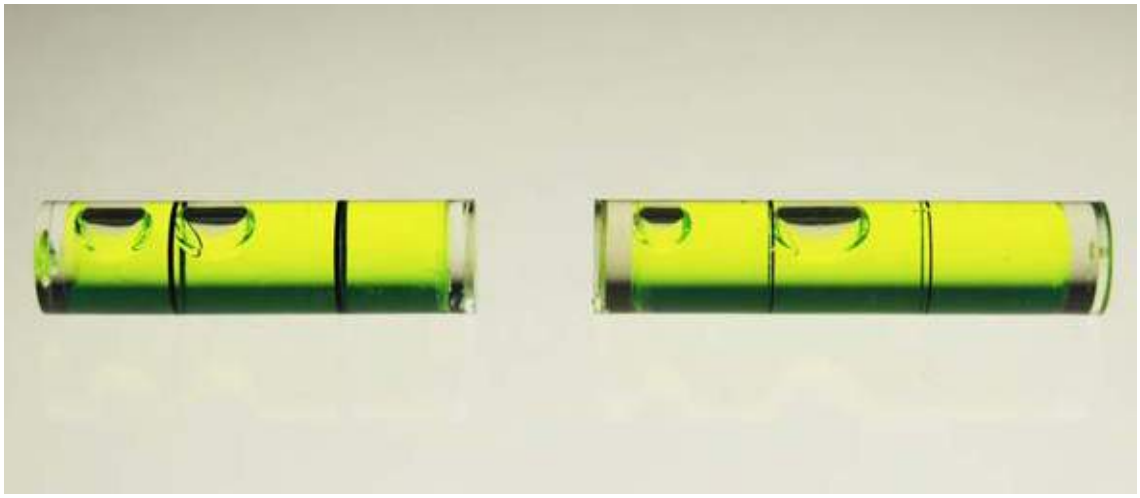

Fig. 128 Double standards (coincidence), bubbles in spirit, 2014.

Similarly as the previous concepts of apparatus and diffraction, the mangle is a metaphoric vehicle, operating as a thought-provoking device. On the one side, it is a reference to the first mechanical laundry apparatus with which water was wrung out of the wet laundry and the sheets were flattened. On the other side, it delineates practices of negotiation with wringing, tearing and consolidating where (a subject) matter is pressed and straightened.
For Pickering, the mangle is

> [A] word with a bit of an edge to it. It disrupts formal, philosophical discourse. It mangles it in a way. It is also a word for an equipment in the kitchen … It is a feminine metaphor which disrupts the masculinist discourse of philosophy and science.[297]

development of the chamber with a focus on materiality. The different substances that were used to fill the hermetically sealed room as well as the materials that were employed to construct the chamber generated unexpected results, influencing the research progress. These emergent constraints were accommodated and gradually refined through the experimenters' tinkering with the materials and with their theoretical understanding of the incidents. See Pickering, *The Mangle Of Practice*.
[296] Ibid., 67.
[297] Andrew Pickering, (2011) 'The mangle of practice and the mangle in practice. New studies on the established topic.' European University of Petersburg, available at http://www.youtube.com/watch?v=5HpXRwb8PT0 (accessed 20 November 2015).

The notion of disruption, mangling and elastification on a practical and a conceptual level activated by the fabrication of metaphorical devices runs through this entire art and design practice. I used the metaphor as a device to mobilise material agency, which in turn activated thoughts and imagination. Firstly, I manipulated the devices, but also the devices mangled themselves and finally they mangled human concepts and understanding by requiring the adjustment of assumptions and actions. Thus, TAU shifted the framework for interpretation and opened up sites for reflection and reconfiguration so that the revamped devices became exploratory participants in an alternative meaning making practice demanding unorthodox, experimental and creative approaches.

Assembly at the Dynamic Boundary

The remodelled spirit levels made this co-production apparent, as a user, a context and/or environment, the measured object, the result and the tool itself become participative constituents in the construction of reality. It is a productive assemblage that is described by Latour as 'a collective of humans and non-humans'.[298] Latour expands this notion of the collective by referring to the etymological meaning of a "thing", which is considered a compound of material and social aspects: in Nordic and Saxon societies the term *thing* was related to *gathering*, which were political meetings and deliberative assemblies where conflicts were settled and resolutions decided.[299] Pelle Ehn, scholar in art, design and communication, links Latour's 'object-oriented democracy' with *participatory design* when he examines agency in regard to humans (designers and users) and also non-human actants such as prototypes, artefacts, models and tools specifically in a design context.[300]

Ehn considers such designs as *boundary objects* adapting the concept from Star and Griesemer, who developed the idea as part of social studies of science to describe a certain flexibility within the representation of a subject matter. For example, language, visualizations, models or equations mediate between different participants and facilitate communication, cooperation and the coexistence of various models.[301] TAU like *Organic Equilibrium* instigate

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[298] Bruno Latour, *Pandora's Hope,* 174.

[299] Bruno Latour and Peter Weibel, *Making Things Public* (Cambridge, Mass: MIT Press, 2005), 22.

[300] An "object-oriented democracy" also termed "Dingpolitik" (translated *thing politics*) is proposed by Latour in Bruno Latour and Peter Weibel, *Making Things Public*, 14. *Participatory design* evolved in Scandinavia under the term *cooperative design* with the objective of joint decision-making to improve working conditions within organisations cooperatively by working with several shareholders of a collective. In this approach the diverse experiences and tacit knowledges of participants and users were integrated fostering cooperation and situation-specific solutions in a joint approach and not in a directive top-down manner.

[301] 'Boundary objects are objects, which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are

such moments of exchange and conversation through their material elasticity and extended responsiveness generating productive uncertainty.

