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# INTERFACE CRITIQUE

## DIAGRAMMATIC OPERATIONS



2023  
004

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# **INTERFACE CRITIQUE**

## *DIAGRAMMATIC OPERATIONS*

Edited by Florian Hadler, Daniel Irrgang & Alice Soiné

Guest editor: Christoph Ernst

# Contents

Christoph Ernst & Daniel Irrgang	
<b>EDITORIAL: DIAGRAMMATIC OPERATIONS</b>	<b>7</b>
Johanna Drucker	
<b>DIAGRAMMATIC INTERFACE</b>	<b>17</b>
Jan Distelmeyer	
<b>WHICH OPERATIVITY? ON POLITICAL ASPECTS OF OPERATIONAL IMAGES AND SOUNDS</b>	<b>23</b>
Kim Frederic Albrecht	
<b>POST_NETWORK</b>	<b>35</b>
Nina Franz	
<b>TACTILITY, SOUND AND DIAGRAMMATICS.</b>	
<b>ULTRASOUND IMAGING AS AN INTERFACE TO THE WOMB</b>	<b>43</b>
Aleksandra Domanović	
<b>DUPLEXES</b>	<b>51</b>
Vilém Flusser	
<b>TOWARD A MAP OF THE BODY</b>	<b>69</b>
Hana Yoo	
<b>SPLENDOUR IN THE GRASS</b>	<b>83</b>
Daniela Wentz	
<b>THROUGH THE AUTISM GLASS.</b>	
<b>BEHAVIOURIST INTERFACES AND THE (INTER)ACTION ORDER</b>	<b>87</b>
Jonathan Zong	
<b>POINTING, MUTUAL INTELLIGIBILITY, AND THE SEEING SUBJECT IN HCI</b>	<b>95</b>
Dora Đurkesac	
<b>SEA SOMA</b>	<b>107</b>
Maria Knilli, in cooperation with Lena Knilli ( <i>hear</i> , a video collage)	
<b>RADIO IN MIND – A CONVERSATION WITH FRIEDRICH KNILLI</b>	<b>117</b>

## **SPECIAL SECTION: INTERFACES AS EXPERIMENTAL ARRANGEMENTS**

Christoph Ernst, Timo Kaerlein & Sabine Wirth

**INTRODUCTION SPECIAL SECTION** 133

Christoph Ernst

**DECONTEXTUALISING 'SCIENCE FICTION PROTOTYPING'** 137

Timo Kaerlein

**CULTURES OF EXPERIMENTATION:**

**TESTING INFRASTRUCTURES IN THE WEB AND BEYOND** 149

Sabine Wirth

**INTER|FACE EXPERIMENTS: FACEAPP AS EVERYDAY AI** 159

## **APPENDIX**

BIOGRAPHICAL NOTES 171

POSTSCRIPTUM 177



# EDITORIAL: DIAGRAMMATIC OPERATIONS

By Christoph Ernst & Daniel Irrgang

*“I believe I may venture to affirm that an intelligible relation, that is, a relation of thought, is created only by the act of representing it. [...] As Diagram, it excites curiosity as to the effect of a transformation of it.”*  
– Charles S. Peirce (1906)

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The fields diagrammatics and interface studies have long been seen as related.<sup>2</sup> Given the fact that diagrammatics is the study of the epistemic properties of materially inscribed externalized signs, which are well known for – but *not* limited to – their use in information visualization,<sup>3</sup> the connection between the two fields is easy to understand. Take for example the well-known class of graphical user interfaces (GUI). A GUI relies on semiotic elements that are spatially distributed according to interrelations they signify. Such elements constitute as visual interfaces an “operational space” (“Operationsraum”)<sup>4</sup> in a medium (e.g., a touchscreen). According to this notion, the interactive visual space of a GUI can be treated as a diagrammatic configuration. As such it is part of a certain “form of relation” between users and computers that has been considered typical for an interface. As Branden Hookway states, “the interface is treated here as a *form of re-*

*lation*. This is to say that what is most essential to a description of the interface lies not in the qualities of an entity or in lineages of devices or technologies, but rather in the qualities of relation between entities.”<sup>5</sup>

Given this notion of the interface, a GUI or website organizes information and possible actions in a specific way, a ‘two-dimensional space’ of interrelations which can be regarded as ‘diagrammatic’ and thus analyzed by using concepts from diagrammatics. Such a connection between semiotic forms of information visualization (in the broadest sense), its multiple forms and historical roots, and the various practices of designing the use of digital media technology is doubtlessly one of the prime examples for a dialogue between interface studies and diagrammatics.<sup>6</sup> However, following Hookway’s definition, other types of connection between diagrammatics and interface studies are plausible as well. A visual interface discussed in Hookway’s work would be for example the Kinalog Display System, dating back to the 1950s. This artificial horizon in airplane cockpits was structurally coupled with the bodily feedback of the pilot, establishing a “pilot-plane system”<sup>7</sup> that made use of rather simple diagrammatic signs dynamically indicating the position of the plane in relation to the horizon. Fol-

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**Quote title page:** Charles S. Peirce, PAP [1906], in: Peirce, *The New Elements of Mathematics*, vol. IV: *Mathematical Philosophy*, ed. Carolyn Eisele (The Hague 1976), pp. 313–330, here 316/17.

2 Cf. Johanna Drucker, *Graphesis. Visual Forms of Knowledge Production* (Cambridge, MA and London 2014).

3 Cf. Johanna Drucker, *Visualization and Interpretation. Humanistic Approaches to Display* (Cambridge, MA 2020); Thomas Lischeid, *Diagrammatik und Mediensymbolik. Multimodale Darstellungsformen am Beispiel der Infografik* (Duisburg 2012); Isabel Meirelles, *Design for Information* (Beverly, MA 2013); Sandra Rendgen, Julius Wiedemann and Nigel Holmes, *Information Graphics* (Cologne 2012); Sandra Rendgen, *History of Information Graphics* (Cologne 2019).

4 Sybille Krämer, ‘Operationsraum Schrift’: Über einen Perspektivenwechsel in der Betrachtung der Schrift, in: *Schrift. Kulturtechnik zwischen Auge, Hand und Maschine*, ed. Gernot Grube, Werner Kogge and Sybille Krämer (Munich 2005), pp. 23–57.

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5 Branden Hookway, *Interface* (Cambridge, MA and London 2014), p. 4.

6 Drucker, *Graphesis*, pp. 138–179.

7 Hookway, *Interface*, pp. 141–148, here 145.

lowing the evolution of interface technologies, today especially the relation between three-dimensional gestural interfaces, diagrammatics, and complex man-machine-relations comes to mind.

Similarly, the process of working with diagrammatic signs and their various forms like diagrams (in the sense of “diagrams proper”<sup>8</sup>), maps, sketches, and infographics has been described as a practice of performing “diagrammatic operations” (“diagrammatische Operationen”).<sup>9</sup> These operations are ‘diagrammatic’ because of their association with the spatial distribution of – mainly but not exclusively – geometric primitives like lines and circles. Diagrammatic operations represent a specific, interrelated way of using spatial configurations as a media for creating information and means of manipulation and operation. This implies an ‘interface relation’ in the sense of the diagram as an externalized medium for epistemic operations, relating a specific semiotic configuration to the significant embodied experience of and

orientation in space.<sup>10</sup> Hence, to ‘think’ and ‘reason’ with diagrams consists of practices of – literally – ‘drawing’ hypotheses and conclusions<sup>11</sup> by means of embodied practices of “reconfiguring”<sup>12</sup> such types of externalized signs. For typically ‘epistemic’ practices such as abstraction or explication, this process is crucial.<sup>13</sup>

Various forms of practices of ‘thinking with diagrams’ have been well researched over the last years, using different theoretical frameworks. Widely influential has been the pragmatist approach of Charles S. Peirce’s semiotics, one of the most important figures in the history of diagrammatics.<sup>14</sup> In addition, there exists a large body of work made up by studies with different philosophical backgrounds that discuss, e.g., the properties of visual systems of logic.<sup>15</sup> Almost all of these positions presuppose that diagrammatic thinking (or

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8 Michael May and Frederik Stjernfelt, Measurement, Diagram, Art. Reflections on the Role of the Icon in Science and Aesthetics, in: *Magnet. Thorbjørn Lausten’s Visual System*, ed. Morten Søndergaard and Peter Weibel (Heidelberg 2008), pp. 53–73, here 67.

9 E.g., Sybille Krämer, Operative Bildlichkeit. Von der ‘Grammatologie’ zu einer ‘Diagrammatologie’? Reflexionen über erkennendes ‘Sehen’, in: *Logik des Bildlichen. Zur Kritik der ikonischen Vernunft*, ed. Martina Heßler and Dieter Mersch (Bielefeld 2009), pp. 94–117; Matthias Bauer and Christoph Ernst, *Diagrammatik. Einführung in ein Kultur- und medienwissenschaftliches Forschungsfeld* (Bielefeld 2010); Birgit Schneider, Operationalität und Optimieren. Einleitung, in: *Diagrammatik-Reader. Grundlegende Texte aus Theorie und Geschichte*, ed. Birgit Schneider, Christoph Ernst and Jan Wöpking (Berlin 2016), pp. 182–187.

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10 “There is a temptation to draw diagrams of the relevant schemata as a way of suggesting intuitively how they operate perceptually”, stated Mark Johnson in his pioneering cognitive semiotics study *The Body in the Mind. The Bodily Basis of Meaning, Imagination, and Reason* while describing the embodied or spatial schemata that he identifies at work in metaphoric abstraction and reasoning (Chicago and London 1987, p. 22).

11 Nikolaus Gansterer (ed.), *Drawing a Hypothesis. Figures of Thought* (Vienna and New York, NY 2011).

12 Bauer and Ernst, *Diagrammatik*, pp. 9–82.

13 Cf. Christoph Ernst, *Diagramme zwischen Metapher und Explication. Studien zur Medien- und Filmästhetik der Diagrammatik* (Bielefeld 2021)

14 Frederik Stjernfelt, *Diagrammatology. An Investigation on the Borderlines of Phenomenology, Ontology and Semiotics* (Dordrecht 2007).

15 Amirouche Moktefi and Sun-Joo Shin (eds.), *Visual Reasoning with Diagrams* (Dordrecht 2013).

'reasoning') is linked to various forms of 'doing.' As a consequence, diagrammatic thinking has been considered a "thinking in action"<sup>16</sup> which is not, in a cognitivist sense, a solely 'mental' operation but for which, among other factors, embodiment and especially gestures play a crucial role.<sup>17</sup>

To highlight this 'practical' and (as a practice) 'embodied' foundation of diagrammatics is important for a rather simple reason: A goal of diagrammatics has always been to provide insight into what Johanna Drucker calls the "*visual forms* of knowledge production,"<sup>18</sup> e.g., by illustrating to what extent the spatialization of logic symbols creates epistemic differences in contrast to other notational systems (algebraic, etc.).<sup>19</sup> According to this notion, analyzing the *visual* properties of a specific diagram (or related forms such as maps, etc.) is

crucial to delineate the creation of new knowledge associated with diagrams in a given context.

As Frederik Stjernfelt and Michael H. G. Hoffmann have shown with great authority,<sup>20</sup> the notion of an "operational definition"<sup>21</sup> of iconic signs in Peirce's work must first and foremost be read as an epistemological and pragmatist issue of expanding and developing knowledge, or: of solving problems. In a Peircean view, 'operating' a diagram means to operate a subtype of iconic signs. The form of representation typical for iconic signs is similarity, and in the case of diagrams' *structural similarity*.<sup>22</sup> From this premise it follows that, while structural similarity is best represented in visual forms and their various media, diagrammatic operations are by no means bound to 'thinking with' two- or three-dimensional visual objects. At this point, however, an epistemological as well as a media-theoretical problem arises. To 'decouple' diagrammatic operations (as a form of reasoning) from the practices of interaction with external materialities – hence *media* –, be they visual or of any other form, 'mentalizes' the notion of diagrammatic operations up to the point that (as in Peirce's work) elementary forms of in-

16 Barbara Tversky and Angela Kessel, *Thinking in Action. Pragmatics & Cognition* 22/2 (2014): 206–223.

17 Cf. Barbara Tversky, *Mind in Motion. How Action Shapes Thought* (New York, NY 2019), in a broader context Sybille Krämer, *Figuration, Anschauung, Erkenntnis. Grundlinien einer Diagrammatologie* (Berlin 2016). With a focus on Cognitive Metaphor Theory (CMT), as it was developed by George Lakoff, Mark Johnson and others, see, e.g., Stjernfelt, *Diagrammatology*, pp. 133–135, 257–261; Schneider, Ernst and Wöpking, *Diagrammatik-Reader*, pp. 87–92, 104–108; Ernst, *Diagramme zwischen Metapher und Explikation*, pp. 253–344; Daniel Irrgang, *Topological Surfaces: On Diagrams and Graphical User Interfaces*, in: *Interface Critique*, ed. Florian Hadler and Joachim Haupt (Berlin 2016), pp. 49–73; Daniel Irrgang, *Erweiterte Kognition. Zum diagrammatischen Zeichen als verkörpertem Denkding* (Berlin 2022), pp. 161–189.

18 Drucker, *Graphesis* (emphasis added).

19 Cf. Sun-Joo Shin, *The Logical Status of Diagrams* (Cambridge, MA and London 1994); Sun-Joo Shin, *The Iconic Logic of Peirce's Graphs* (Cambridge, MA and London 2002); Jan Wöpking, *Raum und Wissen. Elemente einer Theorie epistemischen Diagrammgebrauchs* (Berlin 2016).

20 Cf. Stjernfelt, *Diagrammatology*, pp. 90–92; on the issue of expanding knowledge and the problem of new knowledge in Peircean diagrammatics see Michael H. G. Hoffmann, *Erkenntnisentwicklung. Ein semiotisch-pragmatischer Ansatz* (Frankfurt/M. 2005).

21 Stjernfelt, *Diagrammatology*, p. 99.

22 Charles S. Peirce, *The Essential Peirce. Selected Philosophical Writings*, vol. 2: 1893–1913 (Bloomington, IN & Indianapolis 1998), pp. 272–288.

ference such as abduction *as such* imply a ‘diagrammatic operation.’ While this might be consistent within the confines of Peircean semiotics, it leads to an overgeneralization of any notion of ‘diagrammatic operation.’ In other words: every mental operation becomes diagrammatic. This implies some sort of ‘pansemiotism,’ which is problematic given the material situatedness of cognitive processes as they are expressed in the famous “4E”-paradim in cognitive science and philosophy of mind.<sup>23</sup> A strictly semiotic definition of diagrammatic operations tends to lose focus here.

This leads back to the notion of *interface*, which in turn can be regarded as much more than just the ‘user interface’ in computer science. In fact, an interface can come in a multitude of shapes, forms, and operations. For Brendan Hookway, as a “form of relation” the interface must be “an active relation”

*which actively maintains, polices, and draws on the separation that renders these entities as distinct at the same time as it selectively allows a transmission or communication of force or information from one entity to the other. And in such a way that its overall activity brings about the production of a unified condition or system that is mutually defined through the regulated and specified interrelations of these distinct entities.*<sup>24</sup>

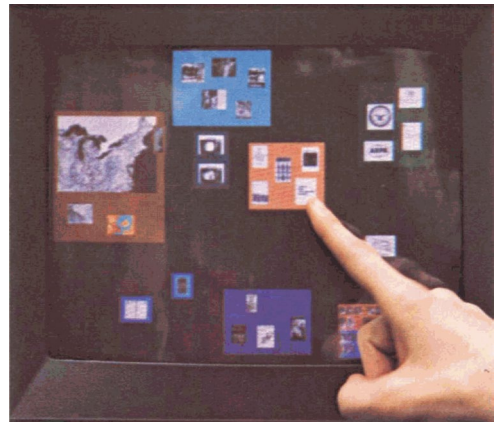
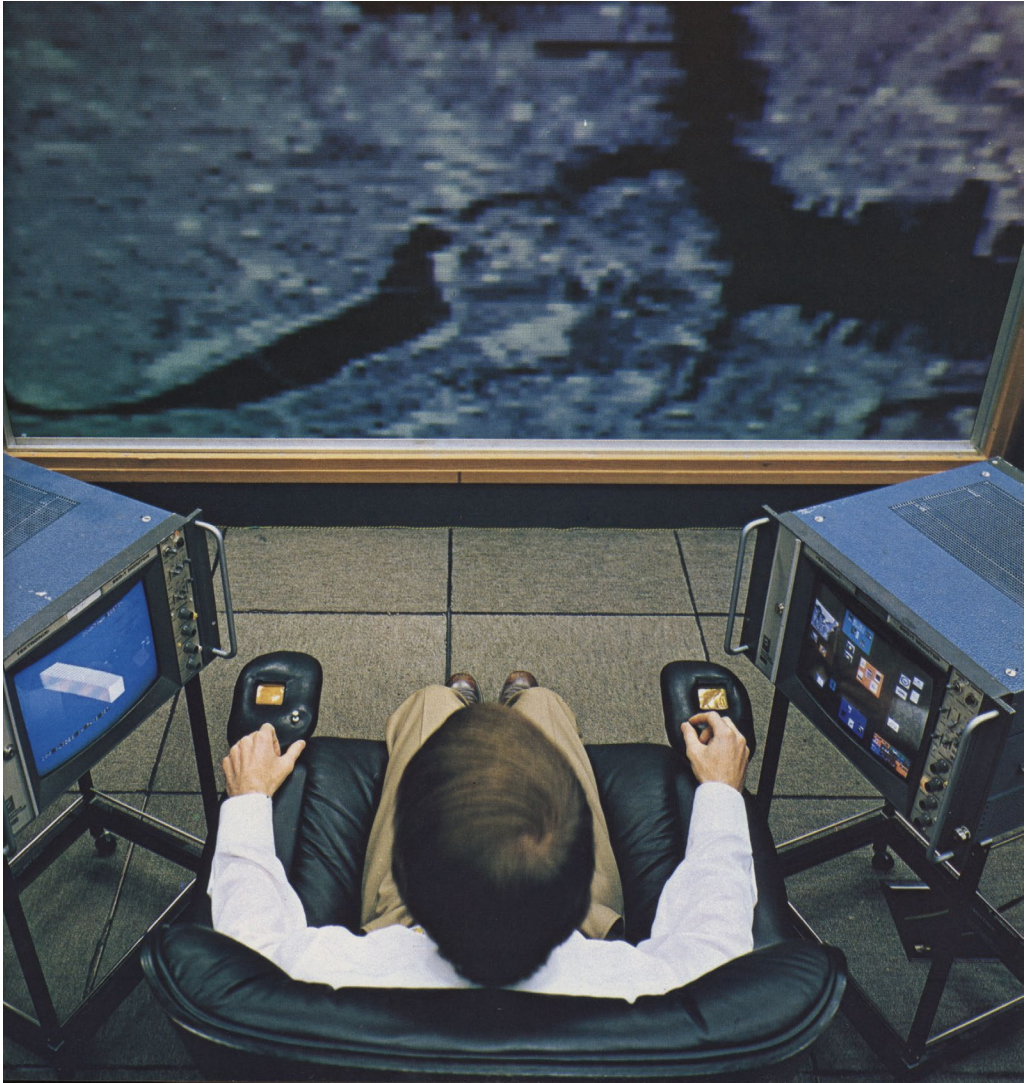
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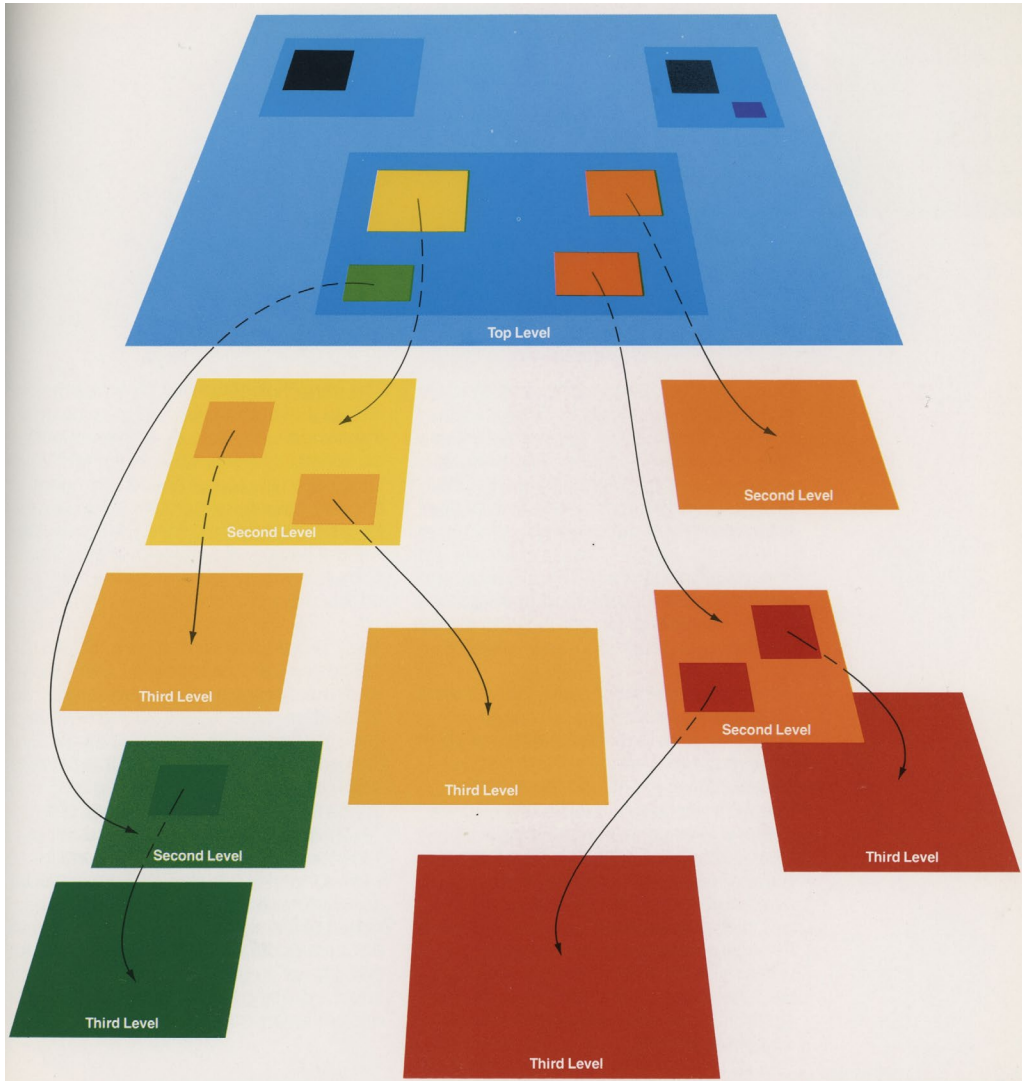
23 4E stands for “embodied,” “embedded,” “extended,” “enactive,” as elementary features of cognitive processes, cf. Albert Newen, Leon De Bruin and Shaun Gallagher (eds.), *The Oxford Handbook of 4E Cognition* (Oxford and New York, NY 2018).

24 Hookway, *Interface*, p. 4.

Not only implies this a much broader concept of interface than ‘just’ the user interface. It is now also possible to define the specific ‘doings’ implied in diagrammatic operations as specific forms of ‘interfacing.’ The conclusion is that diagrammatic operations are – as *practices of interfacing* – always already specific types of ‘interface operations.’ In consequence, the interface is not subject to analytic explication via diagrammatics, but *is always implied in diagrammatic operations as spatialized practices*. This allows to account for the broad heterogeneity of media specific settings in which diagrammatic operations are externalized – be it the sandbox in which the geometric and astronomical diagrams of antiquity were drawn, or be it the manifold forms of computer-based diagrammatic operations and interactions.

The contributions to *Interface Critique 4: Diagrammatic Operations* are devoted to this heterogeneity – to the interplay between diagrammatic forms of interface relations and the interface implied in diagrammatic operations. As interdisciplinary as the various studies on diagrammatics published in recent years, the contributions approach their subjects from the angles of media studies, history of technology, philosophy, art history, science and technology studies, as well as art and design research.





**Left:** The visual devices setup of the 'Spatial Data-Management System' (1976), a HCI prototype for efficient data retrieval developed by the MIT Architecture Machine Group: A large screen for the navigation mode and two touch sensitive monitors to the user's left and right for grasping details (left) and gaining overview (right). A joystick for navigation in 'Dataland' (the telling title of the spatially organized GUI) is mounted on each armrest of the control chair. Image source: Richard A. Bolt, *Spatial Data-Management* (Cambridge, MA: MIT, 1979), pp. 43, 10, 17.

**Above:** With joystick and zoom feature the user could navigate "through" several layers of navigational levels of Dataland. Richard A. Bolt, author of the study, notes as a premise: "It is surprising how pervasive the underlying notion of spatiality is, even in symbolic modes of thought." He concludes later on: "What we should learn are lessons concerning people's ability to create mental spaces and then to search them." (Bolt, *Spatial Data-Management*, image: p. 51, quotes: p. 7., 57) The symbolic and spatial principles – essentially diagrammatic modes of operation – of the Spatial Data-Management System did not only influence the pioneering GUI research at Xerox PARC but also the related development of the Apple Lisa GUI (Roderick Perkins, Dan Smith Keller and Frank Ludolph, *Inventing the Lisa User Interface*. *Interactions* 1 (1997): 40–53).

The contributions that associate directly with this issue's thematic focus of diagrammatic operations are complemented by yet a new 'special section' with papers by members of the working group 'Interface' of the German Society for Media Science (GfM), continuing a tradition that has started with the second issue of this journal. This section focusses on "Interfaces as Experimental Arrangements". We are grateful for the working group's continuous commitment to the interface critique cause. We are also grateful to Maria and Lena Knilli for entrusting us with a very personal obituary to the legacy of their father, Friedrich Knilli (1930–2022). To be able to provide the *Interface Critique* project as a platform to remember this pioneer in both audio drama research and German media studies in general<sup>25</sup> is a privilege.

We are indebted to everyone who contributed to this issue – either directly by submitting a contribution or by supporting us otherwise with feedback, infrastructure, or intellectual encouragement. Without the growing network of contributors and supporters, this project would not be possible. A special thanks goes out to our publisher, arthis-toricum.net, and the Heidelberg University Press, especially Bettina Müller, Frank Krabbes and Anja Konopka.

The next journal issue is in preparation, and so is a prospective new title in our book series. Stay tuned for more things to come!

– Mainz & Berlin, December 2022

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25 Cf. "Das Medium altert, nicht das Thema" – Friedrich Knilli in conversation with Siegfried Zielinski, in: *Zur Genealogie des MedienDenkens*, ed. Daniel Irrgang and Florian Hadler (Berlin 2017), pp. 15–33.

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**Wöpking, Jan**, *Raum und Wissen. Elemente einer Theorie epistemischen Diagrammgebrauchs* (Berlin: De Gruyter, 2016).

# DIAGRAMMATIC INTERFACE

By Johanna Drucker

*“Try designing what can happen in an interface instead of  
just dividing screen real estate into compartments.”*

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Interface: the word suggests a site of between-ness, of negotiation or exchange across thresholds and boundaries. The image of a dashboard comes to mind, filled with controls, or alternatively, the membrane of a cell that selectively allows some substances to pass. Organic or not, these are both mechanical images of instrumental gateways. But an interface can also be understood as a dynamically complex system rather than a controlled boundary, a site of negotiation rather than an opening through which things move. In fact, the very idea of an interface as a site of transfer might be deceptive. Nothing passes, no tokens, no currency, or even language moves across an interface even though it may facilitate delivery of goods or services. The interface itself is a space that provokes events and performs constitutive acts. Like any image, text, performance, or stimulus, it is a provocation for interpretation and engagement. However, the diagrammatic aspect of interface is specific to the way its formal structure articulates such activity.

Transmission and delivery theories of communication have long been set aside in favor of process-oriented understandings in mainstream media studies. Even the most elaborately structured information and entertainment sites don't "deliver" content. They make an experience available for a viewer whose engagement with it constructs a cognitive-affective-sensory event. The interface is a crucial part of this experience, its structuring features enact constraints as well as possibilities. This structuring is em-

bodied in diagrammatic forms that can express organized relations in any sensory modality: graphic, aural, motor-haptic, and/or vocal/sonic. These can be considered diagrammatic because they use organizational structure to articulate the *workings* of knowledge production, they don't just depict information or knowledge in reified form.

This distinction of diagrams as a subset of images is crucial. Many images do work of various kinds through provocation, faith, persuasion, seduction, and other interactions with viewers. But the schematic structure of diagrams (defined generically rather than within a strict semiotic typology), allows them to show *how things, systems, or processes work*. Medieval mystic Ramon Lull's diagrams, classical squares of opposition, or contemporary circuit diagrams serve as paradigmatic examples of diagrams understood as schematic models of working systems. The organization of relations among the diagrammatic elements – rather than pictorial associations or referents – provokes the interpretative events. The diagrammatic features embody specific semantic values: hierarchy, sequence, juxtaposition, proximity, direction, distance, rate of movement, growth and so on. These features are all structuring principles of diagrammatic forms. They embody specific epistemic features in a schematic, spatialized expression of information. The graphic organization of diagrammatic forms is meaningful in itself. While any image provokes interpretation, diagrams are distinct by virtue of how they use organizational relations

to articulate the workings of a system. Thinking of an interface in these terms calls attention to graphical structure as intellectual structure.

In the early days of digital interface, when the CD-ROM was the medium of dissemination of innovative works, there were no standard design conventions. You slipped a floppy disk into a slot, waited for the whirring sound to calm as the program mounted, and viewed the work on screen. Then – what? You poked around with your cursor, guided by the mouse, hoping some action would trigger a response. What cues guided the user in an environment without any standards? Menus, sidebars, links, and other organizing features did not exist, only a hot-spot somewhere offered the user a guide to their actions.

Now the conventions that organize the graphical space of the GUI (or its variation, the Diagrammatic User Interface) discipline not only our behaviors but our conceptualization of interaction of what is possible. We enact mechanistic activities in interfaces every day, largely without thinking, through habitual actions. We click the buttons and follow links in a predictable manner, as if the interface were a vending machine for contents. We swipe, link, and consume. These habits ignore the interpretive complexity of the interface as a performative and constitutive space.

Switching the description of diagrams from one grounded in things that get reified in the process to one that is expressed in procedural terms suggests more than just a change from mecha-

nistic to performative understanding, however. The process-based dynamic is premised on a notion of cognition that is constitutive and constructive, not simply reactive. True, not every moment of engagement with an interface – on screen, in a machine, a vehicle, or in the larger world of made structures and forms – produces self-conscious awareness of the hermeneutic dimensions of cognitive experience. That would be tedious and self-defeating. The habit of such reflection would soon dull the soul out of all meaningful response. But recognition of the made-ness of an interface as an encoded set of disciplining instructions whose programmatic features embed assumptions at every turn is fundamental to the understanding of the cognitive anthropology of interface, its operation as means of knowledge production.

Why does this depend on the concept of the interface as diagrammatic? Because diagrams are images that articulate the workings of systems – in this case, an interface with its features and functionalities – through spatialized organization and relations. Sketch an interface for a project, an application, or any kind of portal to an archive or collection. The first sketches are likely to be wireframes, the organizing scaffold, schematic and formal. Each area is discrete – masthead, menu, logo. Each function is also discrete – search, browse, link, purchase. The categories in the design are, deliberately or incidentally, actually expressions of a cosmology, a worldview structured into habits of thought. On the one hand, this is useful, efficient, and

functional. On the other it supports an unthinking, overly familiar, unexamined interaction. Contrast this with the moment of realization that the dashboard of your vehicle is literally speaking to you, not just in the voice of the automated GPS system or other assistants, but in the very ergonomic structure of address built into the distance between you and its displays. The dashboard is a mode of address, not merely a mode of display. Try designing what can *happen* in an interface instead of just dividing screen real estate into compartments. Conceptualize the dynamics of user actions and behaviors of the features as a conversation and imagine what is occurring within the workings of a performance.

This distinction between display and address is crucial to the concept of enunciation and to the way a diagrammatic interface articulates its subject. Linguist Émile Benveniste developed the concept to describe the reciprocity between “speaking” and “spoken” subjects in language acts and it has been extended to studies of cinema, space, and the visual arts.<sup>1</sup> In visual forms point of view systems, structured into graphics, model the profile of an imagined user. In an interface, the diagrammatic features inscribe this user in visual, linguistic, aural, and haptic domains that carry cultural and social implications structured into their features.