This expanded approach linking participatory design with an object-oriented democracy considers tools and materials not only as devices with a technical function but also in their wider social and cultural context as objects and materials able to modify a particular interaction, belief or behaviour. That means objects are active participants within a dynamic ecology—Ehn uses the term *ongoing life-worlds* of people—providing an extended interpretive framework (materially, socially and culturally) for meaning making.[302]

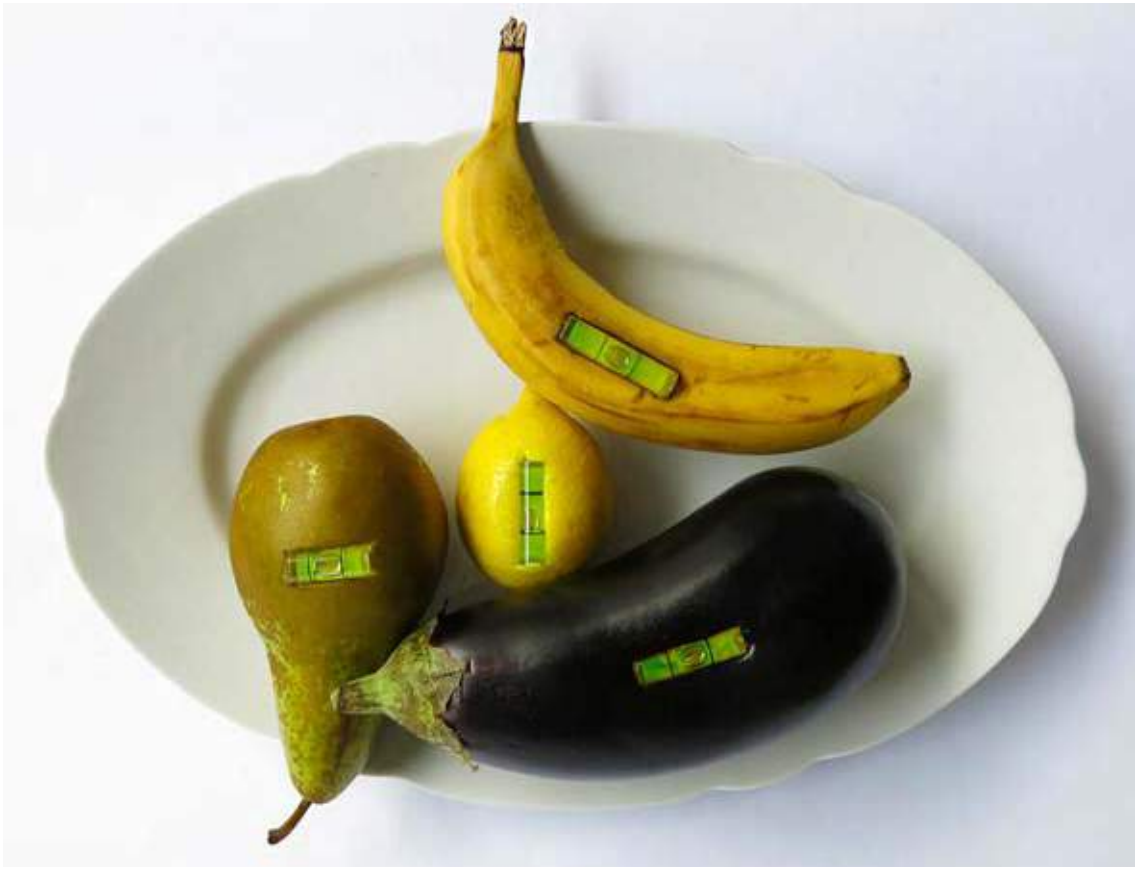

Fig. 129 Bettina Bruder, *Organic Equilibrium*, 2014.

weakly structured in common use, and become strongly structured in individual-site use. They may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is key in developing and maintaining coherence across intersecting social worlds.' Susan Leigh Star and James R. Griesemer. 'Institutional Ecology, Translations and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39'. *Social Studies of Science* 19, no. 3 (1989): 393.

[302] Pelle Ehn, 'Participation in Design Things,' *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*, PDC '08. Indianapolis, IN, USA: Indiana University, 2008): 93. http://dl.acm.org/citation.cfm?id=1795234.1795248 (accessed 30 April 2015).

An Ecological Ethico-Onto-Epistemology

The spirit levels from *Organic Equilibrium* make this greater comprehensive perspective apparent and playfully take the idea of one perfectly plain level, perfect value or unique solution *ad absurdum*. Chance and uncertainty become guiding factors giving accidental, unexpected and undesired qualities the possibility to occur. If the user insists on a "straight" angle it is necessary to tilt the device and to hold it actively in that position (Fig. 130).

The idea of an even stability that can be established and maintained without any further support or cooperation (by the user or with the assistance of another object offering support) is sabotaged and challenged. *Organic Equilibrium* does not provide a convenient either/or outcome but suggests a both/and approach. Applying the spirit levels humorously mobilises a simplifying mindset that prefers a reductionist approach bringing forth a combinatory and inclusive attitude. Formerly excluded forces like irregularity and unpredictability, are now invited into the meaning making process, evoking ideas of relationship, solidarity and situated judgement. *Organic Equilibrium* says in its weirdness that any measuring process is not a simple and effortless undertaking. Rather, a user is confronted with unusual constraints that challenge constructed notions of regularity and simple causation.

Fig. 130 Bettina Bruder, *Organic Equilibrium*, assisted, 2014.

The uneven surfaces and unruly devices require special care and sensitive skills in order to be grasped and handled. It is a thoughtful and slow venture that I associate with an 'ecology of practices as a tool for thinking' as described by Stengers.[303] She refers to Brian Massumi's concept of a political ecology as a 'social technology of belonging' where 'ecology is, then, the science of multiplicities, disparate causalities, and unintentional creations of meaning'.[304] The TAU provoke such challenging and enabling approaches to unpredictability. Operating on a relational and affective level, the tools resist conventionality and generalisation while fostering a sense of diplomacy and situatedness.