The apparently simplest, most banal interfaces of daily life are a vivid demonstration of these principles. Take, for instance, the interface for credit card payment at a check-out in the grocery or supermarket, or a ticket vending machine for the subway or underground. One enters immediately into a relationship with the device. The instructions on the device tell you when to act and what action to take. Your response to the instructions, rendered as direct address with an implied “you” at their core, is haptic and psychological. You direct your gaze, stuck on watching the LED display until it tells you to type a code, hit an “enter” button, and remove your card. You’ve been subject to a disciplinary regime, enunciated by the system through the interface. Even if no bell rings to signal that you have succeeded in your Pavlovian task, you get the psychic reward by being waved through the line. And the “you” who has performed in accordance with the rules of that very minor but none-the-less profoundly significant game is almost entirely reduced to an identity as a position, occupying the space outlined. Extend the analysis to the vending machine for tickets, with its more elaborate menu of destinations, times of day, demographic profiles, and other options each delimiting the “you” specified. “You” are “one-way, to Charing Cross, senior, and off-peak” – generic and specific at the same time. The interface has structured your identity as a place within a system, a penny rather than a pound. You didn’t just get a ticket, you

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<sup>1</sup> Émile Benveniste, The nature of pronouns, in: *Problems in General Linguistics*, translated by Elizabeth Meet (Coral Gables, FL 1971), pp. 217–222; originally published in 1966 as *Problèmes de linguistique générale*.

were constituted as an identity as an outcome of an enunciative process.

Diagrams are graphical forms whose schematic, semantically meaningful, organization makes them particularly well-suited to express logical relations that are highly specific, but also may model generalizable systems that can be put to various purposes. The classical square of opposition is an example. Its structure is crucial to the meaning it produces. The positions of terms in its four corners determines their value and relations. But it can be used for an infinite number of arguments. While many (some might say all) images are provocations for engagement, for making cognitive or affective experience in a dynamic exchange, not all images model working systems – which is, again, the defining feature of diagrams. In addition, many diagrams are produced as non-representational images (in terms of visual similarity) – they come into being through a process of modelling, rather than through representing a pre-existing referent.

Diagrams provoke engagement through their structuring formats. The “diagrammatic” features are graphical, spatial, and relational. Diagrams are open forms. But while other images can also be interpreted with a wide range of meanings, diagrams articulate processes rather than meanings. Again, they show *how* things work, but they also articulate systems as working systems. Instead of deliberating over classification – “Is this or that a diagram?” – the description of diagrams shifts towards a procedural

understanding – “How is this diagrammatic?” A diagrammatic format is a schematic articulation of working intellectual/cognitive, aesthetic/affective or behavioral systems.

Many diagrams suggest or even depict mechanistic systems, but (and again, this is true of the larger category of images of which diagrams are a part) they do their work through acts of enunciation. Enunciative modes are structuring, they are not exchanges between one actor and another. Instead, enunciation assumes that the actors are constituted through that exchange. I am a sister in a familial exchange and a friend in another. I do not come to the exchange with the role or identity intact, they are constituted in and constitutive of the exchange. My “sister-ness” is created in relation to certain expectations, conventions, norms of usage and utterance, tone of voice, familiarity with already extant conversational histories and shared experiences. All of this is evident in the specifics of the activity. The principles of the diagram are that it is premised on the co-constitutive process enacted by enunciation.

Why does this matter? Because as living creatures we are produced at and through the interface we have with each other and the world. This is a structuring process, not a mechanistic exchange. The critical approach used here is the basic premise of a constructivist approach to knowledge. The diagrammatic possibility allows for play, for the unfolding of existence between the potential of provocation and the habits of convention as a dynamic event.

# Reference

**Émile Benveniste**, The nature of pronouns, in: *Problems in General Linguistics*, translated by Elizabeth Meet (Coral Gables, FL: University of Miami Press, 1971), pp. 217–222.

# WHICH OPERATIV- ITY? ON POLITICAL ASPECTS OF OPER- ATIONAL IMAGES AND SOUNDS

By Jan Distelmeyer

*“Operational’ now turns out to be characterized by mutual connec-  
tions and interdependencies, which is why this politically motivated  
and complicating concept is so useful for opening up the diverse  
interface processes that are in use today on a planetary scale.”*

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Harun Farocki sits in front of his editing program pointing at the monitor. “So, for the posterity, I’m going to say that I’m cutting two tracks here,” he begins to talk with a self-deprecating smile in Christoph Hübner’s film *Dokumentarisch arbeiten* (2004/2005).<sup>1</sup> The two tracks are tested for the third part of his installation series *Eye/Machine I–III* (2000–2003). With this, as with *War at a Distance* (2003) and *Counter Music* (2004), Harun Farocki deepens his interest in what he calls “operative images” or “operational images”.<sup>2</sup> At this point, it is not foreseeable that this term, as a highly influential guiding concept, will long outlast the sudden passing of Harun Farocki in 2014 and (to date) become an international field of research<sup>3</sup> – also in the context of *Interface Critique*.<sup>4</sup>

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1 *Dokumentarisch arbeiten: Harun Farocki im Gespräch mit Christoph Hübner*, TV documentary by Christoph Hübner (WDR/ZDF, 2004/2005).

2 Although Harun Farocki had translated the term “operative Bilder” sometimes as “operative images” and sometimes as “operational images,” the latter has since widely prevailed.

3 See, among others, Ingrid Hoelzl (ed.), *The Operative Image* (2014), <https://mediacommons.org/tne/cluster/operative-image>, access: September 14, 2022; Niels Van Tomme, *Visibility Machines: Harun Farocki and Trevor Paglen* (Baltimore 2015); Andreas Broeckmann, *Machine Art in the Twentieth Century* (Cambridge, MA 2016); Jan Distelmeyer, *Machtzeichen. Anordnungen des Computers* (Berlin 2017); Jens Eder and Charlotte Klöckl (eds.), *Image Operations: Visual Media and Political Conflict* (Manchester 2017); Luisa Feiersinger, Kathrin Friedrich and Moritz Queisner (eds.), *Image – Action – Space: Situating the Screen in Visual Practice* (Berlin 2018); Jussi Parikka, *Operational Images* (2022), <https://jussiparikka.net/category/operational-image/>, access: September 14, 2022.

4 See Jan Distelmeyer, Drawing Connections. How Interfaces Matter. *Interface Critique* 1 (2018): 22–32; Christoph Borbach, Navigating (through) Sound. Auditory Interfaces in Maritime Navigation Practice, 1900–1930. *Interface Critique* 2 (2019): 17–33; Matteo

This terminological success story is the starting point for my considerations. For as established as the concept of operational images is today, it is easy to lose sight of a motivation that is essential to its emergence and just as important to its productivity for dealing with contemporary automation and computerization. It is a political motivation in need of explanation and discussion. Turning to this seems to me particularly helpful for asking about the planetary dimensions of the interface processes that are constantly at work for that part of our reality based on hardware and software and performed by means of networks, platforms and “algorithmic decision making”<sup>5</sup> a.k.a. artificial intelligence.

## Operational Images and Diagrammatics

“Well, I call those ‘operational images,’” Harun Farocki explains to Christoph Hübner, “in the sense of images that aren’t there to report anything.” At this moment images from a surveillance camera can be seen on which cars are marked with a square, as these images are not primarily made for the human eye, but elements of

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Pasquinelli and Vladan Joler, The Noosphere manifested: AI as instrument of knowledge extractivism. *Interface Critique* 3 (2021): 37–68

5 AlgorithmWatch, *Automating Society 2019*. <https://algorithm-watch.org/en/automating-society-2019/>, access: September 14, 2022.

an image processing for the purpose of machine automation, in this case a traffic light control.

To this day, operational images are considered to be those images “that are absorbed in a technical execution”<sup>6</sup>, that are “part of an operation”<sup>7</sup>. The term “operational” is intended, as Volker Pantenburg has emphasized, to draw attention to the fact that an image “no longer stands ‘for itself’ in any way but is merely an element of an electro-technical operation”<sup>8</sup>. The interest in machine processes comes into focus, which operational images do not represent, but instead take part in.

The discourse and (artistic) research on operational images have branched out and deepened based on this understanding. For example, Trevor Paglen has pointed to “a kind of irony” that the *Eye/Machine* installations are actually not “composed of operational images” but rather “composed of operational images that have been configured by machines to be interpretable by humans”<sup>9</sup>. However, to a certain extent this composition is less ironic than consistent, for the operativity of these images takes place on several, not only technical-apparative levels.

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6 Harun Farocki, Quereinfluss / Weiche Montage, in: *Zeitsprünge. Wie Filme Geschichte(n) erzählen*, ed. Christine Ruffert et al. (Berlin 2004), pp. 57–61, here 61.

7 Harun Farocki, Phantom Images. *Public. Art, Culture, Ideas* 29 (2004): 12–22, here 17.

8 Volker Pantenburg, *Farocki/Godard. Film as Theory* (Amsterdam 2015), p. 210.

9 Trevor Paglen, Operational Images. *e-flux* 59 (2014), <https://www.e-flux.com/journal/59/61130/operational-images/>, access: September 14, 2022.

The interest in interdependencies shapes the decided openness of Harun Farocki’s approach to operational images from the very beginning. Not meant as a strict definition, rather as a specific and politically motivated working title for the question of a systemic and perhaps paradigmatic change of images on the way to automation and more-than-human agencies and infrastructures, for which humans nevertheless remain responsible. “It’s all very limited and it’s not true in an endless way,” he admits in *Dokumentarisch arbeiten*, “but in this context, these are always different images.”<sup>10</sup>

What makes those images “different” depends on what forms of operations are at work here. This question of operativity (what operates here and how, under what conditions, for what purposes, and with what effects) leads to revealing connections and (depending on the perspective) differences between the concept of operational images and diagrammatics.

With regard to the “operational imagery” developed by Sybille Krämer for a diagrammatic approach focusing on written texts, diagrams, graphs, and maps, for example, there is a clear distinction. Precisely those “images of use” [*Gebrauchsbilder*] in the “context of ‘remote-controlled pictorial action’ in the military, medicine, and research, but also in the interactively accessible virtual spaces” that Sybille Krämer explicitly does “not count as part of the phenomenon of op-

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10 Hübner, *Dokumentarisch arbeiten*.

erational imagery"<sup>11</sup> belong for/with Harun Farocki to operational images.

Beyond that approach, however, the field of diagrammatics (and especially its relations to semiotics) also includes other forms of operativity, which definitely show overlaps with the concept of operational images, such as Birgit Schneider's, Jussi Parikka's, and Aud Sissel Hoel's observations have underlined. Schneider distinguishes four levels on which diagrams can become operative: In addition to "extrinsic operativity," in which diagrams "help shape, change, or even trigger a process," and a dual "cognitive operativity" (in producing diagrams and looking at diagrams), this also includes "intrinsic operativity." *Intrinsic* here implies that diagrams themselves become operative: in the form of circuit diagrams, for example, they "can themselves be electrified, materializing the operation of a diagram."<sup>12</sup> It is this intrinsic operativity that Jussi Parikka – referring to Wolfgang Ernst's media archeological research („diagrams are to be understood in the very technical sense of a visualization of information patterns, circuits and relations which give an idea of how the

otherwise so complex machines work"<sup>13</sup>) – calls "operative diagrammatics."<sup>14</sup>

Thus, it becomes obvious that broader and quite diverse notions of operativity are also at work in the tradition of diagrammatic discourse, which shows a further, fundamental proximity to Harun Farocki's research on operational images. Aud Sissel Hoel has highlighted this with references to Lev Manovich, Wolfgang Ernst, Frederik Stjernfelt, and Charles Sanders Peirce.<sup>15</sup> Her related call to reconsider what is actually meant to be addressed by the adjective "operative" connects her perspective to that of Jens Eder and Charlotte Klonk<sup>16</sup> and also to my approach. This, however, does not apply to Hoel's notion of interface, which – "in the epistemological and ontological sense as intermediaries to the world and other people"<sup>17</sup> – hardly seems to differ from the notion of medium. Operativity here, in any case, cannot be understood as either human or non-human agency, but is rather multi-layered and relational. In this respect, "operative"/"operational" actually denotes less a finding than an appeal to investigate the operations in question.

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11 Sybille Krämer, *Operative Bildlichkeit. Von der Grammatologie zu einer 'Diagrammatologie'? Reflexionen über erkennendes Sehen*, in: *Logik des Bildlichen. Zur Kritik der ikonischen Vernunft*, eds. Martina Heßler and Dieter Mersch (Bielefeld 2009), pp. 94–123.

12 Birgit Schneider, *Operationalität und Optimieren. Einleitung*, in: *Diagrammatik-Reader. Grundlegende Texte aus Theorie und Geschichte*, eds. Birgit Schneider, Christoph Ernst and Jan Wöpking (Berlin 2016), pp. 182–183.

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13 Jussi Parikka, *Operative Media Archaeology. Wolfgang Ernst's Materialist Media Diagrammatics*. *Theory, Culture & Society* 28/5 (2011): 52–74, here 62.

14 Ibid.

15 Aud Sissel Hoel, *Operative Images. Inroads to a New Paradigm of Media Theory*, in: *Image – Action – Space: Situating the Screen in Visual Practice*, eds. Luisa Feiersinger, Kathrin Friedrich and Moritz Queisner (Berlin 2018), pp. 11–27.

16 See Eder and Klonk (eds.), *Image Operations*.

17 Hoel, *Operative Images*, p. 27.

Operational images can be understood against this background of diagrammatics as a – each specific – combination of extrinsic and intrinsic operativity, which admittedly always also includes cognitive operations. Hence, also because of this role of concepts, which become effective and have consequences e.g., in the planning and implementation of automation, operativity according to Harun Farocki does not exclude human agency at all, which is of great importance for the context of interfaces (and also explains Trevor Paglen’s observation of “a kind of irony” in *Eye/Machine*). Operational images can, as Tom Holert puts it, “become components of a functional, technical environment that condition *more or less* automatic action and behavior”<sup>18</sup>.

But just as important than this – to a certain extent – technical level of distinction, for which also Volker Pantenburg’s systematic categories of operativity<sup>19</sup> are helpful, is the explicitly political background of Harun Farocki’s work, which I would like to recall here. It precedes the obviously politically relevant examples of warfare, surveillance, and control that Farocki has worked on for many years and leads to his reading of Roland Barthes.

## Operational/Political Language

About forty years before Harun Farocki turned to operational images in installations, films, and texts, he had addressed the operational language that Roland Barthes contrasted with mythical and thus depoliticized speech.<sup>20</sup> In two early reviews of Barthes’ *Mythologies* from 1965, the then 21 year old Farocki highlighted the political problem of the “constant confusion of nature and history,” the goal of “uncovering the manipulated, the mediated, where it is hidden and unrecognized,”<sup>21</sup> and emphasized how Barthes countered mythic language as “form without content, as depoliticized statement”<sup>22</sup> with the example of the woodcutter.<sup>23</sup>

In *Dokumentarisch arbeiten*, Harun Farocki remembers – “I still have it in my head now” – Barthes’ argument: “He calls ‘opérateur’ the words that are not mythical. He asks: ‘Is there also language without myth?’, and says: ‘Yes, operational language.’ A woodcutter, he speaks the tree, he doesn’t speak about the tree; he doesn’t have this aesthetic distance in

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18 Tom Holert and Felix Koltermann, *Bilder im Zeitalter des Drohnenkriegs*. *Wissenschaft & Frieden* 3 (2014): 30–33, here 30 (my emphasis).

19 See Volker Pantenburg, *Working Images*. Harun Farocki and the Operational Image, in: *Image Operations: Visual Media and Political Conflict*, eds. Jens Eder and Charlotte Klonk (Manchester 2017), pp. 49–62.

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20 See Farocki, *Phantom Images*, pp. 17–18.

21 Harun Farocki, *Der tägliche Mythos*. *Spandauer Volksblatt* (May 16, 1965).

22 Harun Farocki, “Mythen des Alltags” von Roland Barthes, *SFB* (radio broadcast, May 26, 1965), typescript.

23 I would like to thank Volker Pantenburg for providing access to these texts.

which he speaks about it. That's actually what I'm concerned with here."

To speak of operativity and operational images (and sounds) in this sense, then, is not simply to employ a technical term here that serves to signify or define a new functional context. Instead, it has been a political concept from the outset, insofar as it explicitly (and perhaps in vain) attempts to make constellations visible, and thus potentially changeable, that repeatedly elude depoliticized language, our everyday myths, and the corresponding mythical terms (which today include, for example, "artificial intelligence,"<sup>24</sup> "the cloud,"<sup>25</sup> and no less "digital"<sup>26</sup>).

It is above all working contexts that are at the center of both Harun Farocki's and Roland Barthes' considerations: As a "type of speech which is the opposite of myth," Barthes describes operational language, as a "political language" because it "represents nature for me only inasmuch as I am going to transform it, it is a language thanks to which I 'act the object'"<sup>27</sup>.

In 1969, at the time and in the spirit of the West German student movement, Harun Farocki further underpinned this close interlocking of the political and the operational, following the Russian writer Sergei Tretyakov.<sup>28</sup> "The agitation film or any component of an agitation is operat-

ing [operierend]," Farocki writes, in order to then specify agitation and film according to his understanding of "operational" developed along Barthes.<sup>29</sup> Using the example of an "operating film" [operierender Film] about protests and demonstrations, he explains that such a film is "part of the operation of organizing a class." That is why "an operating film" can be judged by "the operation" of the protests, "by how they come about and by the significance of the operation in the class strategy." Farocki equates "operational" and "practical" in this context, while noting that the "theory of the operating film and the theory of operation are intertwined."<sup>30</sup> In accordance with a rather (and contemporary) actionist concept of politics, the theoretical work on "operating film" is thus also conceived here in agitational revolutionary terms.

## Operating and Interfacing

This understanding of "political," which later becomes far more complex in Farocki's work, is of course highly ambivalent, especially from today's perspective – and at the same time instructive and helpful for considering processes and relations in computers, between computers, and to computers. If political is that which just

24 See AlgorithmWatch, *Automating Society* 2019.

25 See Tung-Hui Hu, *A Prehistory of the Cloud* (Cambridge, MA 2015).

26 See Jan Distelmeyer, *Critique of Digitality* (London 2022), pp. 11–33.

27 Roland Barthes, *Mythologies* (New York 1972), p. 146.

28 I would like to thank Tom Holert for this reference.

29 Harun Farocki, *Die Agitation verwissenschaftlichen und die Wissenschaft politisieren* (1969), in: *Harun Farocki. Meine Nächte mit den Linken. Texte 1964–1975. Schriften* vol. 3, ed. Volker Pantenburg (Berlin 2018), pp. 63–75, here 64.

30 *Ibid.*

makes an obvious material difference, which changes the world, which means a literally *incisive* intervention in e.g., what is called “nature” here, this is perhaps first and foremost a critique of the mythical. As here world-changing processes become manifest, while the myth (“hidden and unrecognized”, but no less effective) conceals them. At the same time, this traditional nature/culture dichotomy and hierarchy with clearly separated subjects and objects reveals a remarkable (and again ambivalent) hope for the political as something that recognizably intervenes as culture in nature and thus also may enable resistance to these perceptible forms of culture.<sup>31</sup>

Decades later, Farocki’s works on operational images show that this clear dichotomy can hardly be maintained.<sup>32</sup> “Operational” now turns out to be characterized by mutual connections and interdependencies, which is why this politically motivated and complicating concept is so useful for opening up the diverse interface processes that are in use today on a planetary scale. This applies to all areas of computer use that rely on networking, to all platforms and Internet-based services anyway – and can thus be experienced every day at any time.

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31 Perhaps it is precisely in this context that the “political, revolutionary potential” Barthes hoped for might have been so appealing to Harun Farocki as a “connection between politics, activism and transformation” (see Pantenburg, *Working Images*, p. 51).

32 This distinction proves to be problematic, not least for philosophical reasons (including the fact that culture and nature are not simply opposites) and for historical reasons (including the fact that the traces of the Anthropocene are everywhere today).

For example, my cognitive and physical operating with operational images on the home screen of my smartphone, or with operational sounds when using a smart speaker to start a Netflix series, presupposes and sets in motion a series of interface processes. In each case – both when touching on the operational image (the Netflix icon) in the smartphone grid to then make a selection in the menu (again, using operational images) as well as with the spoken command “Alexa, open Netflix!” or “Alexa, play *Tiger King* on Netflix!” (whereupon the completion is reported with the operational sound “Getting *Tiger King* from Netflix”) – several operations on the diverse levels of the “interface complex”<sup>33</sup> are necessary.

This here includes, *first*, interfaces between software and hardware, thanks to which “the universal machine” now proves to be “behaving as a specialized machine”<sup>34</sup>, a Netflix machine. It includes, *secondly*, interfaces between hardware and hardware, which, for example, in the form of Internet undersea cables, are just as indispensable as, *thirdly*, interfaces between software and software that, for instance, as protocols establish and execute the rules of Internet data traffic. It includes, *fourthly*, interfaces between hardware and the world, which allow for input from outside via sensors such as touchscreens and microphones

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33 See Distelmeyer, *Drawing Connections*, pp. 24–27.

34 Florian Cramer and Matthew Fuller, *Interface*, in: *Software Studies: A Lexicon*, ed. Matthew Fuller (Cambridge, MA 2008), pp. 149–152, here 149.

and, *fifthly*, interfaces between software and humans that (on monitors) convey operational images and (via loudspeakers) operational sounds enabling and confirming my interaction with the software. On this fifth level, humans interact and operate of course not only with machines, but always simultaneously with concepts (of usability, user and machines, among others); these operations are cognitive also in an ideological sense.

## Correlations and Interdependencies

In (platform) processes like these, we are therefore never dealing with just one level of interfaces, but always with an interface complex.<sup>35</sup> The operativity that can be addressed here with the concepts of operational images and operational sounds along the lines of Farocki and Barthes is marked by correlations and interdependencies. It concerns both the operations of computers and the required infrastructures (to be understood as both material and processual, and thus as consuming resources, work, space and great deal of energy<sup>36</sup>) as well

as human operations of dealing with them. This operativity – just like “the digital transformation” in general, even if it aims at technological autonomy – is never purely technical-apparative, never purely automatic or machine-based. Because human interests, conceptions, selections, agendas, activities (from apparatus engineering to click-working to manual waste recycling) and responsibilities are always part of it.

The political dimension of operativity that Harun Farocki developed with Roland Barthes can perhaps be turned and used in this way for the operational images and sounds of the interface complex:

To consider and address them as operational should inevitably lead to the question of which operations and which interface processes are actually involved.<sup>37</sup> Which and whose forms of labor and agency, which conceptions (e.g., of technology), which changes to societies and the planet, which interdependencies are claimed and run, in part, as Farocki put it, “hidden and unrecognized”? How do my operations relate both to those of other people (who program, maintain and scrap devices, mine rare earths, lay and repair cables, send satellites into orbit, etc.) and to the operations of infrastructures and automated computing processes? How do they relate to the operational interventions in the existence of human and other life forms of this

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35 See also Kate Crawford and Vladan Joler, *Anatomy of an AI System: The Amazon Echo as an anatomical map of human labor, data and planetary resources*. *AI Now Institute and Share Lab*, September 7, 2018, <https://anatomyof.ai>, access: September 14, 2022.

36 See Lisa Parks and Nicole Starosielski (eds.), *Signal Traffic: Critical Studies of Media Infrastructures* (Urbana 2015).

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37 It seems to me that the shift recently announced by Jussi Parikka (from discussion of the image to questions of operations) is aimed in a similar direction. See <https://jussiparikka.net/category/operational-image/>, access: September 14, 2022.

planet, which may be part of the “digital transformation” as sufferers (e.g., as cut trees)? And how do the operations of automated processes, such as algorithmic decision making, influence/facilitate/determine the lives of individuals as well as societies and states that rely on them, e.g., for stock market trading, caregiving, and warfare?

One small part of the reciprocities of this global operational business was pointed out by Laura U. Marks with a Netflix example during the 2020 COVID-19 pandemic. She “calculated the carbon footprint of the wildly popular Netflix miniseries *Tiger King*, which streamed 34,000,000 times in the United States in the last ten days of March 2020”. The total energy spent on this, according to Marks, was “the same as the electrical consumption of Rwanda in 2016”.<sup>38</sup>

It is operational coherencies and interdependencies like these that can come into view when the notion of operational images and sounds is not used in a purely technical connotation, but as a challenge to ask about correlations that are political in more than one way. Political here are not only the much-discussed effects on individuals and societies, on new economies and power relations, but also the executed/acting conceptions of a certain operativity and all the human and more-than-human elements utilized for this purpose. To put it differently in

the words of Roland Barthes, it is thus a matter of going on a search for how our operations with operational images and sounds *act the world*.

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38 Laura U. Marks, Streaming video, a link between pandemic and climate crisis, *Rosa Mercedes 2* (April 16th, 2020), <https://www.harun-farocki-institut.org/en/2020/04/16/streaming-video-a-link-between-pandemic-and-climate-crisis-journal-of-visual-culture-hafi-2/>, access: September 14, 2022.



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# POST\_NETWORK

By Kim Frederic Albrecht

*“A community might exist as the non-networked, the gap between the lines, filled, extracted, and enhanced.”*

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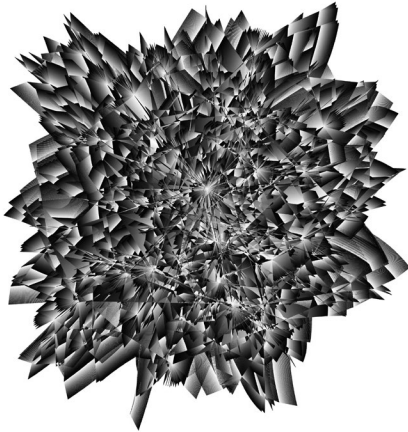


Fig. 0: Visualizing traces of the network forces of repulsion and drawing together.

How do humans interact with each other through technology? A major conceptualization of what is labeled the “digital” are network structures. A model based on two principles: Points and Lines. Within network science and visualization, each element contains one force.

Points repulse each other. They drift away from one another through time. Lines draw together, like springs; they keep the points in proximity and arrange their relationship towards one another.

What are the problems and how can we reimagine novel modes of how to interact within networks? Rather than being embedded within technology, this project explores modes to reshape the fundamental constitutions of the web. But before doing so: Where do the histories of networks come from? And how do these concepts render visible the world we live in?

## Random walks

In 1959, two Hungarian mathematicians, Paul Erdős and Alfréd Rényi, defined the first network model.<sup>1</sup> The two forces of repulsion and proximity now come into play with one another. Connections are drawn by chance within this model. Who you are friends with, what you like on Twitter, comment on TikTok, or who you sit next to within a room is all pure luck. The degree distribution, the number of connections, friends, seating partners, and likes, is normally distributed; everyone has about the same number of connections. Within social media, this would mean that every post will receive the same number of likes and that everyone in the network has about the same number of followers.

## Rich get richer

In 1999, physicists Albert-László Barabási and Réka Albert studied the structure of the World Wide Web and found that the distribution and connections are far from the randomness previously described. They initiated the idea that networks contain what they have called “preferential attachment,” which means that some points within a network become much more connected than oth-

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<sup>1</sup> Paul Erdős and Alfréd Rényi, On Random Graphs. I. *Publicatio-nes Mathematicae* (1959): 290–297.

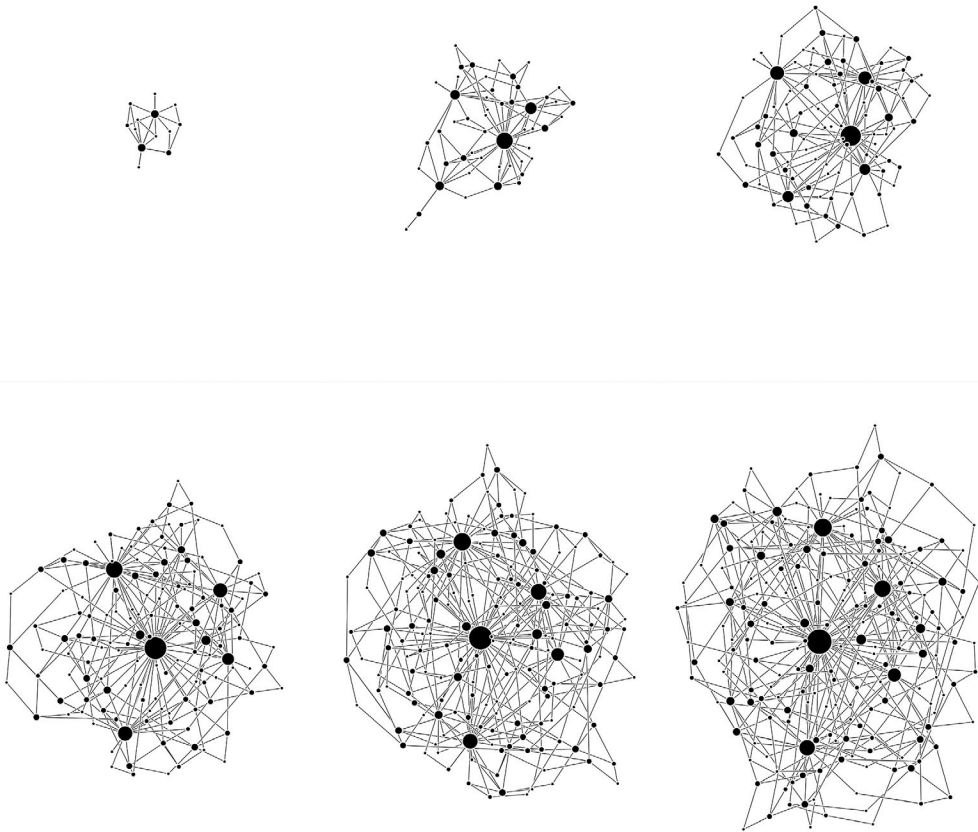


Fig. 1: A temporal visualization of the Barabási–Albert model generating random scale-free networks using a preferential attachment mechanism.

ers.<sup>2</sup> For this reason, Barack Obama, Justin Bieber, Katy Perry, and Rihanna all have over 100 million followers, while you do not. The model itself is time-based. Over time, new points emerge and connect to already existing nodes. This process is not random but determined by the effect that nodes already containing many connections gain even more links over time.

One year after discovering the rich-get-richer effect, the same researchers found a problem within the system.<sup>3</sup> The model is very stable to random attacks, but once you target the hubs – the highly connected points – the network falls apart quickly. Attackers can take apart these systems easily once they remove the right connections. What seems purely theoretical and speculative most prob-

<sup>2</sup> Albert-László Barabási and Réka Albert, Emergence of Scaling in Random Networks. *Science* 286/5439 (1999): 509–512.

<sup>3</sup> Réka Albert, Hawoong Jeong and Albert-László Barabási, Error and attack tolerance of complex networks. *Nature* 406/6794 (2000): 378–382.