Connectivity and mutual contingency between different factors are utilized constructively and made apparent. A sense of belonging and interdependency is activated by the reconfigured measuring devices of TAU revealing the intertwinement of matter, meaning and measurement. The term *ethico-onto-epistemology* expresses such complementary relationality—an expression developed by Barad to contest the separability between reality and representation emphasising the entanglement between ethical responsibility, ontology and epistemology.[305] She states that 'ontological units are not "things" but phenomena' that are entangled and intertwined to draw attention to the contingent conditionality of being, knowing and ethics as each aspect is mutually implicated.[306] This ecology of practices is tied up with issues of responsibility and accountability explicating the political and ethical relevance of meaning making, boundary-setting and measurement.

The final discussion of artworks using measuring instruments like the spirit levels expounds the intertwinement between measurement, politics and ethics with the example of the controversies at the border between Mexico and the United States.

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[303] Isabelle Stengers, 'Introductory Notes on an Ecology of Practices,' *Cultural Studies Review* 11, no. 1 (2005): 186. See also: Isabelle Stengers, 'Another Science Is Possible!' A Plea for Slow Science,' presented at the Inaugural lecture Chair Willy Calewaert 13 December 2011, Faculté de Philosophie et Lettres, ULB (2011-2012).
[304] Stengers, 'Introductory Notes', 183. Isabelle Stengers, *Cosmopolitics 1* (Minneapolis: University of Minnesota Press, 2010), 34.
[305] Barad, *Meeting the Universe Halfway*, 185.
[306] Ibid., 141.

Boundary-work outside of the Comfort Zone[307]

The work *Cross Coordinates* from Ivan Abreu is associated with socially engaged art highlighting political and ethical concerns. He developed a peculiar spirit level to provide a platform for participants on the different sides of the border between Mexico and the United States to collaborate in order to find a cross-border equilibrium (Fig. 131). Abreu created the work *Cross Coordinates* 2010 for the bicentennial anniversary of Mexican's independence from Spain. The project challenged questions of cooperation and participation across political, social and geographical contexts. In a Situationist approach, it aimed to provoke the revitalisation of human encounters, which were jeopardised at that moment in time and at that specific location by illicit drug-trafficking between Mexico and the United States.

The illegal transactions of drugs versus money and weapons fuelled corruption and crime. The population in the border cities was in a desolate state of fear and insecurity.[308] It was a climate of distrust and hostility, where Abreu intended to offer a site for potential convergence, engagement and togetherness in the form of a collaborative game with the spirit level. The device was set up in three scenarios – in public space, in a gallery setting and online. Random people from the street, but also invited politicians, industrialists and academics were involved playing the game together with the objective of bringing the device into balance. Balancing out the spirit level was a challenging process due to the extraordinary length of the device, which requested finesse, sensitivity and a tacit form of communication that required the participants to coordinate their interaction.

The project in the gallery and online recorded the duration of the meetings. This time was converted into kilometres with the aim to surpass the length of the U.S./Mexican border. The goal was achieved when the project was presented 2012 at Ars Electronica.

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[307] I borrow the term *boundary-work* from a paper by Thomas F. Gieryn. Researching the sociology of science, he developed the concept of boundary-work to show that science constructs techniques of demarcation and division in order to distinguish scientific practice from non-scientific activities but also to maintain differences between the different academic disciplines. Gieryn claims that scientific ideology aims for the political independency, monopolisation and preservation of scholarly sovereignty. Thomas F. Gieryn, 'Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists,' *American Sociological Review* 48, no. 6 (1983): 781.

[308] For example, the Mexican border city Ciudad Juárez was described in 2010 as the 'global murder capital.' Katie Amey, 'Juarez, Mexico: From "Murder Capital" to Tourist Attraction?' *Mail Online*, 2 July 2015.
http://www.dailymail.co.uk/travel/travel_news/article-3147436/The-difficult-PR-job-world-Mexican-city-considered-global-murder-capital-attempting-lure-tourists-back.html (accessed 14 February 2016).

Fig. 131 Ivan Abreu, *Cross Coordinates*, 2010. The CC license does not apply to this picture.

The particular challenges of complexity and unpredictability within Abreu's project were outlined by Kate Bonansinga, the director of the Rubin Center of the University of Texas in El Paso, which commissioned *Cross Coordinates* in 2010. She draws a link between net-art and art engaged with social and political interests when she states:

> Both new media art and socially engaged art are based on systems and on interdependence: political scientists might use the terms "collectives" and "cooperatives," socially engaged artists might use "dialogic systems" and "collaboration," and new media practitioners might use "interaction" or "open systems".[309]

This perspective explicates the notion of an ecology where various (f)actors are intertwined and interact with each other. With the TAU, I intended to expand this understanding of dynamic relationality. I used devices, materials and the rigid logic of technology to offer a platform for mutual encounters assembling various actants and agencies. In other words, measuring devices were considered not only as structuring and boundary-making apparatuses but also in regard to their generative, performative and collaborative agency that assembled and entangled different (f)actors and stakeholders within a situation.

[309] Kate Bonansinga, *Curating at the Edge: Artists Respond to the U.S./Mexico Border* (Austin: University of Texas Press, 2014), 183.

Fig. 132 Ivan Abreu, *Cross Coordinates*, educators from Mexico and the United States balancing, 2010. The CC license does not apply to this picture.

While *Cross Coordinates* addressed questions of collaboration and agreement between various human participants, *Organic Equilibrium* extended the scope of potential collaborators to non-human forces emphasizing the performative agency of the tool itself but also the agential aspects of the employed materials, the environment, the user and the outcome that are all entangled in a collaborative meaning making process.

Bonansinga underlines these reassembling and communicative qualities in a participatory, social perspective by drawing on Grant Kester's concept of *dialogical art*, which instigates an 'active, generative process that can help us speak and imagine beyond fixed identities, official discourse and the perceived inevitability of partisan political conflict'.[310]

Organic Equilibrium attempts to expand this process to instigate imaginative exploration and new approaches to complexity and uncertainty beyond scientifically driven ideologies and rational or habitual models of thought that underlie current forms of human action.