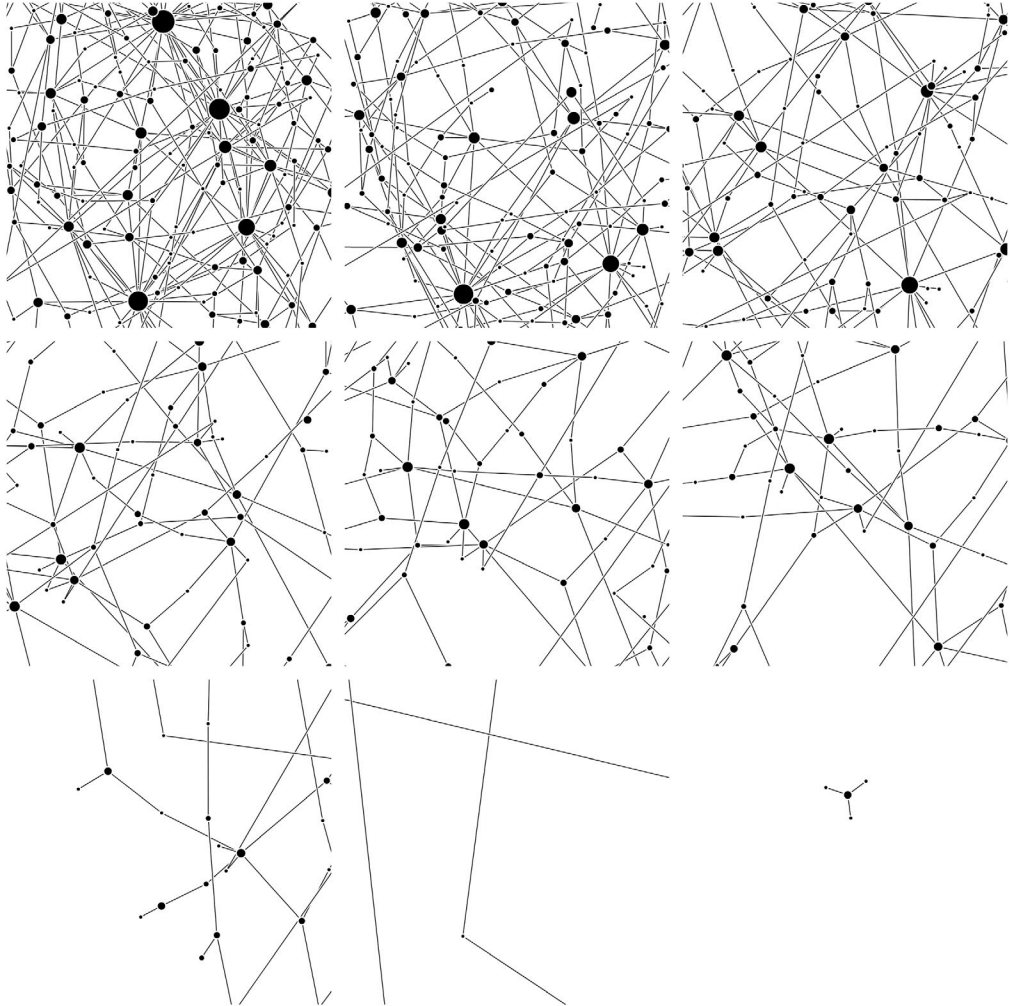


Fig. 2: A targeted attack on the hubs of a Barabási–Albert modelled network.

ably has significant consequences in the world we inhabit. One can only speculate on the destruction of social movements such as the Arab Spring. The speculation is much narrower when it comes to the COVID-19 pandemic.<sup>4</sup> The results of

preferential attachment in global air traffic are well-studied. Without the airport hubs of a few places that connect the globe, the spreading of the virus would have been much slower and thus better to control.<sup>5</sup> The super-spreader phenomenon is a network effect.

4 Romualdo Pastor-Satorras and Alessandro Vespignani, Epidemic Spreading in Scale-Free Networks. *Physical Review Letters* 86/14 (2001): 3200–3203.

5 Dirk Brockmann, Lars Hufnagel and Theo Geisel, The scaling laws of human travel. *Nature*, 439/7075 (2006): 462–465.

On October 8, 2021, the theory of network destruction moved from research into plain sight. The removal of an internet hub became a reality and with it its consequences. Facebook and all its apps – Instagram, WhatsApp, Messenger, and Oculus – disappeared from the internet. The outrage lasted over five hours. The consequences were devastating. As the *New York Times* wrote:

*In some countries, like Myanmar and India, Facebook is synonymous with the internet. More than 3.5 billion people around the world use Facebook, Instagram, Messenger and WhatsApp to communicate with friends and family, distribute political messaging, and expand their businesses through advertising and outreach.*<sup>6</sup>

Might this have been the first of many major outages in the digital networks we are embedded in? The conception of rich-get-richer is how our digital social structure, economy, and technological infrastructure function.

## Network sculptures

How could the previously discussed concepts of preferential attachment and the temporal shaping of communities be altered, navigated, politicized, and shaped to sculpt something more resilient and less pandemic? One path is to alter the

possibilities of a network and restructure its politics.

In the first experiment, any point in the network can have no more than three connections. A political restriction on connectedness. What would Twitter look like if everyone could only follow ten people? This network's altered, sculptured structure would be much slower in transport – but more resilient. Removing connections would not significantly alter the given system. Hong Kong's 'be water' protests contained a similar strategy: There is no one to imprison when there is no apparent leader.

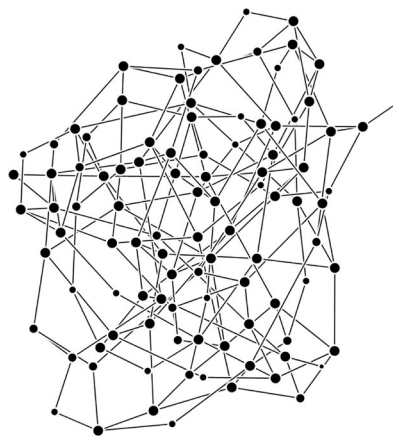


Fig. 3: Networks containing a maximum number of connections form non-hierarchical meshes.

In a second experiment, links decay over time. This network sculpture would only form connections for brief moments to reconstruct itself constantly. Relations within this system are always in question. The system is consistently on the edge of something else. Or within the

<sup>6</sup> Mike Isaac and Sheera Frenkel, *Gone in Minutes, Out for Hours: Outage Shakes Facebook*. *The New York Times* (October 5, 2021); <https://www.nytimes.com/2021/10/04/technology/facebook-down.html>, access: October 19, 2022.



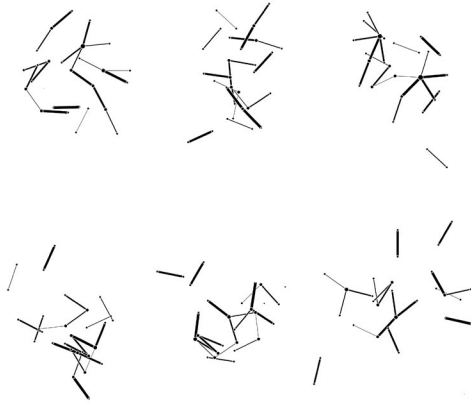


Fig. 4: Network models including decaying links form structures barely resembling the previous network structures.

concept of social networks: You only stay friends with your friends if you keep interacting with them

## Negative networks

Previously, we observed alternative sculptures of network structures reshaping the politics of connectivity. But the social could also move beyond such a perspective and question the system of points and lines entirely. What if the network in its temporal emergence is not about the nodes and edges it is seemingly abstracted as? What if the network is about the space it fills throughout its movement? The negative space, the holes, non-spaces, the void, and the in-betweenness become the driving force rather than the point and lines. A community might exist as the non-net-

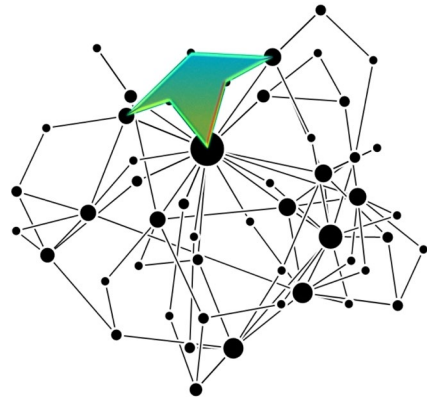


Fig. 5: What if the important aspect of a network visualization are not the points and lines but rather the spaces in between? The negative non-networked spaces?

worked, the gap between the lines, filled, extracted, and enhanced. Temporality leaves the traces behind, the connections, an emergent pattern of relatedness. The network becomes a mere illusion towards the surface it operates on. The trace, the past of the network, is the essential constitution within this model. Rather than focusing on whom I am connected to and how many likes and comments I receive, the focus shifts toward the aftermath of the networked.

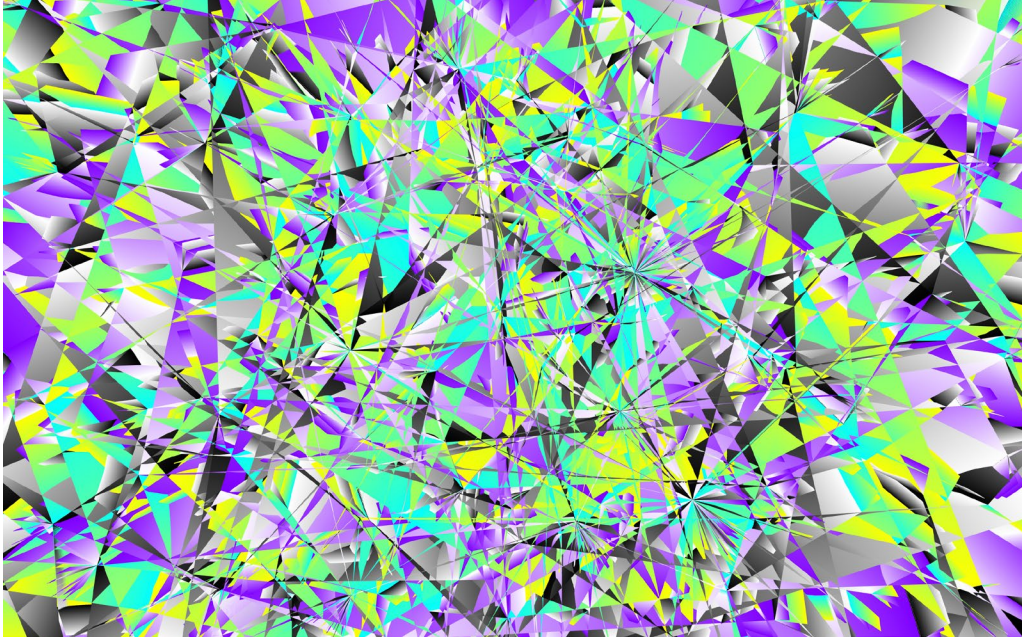


Fig 6: Not the network but its traces, the past movements of the two forces of repulsion and drawing together become visible in this visualization.

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**Isaac, Mike, and Sheera Frenkel**, Gone in Minutes, Out for Hours: Outage Shakes Facebook. *The New York Times* (Oc-

tober 5, 2021); <https://www.nytimes.com/2021/10/04/technology/facebook-down.html>, access: October 19, 2022.  
**Pastor-Satorras, Romualdo and Alessandro Vespignani**, Epidemic Spreading in Scale-Free Networks. *Physical Review Letters* 86/14 (2001): 3200–3203.



# TACTILITY, SOUND AND DIAGRAMMATICS. ULTRASOUND IMAGING AS AN INTERFACE TO THE WOMB

By Nina Franz

*“Emphasizing the diagrammatic aspects of ultrasound images can help to form a more complete picture of the technological and discursive components that led to the construction of the ultrasound image.”*

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A law that went into effect in Texas in 2020 stated that an abortion was to be legal only before a “fetal heartbeat” could be detected. The “heartbeat” was defined as “cardiac activity or the steady and repetitive rhythmic contraction of the fetal heart within the gestational sac”<sup>1</sup> and made visible as a moving image on the screen of an obstetric sonogram, as early as six weeks of gestation. But the status of this image and its interpretation is anything but clear. Critics of the legislation, which in retrospect appears to be a harbinger of the momentous overturning of *Roe v. Wade*<sup>2</sup>, argued that “the flickering that we’re seeing on the ultrasound that early in the development of the pregnancy is actually electrical activity, and the sound that you ‘hear’ is actually manufactured by the ultrasound machine”.<sup>3</sup> This contestation of the legal status of embryonic cell development as “life” was only the latest in a long line of arguments that had been presented since the 1980s in feminist theory of technology, which criticized the particular impact that ultrasound imaging had on the political status of the female body.<sup>4</sup> In the following par-

agraphs, I want to draw attention to the “diagrammatic” capacity of ultrasound imaging as one important denominator in the current debate on what could be described as the sonographic interface to the womb.

In her seminal work *Disembodying Women. Perspectives on Pregnancy and the Unborn*<sup>5</sup> German historian Barbara Duden gives a historical account of the techniques of (visual) access to the pregnant body. Before physiological drawings, prints, models and, in the 20<sup>th</sup> century, postmortem-photography and obstetric sonography turned pregnancy into a purportedly objective process, rendering the pregnant body transparent to the outside observer, the status of pregnancy depended on the woman’s subjective judgement alone. As Duden shows by studying examples like the medical diaries of a *medicus* in the city of Eisenach in the early 18<sup>th</sup> century, a pregnancy began when the women felt the “quickening” – meaning the first movements of the fetus in her

1 Selena Simmons-Duffin and Carrie Feibel, The Texas Abortion Ban Hinges On ‘Fetal Heartbeat’ Doctors Call That Misleading. *NPR*, May 3, 2021; URL: <https://www.npr.org/sections/health-shots/2021/09/02/1033727679/fetal-heartbeat-isnt-a-medical-term-but-its-still-used-in-laws-on-abortion>, access: August 17, 2020.

2 The US-Supreme Court decision of 1972 established the constitutional right to have an abortion, it was overruled in June 2022 in a 6-3 vote.

3 Simmons-Duffin and Feibel, The Texas Abortion Ban Hinges On ‘Fetal Heartbeat.’

4 Just to name but a few: Ann Oakley, The Reign of Technology: Antenatal Care 1960-80, in: *Captured Womb: A History of Medical*

*Care of Pregnant Women* (Oxford, 1984), pp.155–209; Rosalind Pollack Petchesky, Fetal Images: The Power of Visual Culture in the Politics of Reproduction. *Feminist Studies* 13/2 (1987): 236–292; Carol Stabile, Shooting the Mother: Fetal Photography and the Politics of Disappearance. *Camera Obscura* 10/1 (1992): 179–205; Julia Epstein, The Pregnant Imagination, Fetal Rights, and Women’s Bodies: A Historical Inquiry. *Yale Journal of Law and the Humanities* 7 (1995): 139–162; Joanne Boucher, Ultrasound: A Window to the Womb? Obstetric Ultrasound and the Abortion Rights Debate. *Journal of Medical Humanities* 25/1 (2004): 7–19; Meredith Nash, From ‘Bump’ to ‘Baby’. Gazing at the Foetus in 4D. *Philament Journal* 10 (2007); Karen Barad, Getting Real: Technoscientific Practices and the Materialization of Reality, in: *Meeting the Universe Halfway* (Durham 2007), pp. 189–222. I am indebted to Heike Klippel for her important leads.

5 Barbara Duden, *Disembodying Women. Perspectives on Pregnancy and the Unborn*. Translated by Lee Hoinacki (Cambridge, MA 1993).

womb. Throughout the history of modern science, advances in medical imaging turned this private experience into a heavily mediated practice that took the assessment from the subjective perception of the woman and handed it over to the instruments of medical professionals, marking a shift from a “haptic-tactile to a visual-geometric”<sup>6</sup> paradigm of obstetric perception. Thereby the female womb was transformed from an intrinsically private realm, defined by its categorical inaccessibility and invisibility to any outside view, to a politically contested, visually mediated “public space”.<sup>7</sup>

A milestone in this development was the publication of Lennart Nilsson’s seventeen photographs of the developmental stages of human embryos and fetuses in the cover story “Drama of Life Before Birth”<sup>8</sup> for *LIFE Magazine* in 1965, whose eight million copies sold out within only three days. This “unprecedented photographic feat in color” portrayed the fetus sixteen and eighteen weeks after conception in its amniotic sac, completely detached from the surrounding body. Like an astronaut the fetus floats in a dark, empty space – a prototype of the detached individual that lacks any social

connection.<sup>9</sup> As Duden and others have pointed out, this depiction of the fetus as completely detached from its real physical context lent itself readily to political instrumentalization. Ironically, the anti-abortion activists who later upheld the image of Nilsson’s fetus as an icon for their “pro-life” struggle were conveniently unaware that the images were taken of aborted fetuses that had been elaborately arranged by the photographer, propped up, backlit and colored to look “alive” outside of their physical context. But Nilsson’s images not only convey a false autonomy of the fetus. Duden highlights that at the same time its attachment to the placenta through the umbilical cord also presupposes the presence of a supply system, which is conspicuously absent from the picture.<sup>10</sup> This surrounding “ecosystem” with the capacity of sustaining the life of the fetus is the pregnant woman.

While the impact of Nilsson’s photographs on public perception (and, likewise, the *perception as public*) of “fetal personhood” can hardly be overestimated, the real breakthrough for the obstetric interface came with ultrasound technology. For Duden, this difference is marked by the progression from the fetal image as “ideogram” to “diagram”.<sup>11</sup> Citing

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6 Quoted from the German edition: Barbara Duden, *Der Frauenleib als öffentlicher Ort. Vom Mißbrauch des Begriffs Leben* (München 1991), p. 67.