Both works – *Cross Coordinates* and *Organic Equilibrium* – activate the associative and collaborative aspects within an encounter. While *Cross Coordinates* facilitates the revival of

[310] Grant Kester as cited in Bonansinga, *Curating at the Edge,* 184. Grant H. Kester, *Conversation Pieces: Community and Communication in Modern Art* (Berkeley, California: University of California Press, 2004), 8.

"frozen" relationships between humans and the renewal of social interaction by mobilizing cooperation across borders, *Organic Equilibrium* provokes new meaning and different forms of encounter by disclosing the material agencies that collaborate with humans and intra-act within a measuring process. Meaning making is presented as a participative and social practice between various human and non-human materials to offer a site for the development of more responsible relationships between humans and the world.

Unforeseen and Restless

Encounters with mutable materials within measuring processes may create new values and alternative practices so that unpredictability and irregularity can be taken into account and persistent ideas of conventional rationality and clear-cut efficiency may be surpassed.

With the three groups of experiments presented within this chapter – *Cups for Alice, Time Stretchers* and *Organic Equilibrium* – I contextualized the material agency of measuring devices to provoke alternative discoveries by means of emergent processes, transforming substances and unpredictable deflections. These irregular deformations generate new compositions and relationships prompting imaginative engagement and curiosity in developing more situated and adequate approaches to deal with complexity and uncertainty in new and constructive ways. The approaches that were developed under the premise of *Elastic Design* propose a performative meaning making practice: not exclusive, disembodied and in isolation but responsive to contingencies, intensities and resistances that are activated by material agency. It is my hope that complex and controversial situations may be understood and negotiated differently so that an alternative and more viable reality can be envisioned and constructed.

Postscript

In order to facilitate this socio-cultural transformation, I implemented the new *Elastic Metric System* on a temporary basis as an intervention at several places in public space.[311]

Fig. 133 Bettina Bruder, installing the *Elastic Metric System* temporarily in public space, 2014.

[311] Documentation in the Appendix.

CONCLUSION

> 'We need new forms of literacy to decode today's world.' [312]
>
> 'Brilliant! Let's create a new way!' [313]

Elasticity as a concept and as a material component injected into measurement and representation, fostered alternative forms of understanding about unruly and complex reality, which is presently tackled with rigid concepts, reductionist attitudes and orderly models of thought. I argued that the mechanistic conceptions of established science, smart technologies and a commodifying economy are too deterministic, simplified and stale to understand and address the wicked problems of our times. Conventional approaches of control, detachment and dissection restrict our ways of thinking, limit creative action and confine our imaginative skill-set. They permeate an innovative (design) practice by forming a resistant force in developing creative approaches and fresh perspectives for a viable future.

I sought to address the intricacies of reality through different means and explorations motivated by the concept of elasticity, which I applied to notions of rigidity and order exemplified by measurement and standards. In 'Preliminary Measures', I introduced metrology, standards, and protocols as the foundation for my experimental practice-based research. Elasticity assisted in 'Unmeasuring and Liquefaction' to unlock and dismantle established forms of measurement and standardisation through gentle interventions and playful disruptions. Shifting conventional understandings inspired experimental thought and action fostering alternative forms of meaning and making. In 'Rescripting Ready-Made Experiences', I developed deviating forms of interaction with communication technology tweaking visual representation and perception of factual information. These experiments "forced" new forms of embodied understanding through an aesthetic of dynamic uncertainty and variability. 'Wicked Entanglements' encouraged inventive and participative meaning making as a social process co-producing knowledge with uncontrollable factors. Here, measurement was modified and became a collective practice situated within enriched conditions of multiplicity and probability; this collective included the agency of non-human

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[312] Rosi Braidotti, philosopher and feminist theoretician links critical thinking as a nomadic, subjective practice with Haraway's situated knowledges proposing a visionary *process ontology* to account for the complexities in fast-changing societies. Rosi Braidotti, 'Posthuman, All Too Human,' *Theory, Culture & Society* 23, no. 7–8 (2006): 200.

[313] Overheard comment during an exhibition where the audience could engage with the *Elastic Standard Metre*. Exhibition 'Double Whammy', curated by Mike Barnard for Platform72 & *Art Month* Sydney, 05.-26. March 2013.

matter as an active collaborator in the production of knowledge subverting notions of objectivity, control and certainty while different approaches, insights and discoveries were motivated. Consequently, *Tools for Alternative Understandings* may cultivate a different sensorium and stimulate unconventional thoughts through their material-discursive agency catalysing more engaged and responsive forms of meaning making with different viewpoints and courses of action.

Deflecting and dispersing the rigidity of measurement by using ambiguity and uncertainty as inspirational forces was integral to this studio practice. It allowed me to experiment with various strategies and techniques in a transversal mix of methodologies. Building on Haraway's situated knowledges and expanding Barad's approach to agential interpretation informed by the uncertainty of measurement in quantum physics, *Elastic Design* recalibrated established forms of knowledge production through reconfigured measurement provoking alternative (design) approaches to wicked complexity. Such opportunities allowed experiencing indeterminacy and open-endedness and stimulated the social imaginary about intricate realities. Contrary to conventional measurement that produces Cartesian Cuts implicating absolute objectivity, order and manageability, *Tools for Alternative Understandings* complicated a situation experimentally revealing innate power structures and unnoticed relations. Rather than denial, simplification or exclusion, these yet unrepresented and unimagined relations require different approaches. Thus, the alternative understanding that I associated with the term *Fingerspitzengefühl* (fingertip feeling) provoked a more thoughtful engagement with reality taking underprivileged, unnoticed and unexpected interests into account. In other words, *Tools for Alternative Understandings* are devices to recalibrate human sensitivity and reshape ideas about convenience, scientific rationality and economic efficiency.