7 This is conveyed much more strongly by the title of the original German edition than in the English translation: *Der Frauenleib als öffentlicher Ort. Vom Mißbrauch des Begriffs Leben* [The Female Womb as Public Space. On the Misuse of the Concept of Life].

8 Lennart Nilsson, Drama of Life Before Birth. *Life*, April 30, 1965.

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9 Duden, *Der Frauenleib als öffentlicher Ort*, p. 29.

10 Ibid.

11 Ibid., p. 42. To quote the complete sentence (which is missing in the English translation) on the distinction between “ideogram” and “diagram”, a distinction that is also relevant for semiotic perspectives on diagrammatics: “Ich will eine Brücke bauen, die vom Hocker zum Fötus, vom Ideogramm zum Diagramm, von Frauenahnungen zu medizinischen Diagnosen führt.” [I want to build a bridge leading from the squatter (fetus in a squatting position, N.F.) to the



Figs. 1a & b: Lennart Nilsson, "Drama of Life Before Birth," cover story for *LIFE Magazine*, April 30, 1965; image excerpts.

Hildegard von Bingen, Duden shows that in the 12<sup>th</sup> century, the imagination of the fetus used to be approached through metaphors and holistic descriptions rather than analysis, "the complete opposite of anatomy",<sup>12</sup> the inside of the womb as a secret that awaits interpretation. In this way, the ideogram conveys through words that which is hidden in the inside of the womb, categorically invisible. The iconic semblance of Nilsson's fetus on the other hand, while heavily manipulated, is a more or less direct visual representation, while the sonographic image approximates a diagrammatic operation, in so far as it visualizes the measurements of sound waves of frequencies above the threshold of human audibility (typically 1-30 megahertz for diagnostic ultrasound<sup>13</sup>). An ultrasound transducer uses piezoelectric crystals to induce oscillations, which are then transmitted as ultrasound waves into the body. The ultrasound is emitted in short pulses, as a narrow beam. A grid of such beams builds a two-dimensional image. The same piezoelectric crystal acts as a receiver, converting the reflected or back-scattered pulses (the echo) into electronic signals that allow calculation of the distance to the object based on the time the beam travelled. The measurements are then translated according to machine settings into a brightness factor on the graphical screen interface, where they form the basis for the diagnostic ul-

<sup>12</sup> *Ibid.*, p. 43.

<sup>13</sup> Elisabetta Buscarini et al., *Manual of Diagnostic Ultrasound*, vol. 1 (Geneva 2011), p. 3.

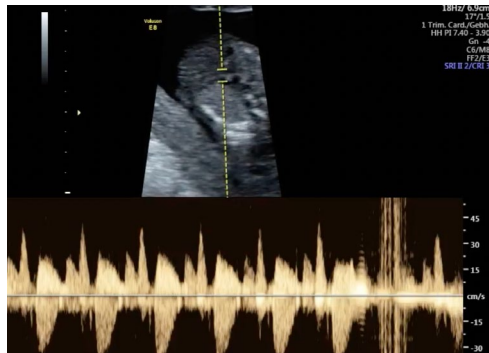
fetus, from the ideogram to the diagram, from female intuitions to medical diagnoses.]

trasound image.<sup>14</sup> Although the resulting screen image appears to be “photographic” (or videographic) in that it depicts either the surface or a cross-section of the fetal body, still or in motion, it has to be understood as a graphic representation made up of measurements that are then pieced together and interpreted to be readable for the human eye. This *diagrammatic* capacity of obstetric sonography – as a heavily mediated visual interpretation of measured data – is lost to the recipients of these images. In the “fetal heartbeat”<sup>15</sup> debate this has consequences for the political contestations that are at stake, namely, the establishment of the embryo or fetus as a new category of legal person, and its precedence over the legal status of the woman. At six weeks of gestation, electrical impulses in the cells that will form a functional organ only much later (at approximately 20 weeks of gestation<sup>16</sup>) are translated to a moving screen image as well as an audible sound effect by means of ultrasonography. The result is a compelling effect that, in combination with a specific discursive emphasis on “fetal life”, seems to prove the existence of a functional organ, and, by extension, the existence of an autonomous, legal subject that takes prec-

edence over the rights of the body that carries it.



Fig. 2: Ultrasound image at seven weeks of gestation, author's own archive.



Figs. 3 and 4: Ultrasound images at 14 weeks of gestation, author's own archive.

14 See *ibid.*, pp. 9–10 as well as Reinhard Lerch et al., *Technische Akustik. Grundlagen und Anwendungen* (Heidelberg 2009), pp. 587–589.

15 At six weeks of gestation the correct term is “embryo”, not fetus. To speak of a fetus here is in itself an ideologically-tinged misnomer.

16 Eleftheria Pervolaraki et al., *Antenatal Architecture and Activity of the Human Heart*, *Interface Focus* 3, 2013, pp. 1–10. I want to thank Paul Edwards for pointing out this reference.



While diagrams are defined by their capacity to convey information through visual or graphic means, often in combination with textual and numerical elements, the question has been raised if the meaning of the term could be expanded to include auditive and even tactile signs.<sup>17</sup> Obstetric ultrasonography presents an interesting hybrid between material components that are sonar (the ultrasound wave), tactile (the piezoelectric crystal that acts as transducer and both emits and receives the sound wave, as well as literally touching the surface of the body) sonar-tactile (the interaction between womb/embryo and ultrasound), and diagrammatic techniques that present measured data in form of a topologically composition on a screen, as well as through sound, which are always accompanied and made interpretable by text and numbers. As the comparison with Nielson's fetal photographs reveals, the truth value of such images as purportedly "direct representations" is no less contestable than that of the diagrammatic representations, which, by their very nature, contain an interpretative element that is built into the technology of visualization.<sup>18</sup> Emphasizing the diagrammatic aspects of ultrasound images can help to form a more complete picture of the technological and discursive components that led to the construction of the ultrasound image.

Karen Barad has highlighted the importance of recognizing this "relationship

between the material and the discursive"<sup>19</sup> in what they call *agential realism*. In continuation with the long history of feminist discourse on ultrasound, their chapter on "Entanglements and Re(con)figurations"<sup>20</sup> in *Meeting the Universe Halfway* (2007) puts a critical focus on the images of obstetric sonography and uses the piezoelectric transducer as the prime example to illustrate what they describe as the "intra-action" between observing subject, technology, and the object of observation. According to Barad, "the piezoelectric transducer is [...] the machine interface to the body"<sup>21</sup> and "the marks on the computer screen (the sonogram images, sonic diffraction patterns translated into an electronic image) refer to a phenomenon that is constituted in the intra-action of the 'object' (commonly referred to as the 'fetus') and the 'agencies of observation'". If we follow Barad, putting the focus on the numerous tactile, sonic, visual and discursive elements that produce the diagrammatic image of the fetus/embryo reconfigures the interface to reveal an "intra-face"<sup>22</sup> of the womb. This makes it impossible to think of "unborn life" as an isolated entity, but puts forward the idea of an entity that is quite literally entangled with the physical reality that surrounds it.

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19 Karen Barad, *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning* (Durham, 2007), p. 191.

20 Barad's chapter on Ultrasound inspired Aleksandra Domanić's work for her exhibition "Becoming Another" (September 16 – October 21, 2021, Audemars Piguet Contemporary, Berlin), which in turn inspired the research for this article, along with a new series of images by the artist (in this issue, pp. 51–67).

21 Barad, *Meeting the Universe Halfway*, p. 202.

22 Ibid. 201.

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17 Roland Posner, *Diagrammatische Zeichen, Einführung. Zeitschrift für Semiotik* 31/3–4 (2015): 213–229, here 215.

18 Cf. Johanna Drucker, *Graphesis. Visual Forms of Knowledge Production* (Cambridge, MA 2014).

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# DUPLEXES

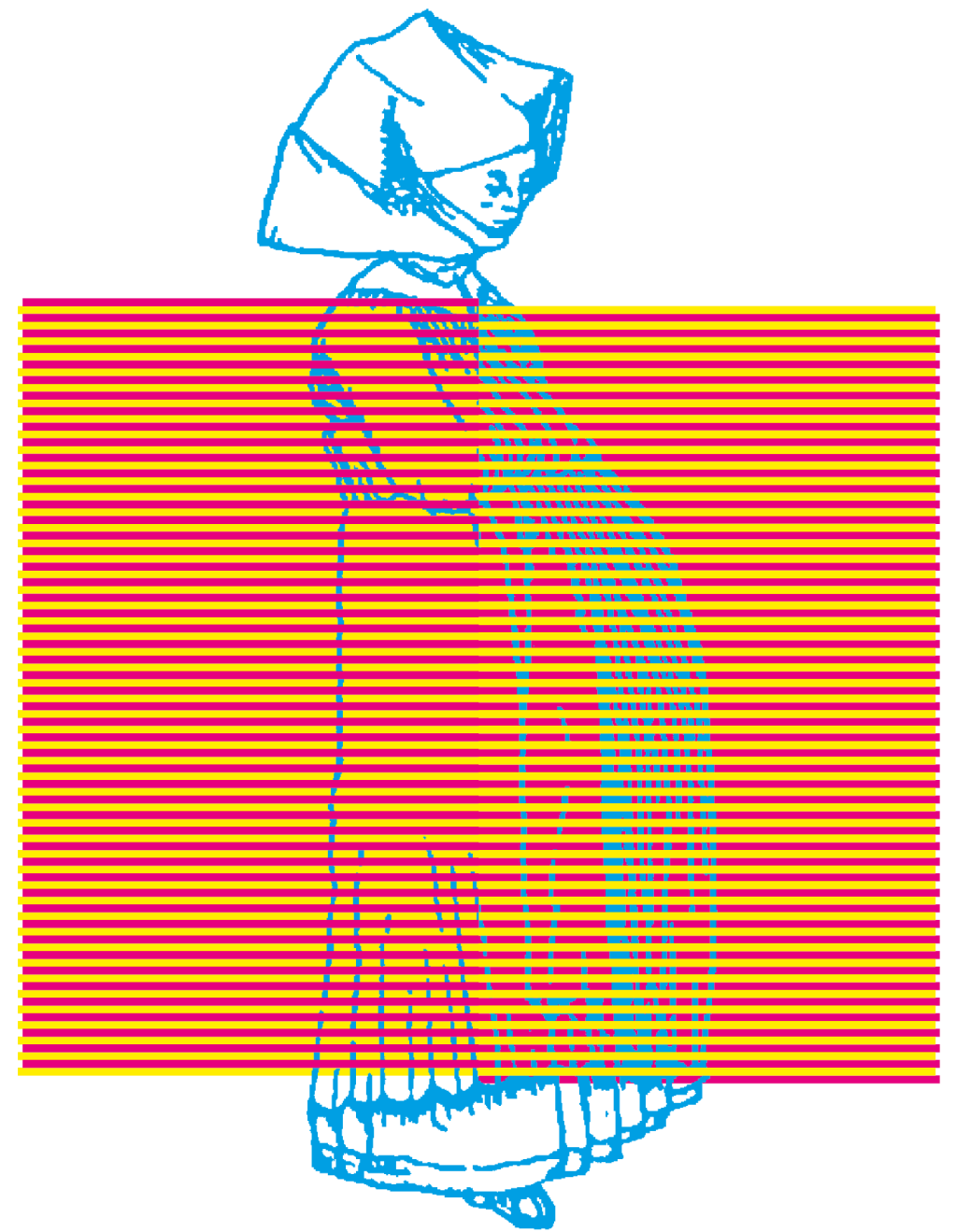
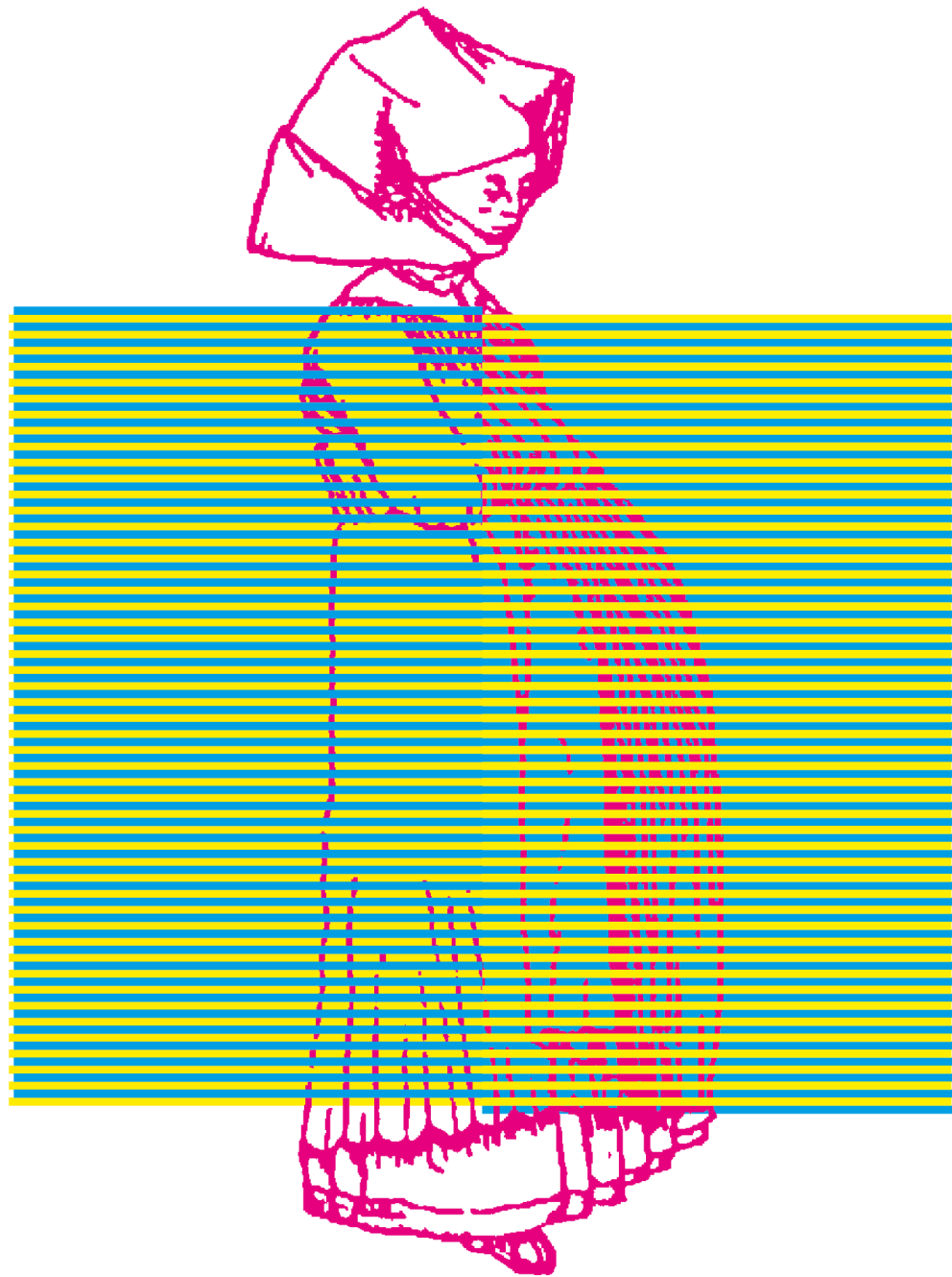
By Aleksandra Domanović