Elastic Design as an experimental methodology presented a conceptual and visionary modification for design. While speculative design offered the field for my practical encounters, critically engaging with future scenarios, it remains within present ruling logic of design reproducing power imbalances and structural inequalities—conceptually and politically. Hence, *Elastic Design* may operate as a conceptual and political enhancement for speculative design injecting alternative dimensions for epistemological and ontological considerations whilst indicating an implicit interdependency. It proposes the diversification and contestation of conventional approaches for knowledge creating new forms of negotiation and meaning making by challenging what is considered meaningful and what is ignored

(through conventional measurement). Elasticity is engendered by the *Tools for Alternative Understandings* deploying unpredictability through material agency and rendering uncertainty tangible stimulating tactile encounters, which evoke intellectual and thoughtful responses. As such, the reconfigured measuring tools offer an experimental and experiential laboratory coupling theoretical inquiry with practical engagement to induce alternative models of thought besides disciplinary narratives. This shift in meaning making has ethical and political implications linking Latour's call for an "alternative design" with the possibilities for intellectual transformation and empowerment, which were realised through an elastified speculative design practice.[314] Uncertainty was used within this approach as an opportunity to reconfigure engagement, discourse, and conceptions creatively. Hence, the project's field of action is synchronistic with cultural, social and political concerns aspiring to emancipated approaches for current and future challenges of complexity.

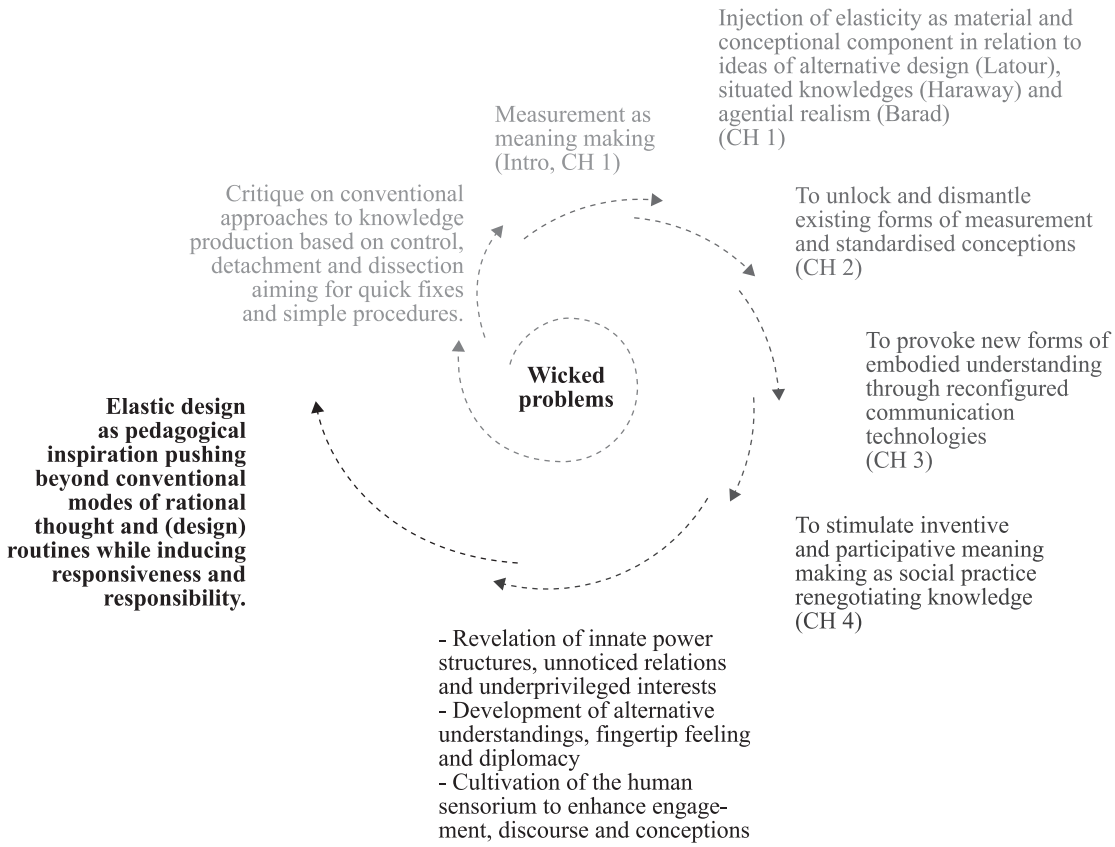

Fig. 134 Diagram with summary of key points.

[314] Bruno Latour, 'A Cautious Prometheus? A Few Steps toward a Philosophy of Design (with Special Attention to Peter Sloterdijk).' Cornwall: Design History Society Falmouth (2008): 13.

Prevailing design practice seems to negate the wickedness of current problems aiming for quick fixes in an authoritarian approach and a selective mindset. Instead, *Elastic Design* can be used as a catalyst for change. I describe the concept as a pedagogical inspiration to unravel established attitudes and systems of thought through its imaginative and playful quality not only in the practice of design and research but also in other areas of human understanding. It is a conceptual approach to access and allow uncertainty and complexity in an intelligible way; opening up sites for transformation and renovation whilst pushing beyond the boundaries of conventional modes of rational thought and operation.

This situated and emergent form of knowledge making takes unpredictability, multiplicity, and contradiction into account constructively, capitalising on the ideological tension between order and disorder. Thus, *Elastic Design* fosters explorative flexibility and simultaneously, the concept accounts for limitations and constraints. Through its inherent instability, the approach requires constant care and renegotiation triggering a material and performative form of thinking and understanding. *Elastic Design* does not promote an "anything-goes" attitude.[315] On the contrary, it insists on a responsive being, and responsible doing, in a wicked world of multiple realities. *Elastic Design* is an experiment about alternative being, doing and thinking. This transformative change can be realised through intra-actions by, and interactions with the *Tools for Alternative Understandings*.

[315] Paul Feyerabend, *Against Method*. 3rd ed. (London, New York: Verso Books, 1993), 14.

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APPENDIX

$$\sqrt{196} + (4 \times \frac{101}{2}) + 2$$

Table 2: ***Elastic Standard Metre***

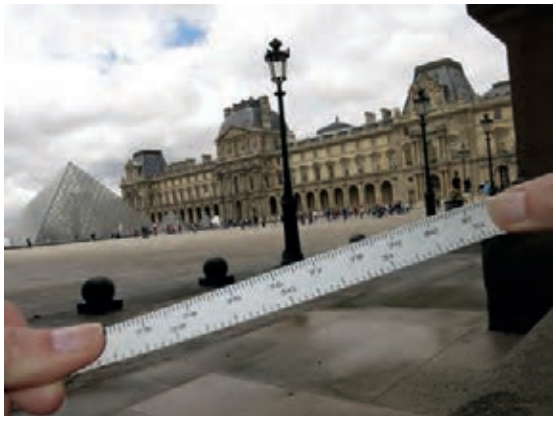
Un-measuring performance in Paris, measurement results

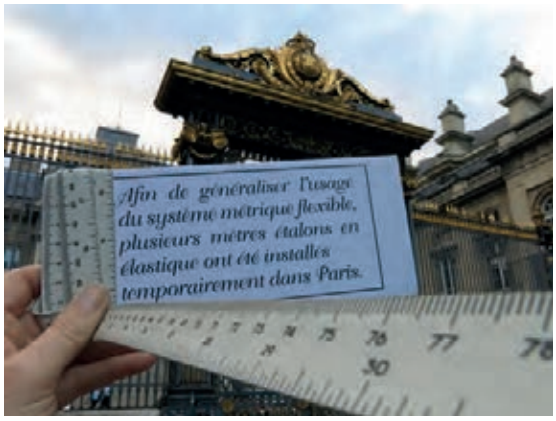
Date	**metric measurement in centimetres**
23.05.2013	88.0
24.05.2013	85.0
25.05.2013	73.7
26.05.2013	99.8
27.05.2013	78.0
28.05.2013	67.5
29.05.2013	99.6
30.05.2013	69.0
31.05.2013	82.9
01.06.2013	90.4
02.06.2013	93.7
03.06.2013	60.2
04.06.2013	74.0
05.06.2013	66.6
06.06.2013	58.8
07.06.2013	78.0
08.06.2013	99.3
09.06.2013	78.2
10.06.2013	86.0
11.06.2013	97.8
12.06.2013	99.4
13.06.2013	68.5
14.06.2013	77.6
15.06.2013	66.7
16.06.2013	94.8
17.06.2013	74.7
18.06.2013	89.5
19.06.2013	97.4
20.06.2013	100.0
21.06.2013	87.4
22.06.2013	67.5

Table 3: ***Unstationery***

Measuring ISO 216, standard A4 paper measurement results

Date	**paper format in centimetres**
01.07.2013	12.0 x 18.0
02.07.2013	08.0 x 13.5
03.07.2013	20.0 x 08.5
04.07.2013	16.0 x 16.0
05.07.2013	56.5 x 52.0
06.07.2013	14.5 x 19.0
07.07.2013	11.0 x 18.0
08.07.2013	12.7 x 10.2
09.07.2013	19.5 x 12.0
10.07.2013	28.0 x 19.0
11.07.2013	63.5 x 41.0
12.07.2013	27.0 x 20.0
13.07.2013	36.5 x 18.0
14.07.2013	14.2 x 19.3
15.07.2013	10.1 x 14.0
16.07.2013	14.5 x 19.0
17.07.2013	20.0 x 29.1
18.07.2013	13.3 x 19.5
19.07.2013	17.0 x 10.7
20.07.2013	14.7 x 10.8
21.07.2013	29.0 x 33.0
22.07.2013	07.0 x 04.5
23.07.2013	08.0 x 04.5
24.07.2013	04.0 x 06.0
25.07.2013	18.0 x 21.0
26.07.2013	23.0 x 36.0
27.07.2013	22.0 x 18.5
28.07.2013	15.2 x 11.4
29.07.2013	12.0 x 15.4
20.07.2013	16.0 x 12.7





Bettina Bruder, reinstallment, *Elastic Metric System* at 16 historical places of the *monuments métriques* of 1796 in 2013:
Fig. 135 Porte Antoine (Bastille)
Fig. 136 Place Maubert
Fig. 137 Palais National
Fig. 138 Pont Neuf
Fig. 139 Palais de Justice
Fig. 140 Place de Grève
Fig. 141 Gallerie des Tableaux, Louvre
Fig. 142 Jardin des Plantes