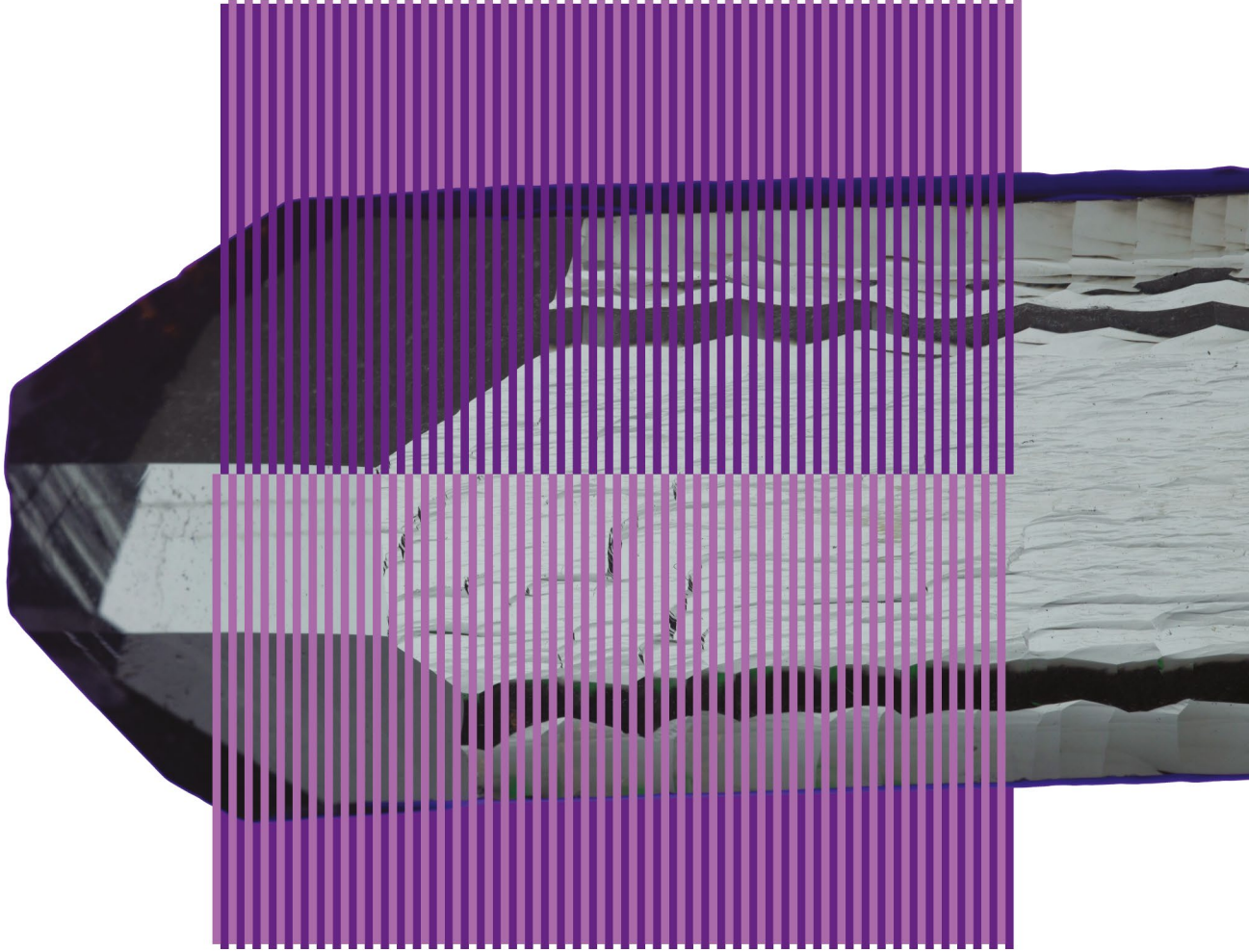
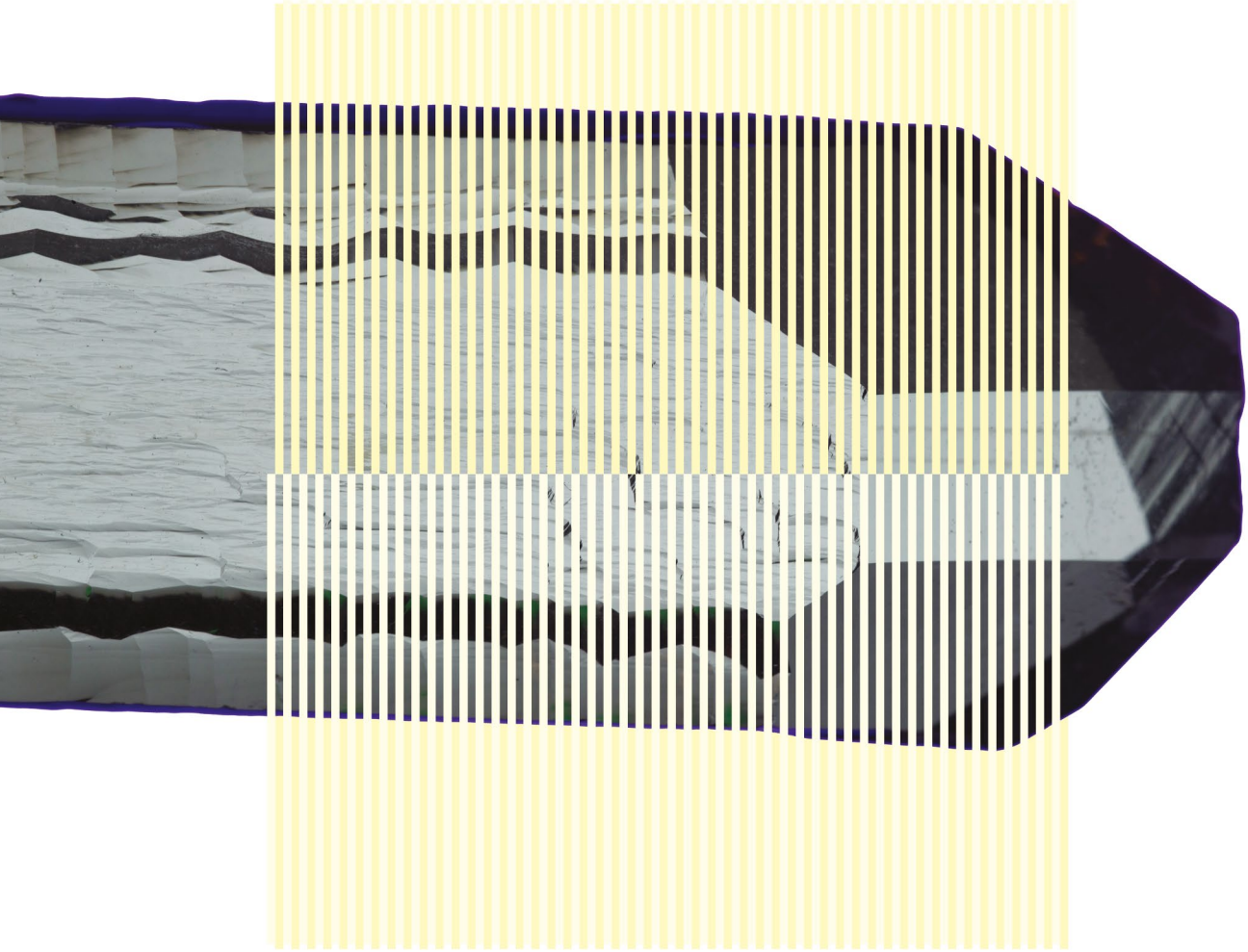
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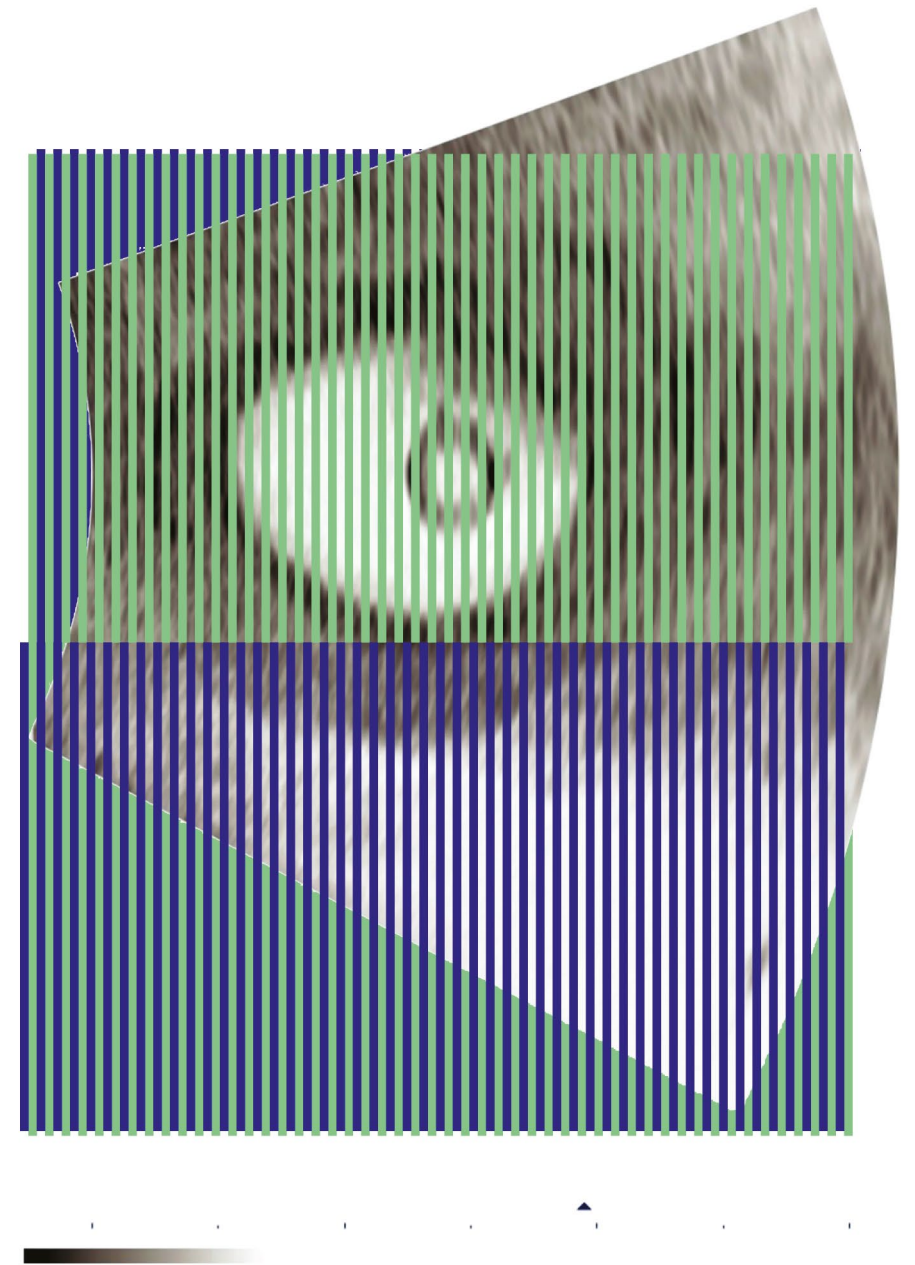
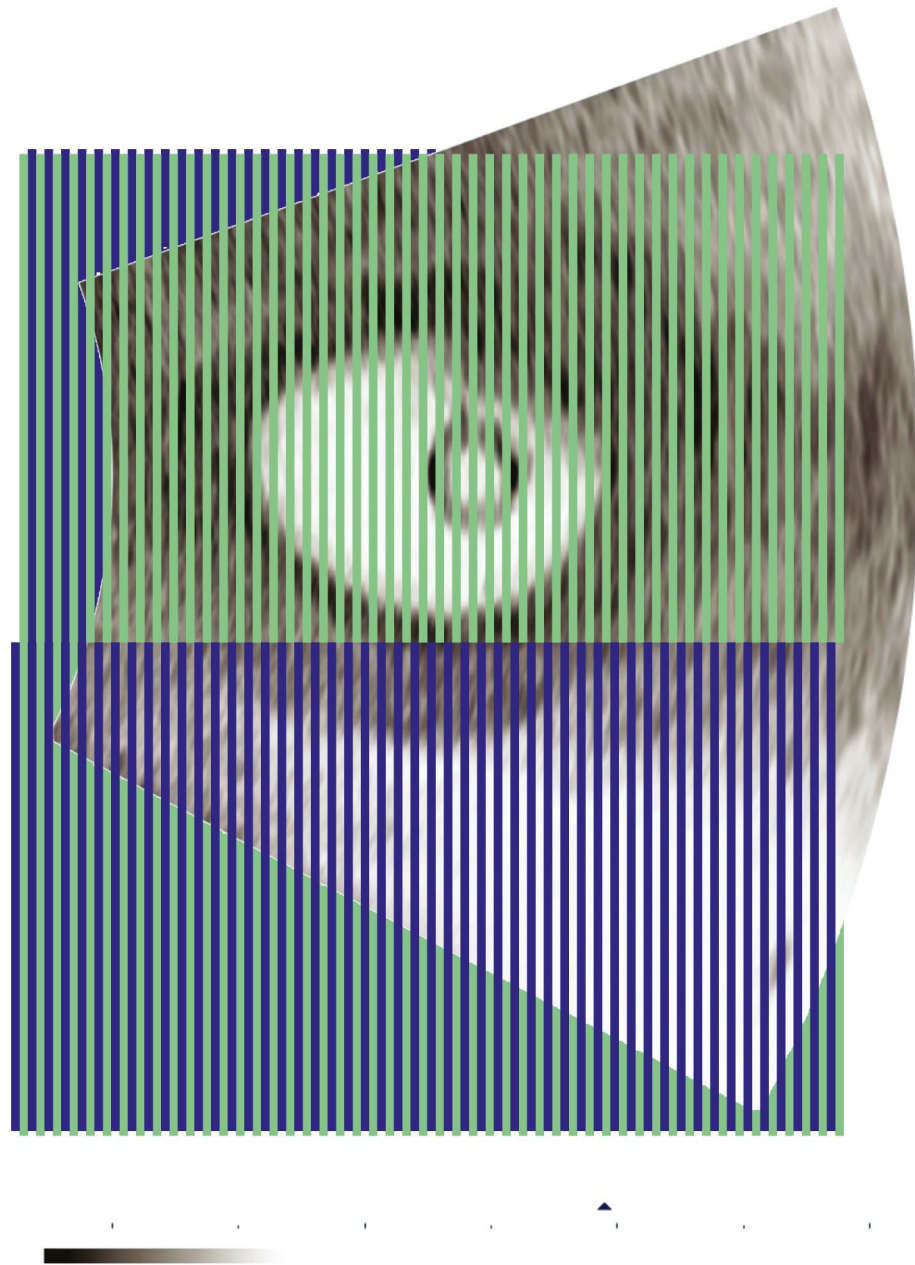
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DOI: <https://doi.org/10.11588/ic.2023.4.93409>