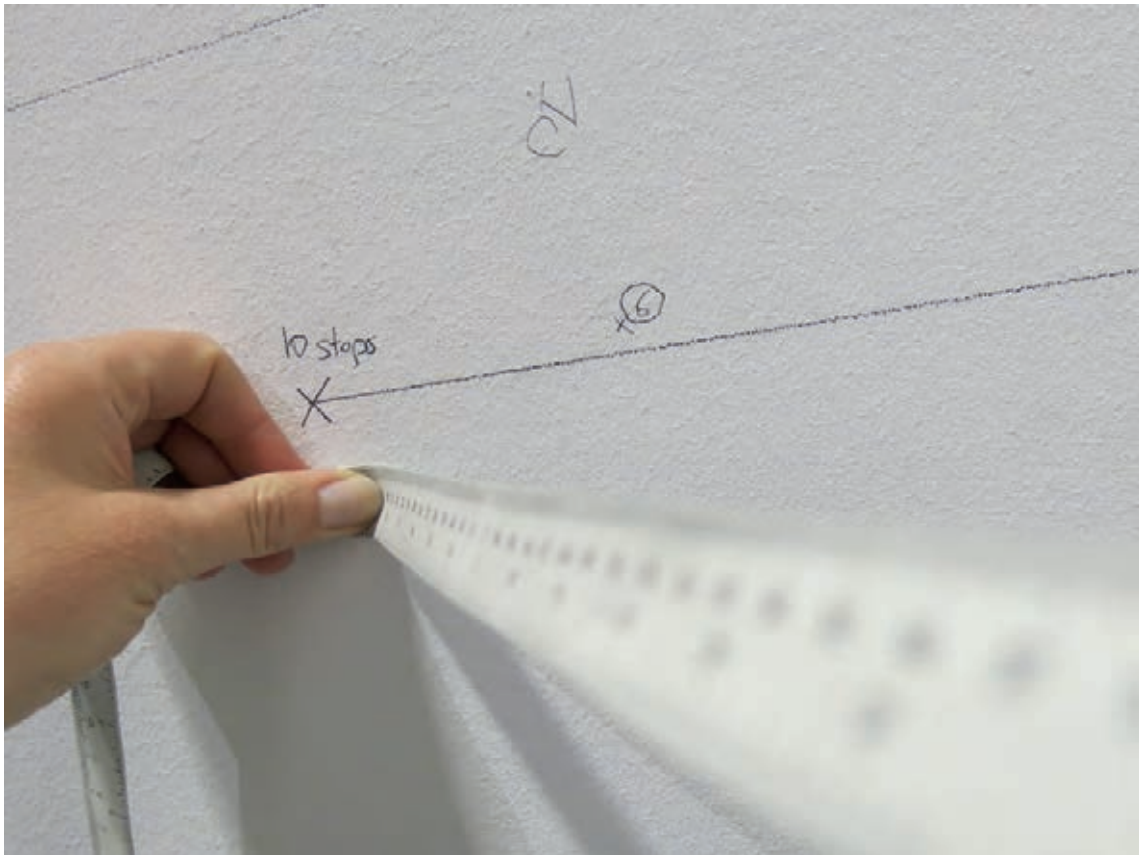




Bettina Bruder, reinstallment, *Elastic Metric System* at 16 historical places of the *monuments métriques* of 1796 in 2013:
Fig. 143 Porte Martin
Fig. 144 Porte Denis
Fig. 145 Place Vendome
Fig. 146 Rue Denis, près la rue aux Ours
Fig. 147 Boulevard des Italiens
Fig. 148 Bibliothéque Nationale
Fig. 149 Poste aux Lettres
Fig. 150 Palais Egalité

Bettina Bruder, reinstallment of the *Elastic Metric System* at public places, museums, galleries, historical landmarks:

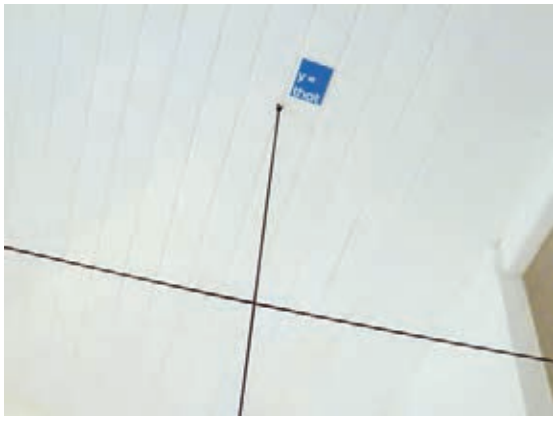
Fig. 151 près de l'arc de Triomphe
Fig. 152 Deutsches Museum, Munich
Fig. 153 Limes, Roman boundary wall
Fig. 154 Venice Biennale 2013
Fig. 155 Centre Pompidou



Bettina Bruder, unconventional measurements with the *Elastic Standard Metre*:

Fig. 156 Interfering with a measuring performance at Palais de Tokyo, 2013

Fig. 157 Measuring the Eiffeltower, 2013
Fig. 158 Smelling the *Elastic Standard Metre,* 2013
Fig. 159 - 160 Stretch test with 2 kilogram, 2013









Bettina Bruder, rubberband installations and exhibitions as an exploration of diagrammatic thought inspired by elasticity in the course of this project:

Fig. 161 Sheffer Gallery, This, that and the other, 2013
Fig. 162 PopUp in the Rocks, Sydney, 2011
Fig. 163 People engaging with the installation
Fig. 164 People engaging with the installation
Fig. 165 Open studio, Cité des Arts, Paris, 2013
Fig. 166 Open studio, Cité des Arts, Paris, 2013
Fig. 167 Zeropoint, Sort off track, Redfern Biennale 2014
Fig. 168 PopUp in the Rocks, Sydney, 2011

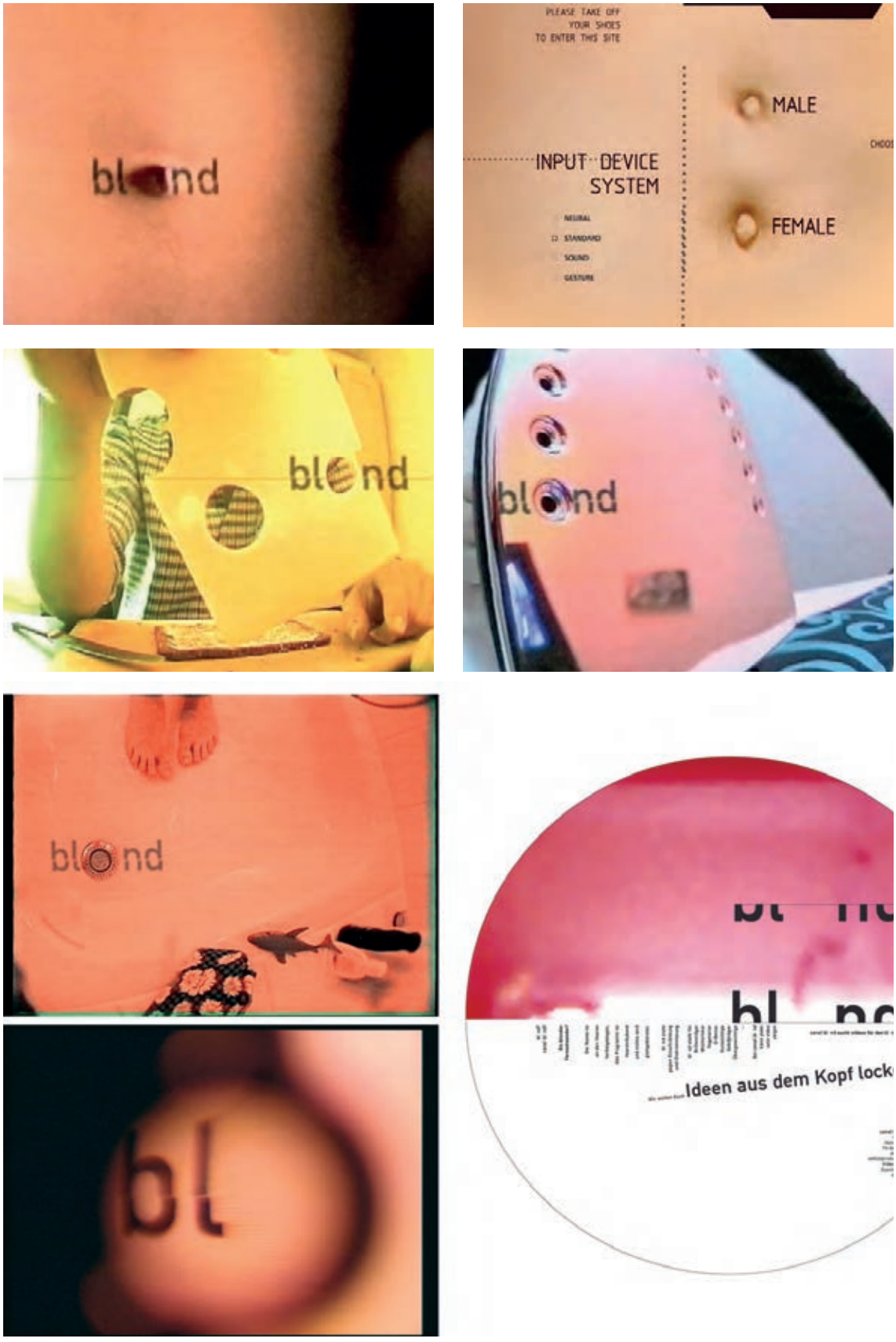


Fig. 169 - 175 Bettina Bruder, *canal blond*, 1997. Station ID for open TV channel broadcasting homemade videos. Deployment of household appliances, belly buttons and optical devices as reference points offering escapes to irrationality with imaginative encounters. The CC license does not apply to these images.

Fig. 176 - 180 Bettina Bruder, *nearly nothing*, 2002. Interactive installations using household appliances to mediate immateriality and intangibility. The CC license does not apply to these pictures.

An exploration on the relasticity of culture

How to cope with instability and flux in human culture as part of changing, flexible networks. How to make these transformations tangible.

„What is meant by interpretations, flexibility, and fluidity is simply a way to register the vast outside to which every course of action has to appeal in order to be carried out. This is not true for just human actions, but for every activity. Hermeneutics is not a privilege of humans but, so to speak, a property of the world itself. The world is not a solid continent of facts sprinkled by a few lakes of uncertainties, but a vast ocean of uncertainties speckled by a few islands of calibrated and stabilized forms.“

Latour, B. (2005). Reassembling the Social. An Introduction to Actor-Network-Theory. Oxford University Press

The ongoing discourse and interest to define and sharpen terms and definitions underpin the hypothesis of my research that we encounter a dilution of perceived orders and structures.Boundaries of meanings and definitions are blurred, flexible interpretations can be found, heterogeneous needs and expectations can be observed in different areas like science, law, art, philosophy, communication, economy.

Bruno Latours investigation and description of knowledge production shows, that the system of practices crosses fields and disciplines. Through this openness, new insights and structures become possible, new interpretations can be made. An increasing interest in the application, socialisation and transdisciplinarity of knowledge can be identified. My own research project oscillates in this stress field of human culture.

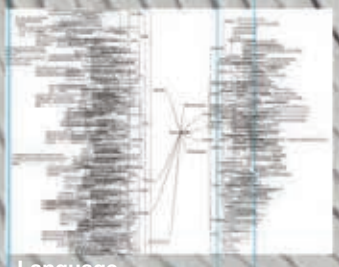
Research question:
How to cope with current sociological areas of instability and flux in human culture and how to take into account that we are part of changing, flexible networks with an increasing dissolution of structures, meanings and definitions? How to make transformations tangible and explicit?

Methodology:
artistic, practice based research, questioning conventions and standards, searching for alternatives and possible strategies for future systems of communication.Offering different perspectives by subtle destabilizations.

Inaccuracy in cultural constructions gives room for development and innovation. I am interested in processes of conditioning, the assignment of meaning and translation.

The argument of elasticity within the formation of a worldview will be developed by investigating in the specific area of standards and perception. I am suggesting that manmade decisions and organisations of knowledge are not as rigid, infallible and axiomatic as they are confirmed in standards and conventions. Poststructuralism questioned and analysed these forces by the general practice of destabilization of meanings and deconstruction. My research on the elasticity of standards is based on these movements. A range of recent authors like Jane Bennett, Bruno Latour and Peter Sloterdijk explain the complex situation with terms like acteur-network-theory, agents, spheres and vibrant matters.

This tendency in philosophy, arts and science can be described as the attempt to make the connections tangible and elucidate the interrelations between most different areas in human culture. The practice of analogies – the rational process of transferring information from one area of research interest to another particular subject is a common technique in arts and science to foster knowledge.


Language


Standards


Diagrams


Nature - Permaculture

Fig. 181 Bettina Bruder, poster for presentation University Bern, Winterschool, *Transforming Knowledge and Epistemic Cultures*, 2012.
The CC license does not apply to this poster.

Media Arts, COFA
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Fig. 182 Bettina Bruder, poster for open studios at Cité Internationale des Arts, Paris, 2013. Exhibition of *Disorienting Descartes, Elastic Standard Metre* and rubberbands. The CC license does not apply to this poster.

Fig. 183 Participation in exhibition at Griffith University Gallery, Brisbane, 2015, *Experimental Thinking / Design Practices.* Exhibition of *Ortho* and *Cups for Alice.* The CC license does not apply to this poster.