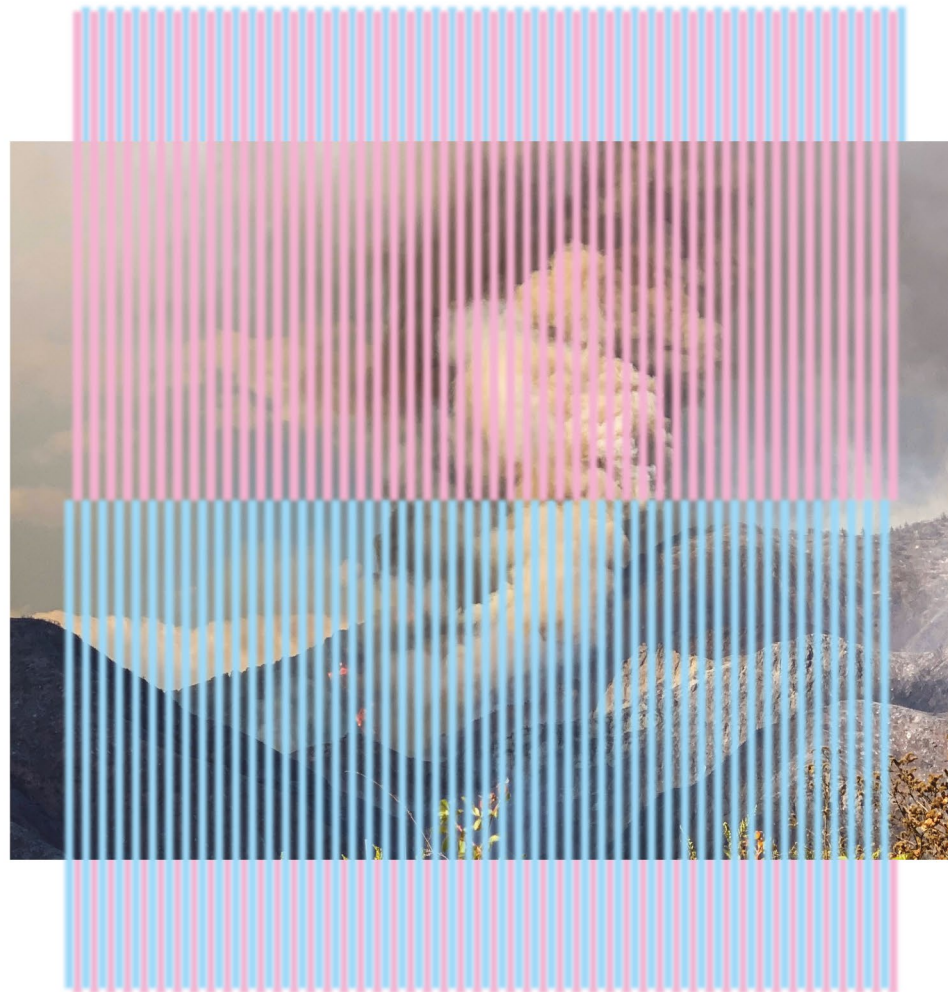
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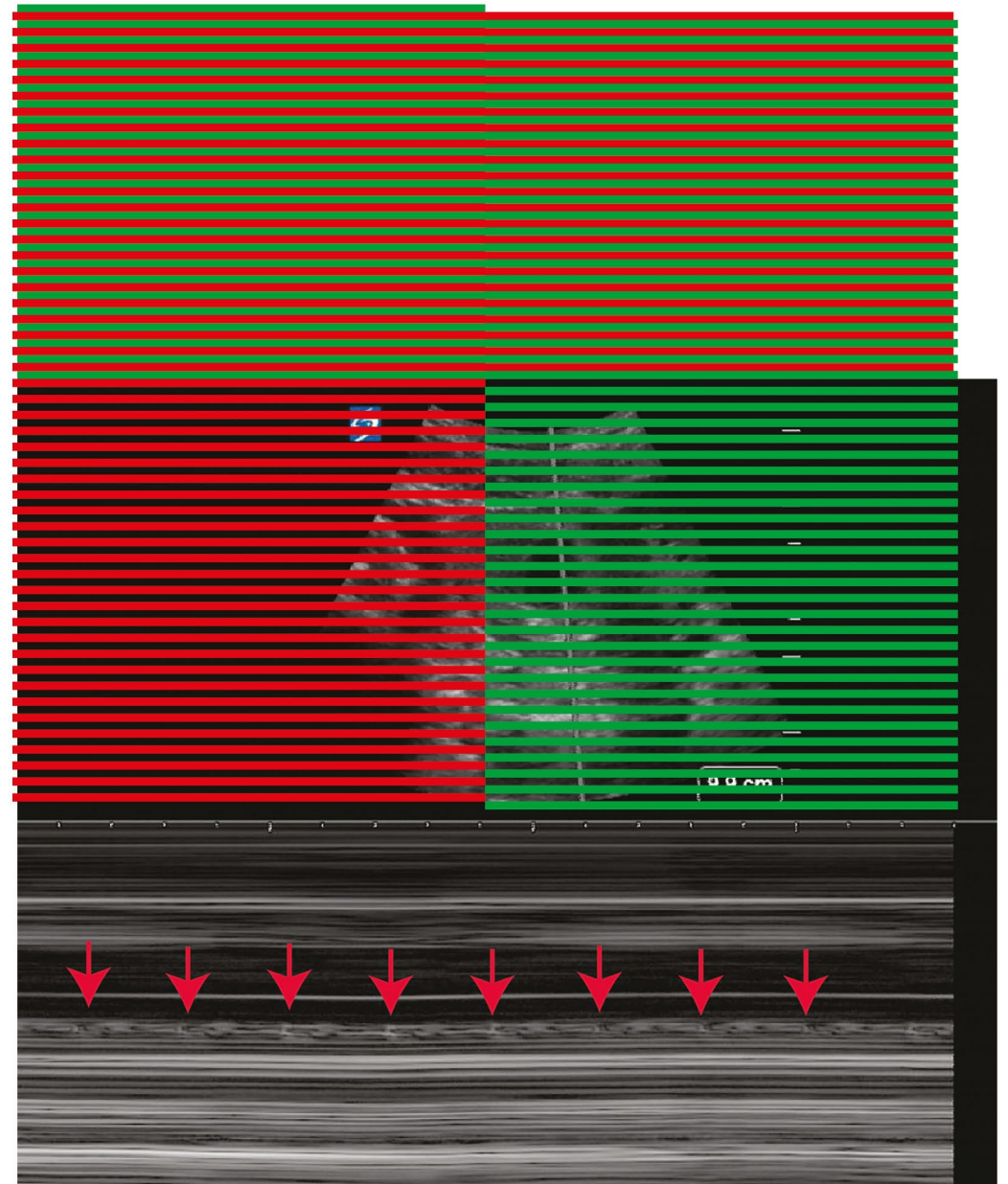
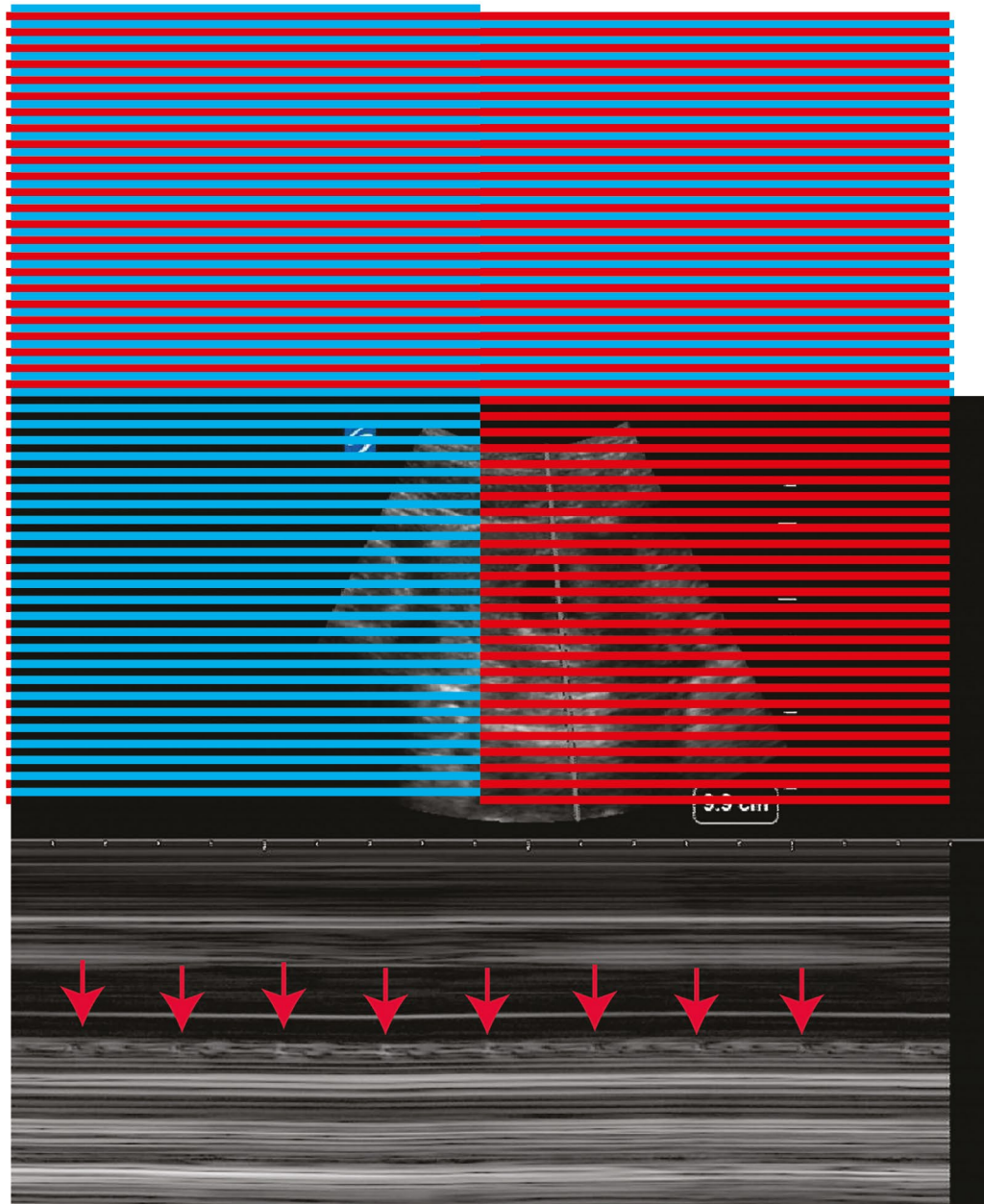












The images in this section are the latest addition to Aleksandra Domanović's exploration of the co-constitutive powers of the gaze that she has been developing for the past two years. Employing the Bezold-effect, an optical illusion that makes a color appear to change depending on its adjacent colors, the works illustrate the fraught distinction between seeing and perceiving, as well as the entangled object/observer relationship in Karen Barad's account of the ultrasound. In their 2007 book *Meeting the Universe Halfway*, Barad analyzes the social, material and discursive changes that take place in the technological "seeing" of ultrasonography. There is no unambiguous way, they argue, to differentiate between the object and the agents of observation. Separated from both mother and fetus, the image of the ultrasound becomes the object, and we the viewers the agents of observation.

The series of images and the previous text by Nina Franz are the result of an ongoing exchange between the artist and the author.

### Captions

1

A figure from the cover design of Barbara Duden's *Der Frauenleib als öffentlicher Ort: Vom Mißbrauch des Begriffs Leben* (Munich: Mabuse, 1994).  
Copyright: Helmut Gebhardt

2

A lab-grown piezoelectric crystal.  
Copyright: DIOMEDIA / Science Source / Ted Kinsman

3

An ultrasound image of a human embryo with cardiac activity located in close proximity to the yolk sac at approximately six weeks of gestation.  
Copyright: Dr. med. Miroslava Domanović

4a

Professor Ian Donald, English physician who pioneered the diagnostic use of ultrasound in obstetrics, 1975.  
Copyright: Mirrorpix

4b

Professor Ian Donald, pioneer of ultrasound obstetrics, speaking at an Abortion Bill protest meeting organized by the Society for the Protection of Unborn Children held at Caxton Hall, London, January 24, 1967.  
Copyright: AP

5

View of the El Dorado Fire from El Dorado Ranch Park on Saturday, September 5, 2020.  
The El Dorado Fire, colloquially known as the Gender Reveal Fire, was a wildfire that burned near the community of Yucaipa and the San Gorgonio Wilderness Area of the San Bernardino National Forest in San Bernardino County, California in the United States, during the 2020 California wildfire season. The fire was caused by a pyrotechnic device at a gender reveal party and spread rapidly, causing one firefighter fatality.  
Copyright: San Bernardino National Forest, Zach Behrens

6

Linear ultrasound transducer.  
Copyright: Aleksandra Domanović

7

Ultrasound image of electrical activity interpreted as "fetal heartbeat" at seven weeks of gestation.  
Source: <https://www.criticalcare-sonography.com/2016/11/13/now-you-see-it-now-you-dont/>  
Copyright: Critical Care Sonography, Genevieve Carbonatto



# TOWARD A MAP OF THE BODY

By Vilém Flusser

*“The body structure which this paper is going to propose is a space-time continuum and therefore not easily executable in the traditional two-dimensional map form. [...] This is how it wants to be read: as a raw sketch to be translated into more adequate means of communication.”*

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### Editorial preface

“Practically all the models now at our disposal are space models”, wrote Vilém Flusser (1920–1991) in a posthumously published essay, “On the Crisis of our Models”.<sup>1</sup> It was supposed to be a guide to develop a universal model of the human body from a phenomenological perspective, a guide that the Czech philosopher had imagined for artists and other practitioners of the video or “technical image”. Silvia Wagnermaier, then research assistant at the Vilém Flusser Archive in Berlin, has described this aspect of Flusser’s work, which so far has received little attention in studies of his legacy, with the keywords “bodies and body maps, body and body models, skins and dermatologies”.<sup>2</sup> This thematic complex includes Flusser’s essays “Ist ein Modell meines Leibes möglich?”<sup>3</sup> [Is a Model of My Body Possible?] and “Toward a map of the body”,<sup>4</sup> both remained unpublished during Flusser’s lifetime.

The manuscripts are undated, but Wagnermaier concludes from the paper and the type of typewriter used that they were probably written during the same period. If we look at sources such as Flusser’s correspondence with Patrick Milburn, the editor in chief of *Main Currents in Modern*

*Thought*, a journal in which Flusser published one of his most important texts in the US,<sup>5</sup> we can not only date the essay relatively precisely to 1974. We also find traces of the genesis of “Toward a map of the body” and the references that sparked the idea to conduct a phenomenological thought experiment as an embodied self-observation. In a letter dated May 1974 Milburn wrote to Flusser about his current research interests. In particular, the problem of the phenomenology of the lived body strongly interested him at the time: “Most fundamental, of course, is a phenomenology of the lived, bodily experience, of the qualities of the body and its organically-intended regions – it would be interesting to compare such ‘inward’ maps of the ‘organs’ with Tibetan and Hindu anatomies.”<sup>6</sup> In his answer Flusser accepted Milburn’s challenge to conceive such a “map” of the human body and right away outlined a model that shall be conceived as a “pulsating ball”.<sup>7</sup> The human body as a phenomenological “time-space continuum”<sup>8</sup> was obviously already occupying Flusser at this point: “I am very much bewildered by the problem of the organism closest to me: my body. After all: since my body stands between myself and all other things, and since it mediates between myself and all other things, it models everything.”<sup>9</sup>

Flusser described such a model of the human body as a cognitive zero point conceived as sphere in his essay “On the Crisis of our Models”, which one may add to Wagnermaier’s list of texts

1 Vilém Flusser, *On the Crisis of our Models*. (Theoretical considerations and a practical proposal), manuscript Vilém Flusser Archive, ref. no. 2767 (undated, ca. 1974), p. 3.

2 Silvia Wagnermaier, *Zuführung zum Text Vilém Flussers*, in: *Lab: Jahrbuch 2000 für Künste und Apparate*, ed. Kunsthochschule für Medien Köln/Verein der Freunde der KHM (Cologne: Walther König 2000), pp. 113–114, here 113.

3 Manuscript Vilém Flusser Archive, ref. no. 2451 (undated, ca. 1974).

4 Manuscript Vilém Flusser Archive, ref. no. 2800 (undated, ca. 1974). German variant: *Von den Möglichkeiten einer Leibkarte*, manuscript Vilém Flusser Archive, ref. no. 2058 (undated, ca. 1974); published in: *Lab: Jahrbuch 2000 für Künste und Apparate*, pp. 115–124.

5 Vilém Flusser, *Line and Surface*. *Main Currents in Modern Thought* 29/3 (1973): 100–106.

6 Milburn to Flusser, May 10, 1974, letter Vilém Flusser Archiv, ref. no. Cor. 144, document 8.

7 Flusser to Milburn, May 21, 1974, letter Vilém Flusser Archiv, ref. no. Cor. 144, document 9.

8 *Ibid.*

9 *Ibid.*

on body maps and dermatologies. Apparently, the essay was written still under the impression of the correspondence with Milburn. If one compares it with “Ist ein Modell meines Leibes möglich?” cited by Wagnermaier, it becomes apparent that the texts correspond in large parts or that the German essay probably originated from the translation and revision of the English one. Also “Toward a map of the body”, which invokes similar themes, was apparently written during the same period, probably at a point in time after the other two essays. In them Flusser explicitly articulated his interest in the “new” research on a phenomenology of the body. As usual, he does not disclose sources. The terminology used, however, shows the omnipresent influence of Martin Heidegger in Flusser’s work, who himself did not develop a phenomenology of the body, but nevertheless worked out the subjective significance of, according to Flusser, the “standpoint of being-in-the-world”<sup>10</sup>. An engagement with the work of Maurice Merleau-Ponty also seems to become apparent when Flusser refers to the human body as “the way in which we are in the world” (cf. Merleau-Ponty’s *corps vécu*). If not in the three essays mentioned here, Merleau-Ponty does appear in other writings by Flusser, among the best known is his book *Vampyrotheuthis infernalis* (1987).

The essay, and this is why it is published here, does not only touch topoi of phenomenology, but also of diagrammatics, wider theories of embodiment, and interface studies. We do not want to imply or dictate a particular reading of the essay in such contexts. But we would nevertheless like to point out that Flusser’s thought experiment combines questions of embodiment with diagrammatics – the body map model is described by Flusser as a genuine diagrammatic system

– while framing one’s own body as an interface system of input and outputs, as a threshold where the world perceived is bestowed with sense. Also, the text is written with at the time new media technologies such as video in mind, which would allow, according to Flusser, to represent the model – which is necessarily a “space-time model”<sup>11</sup>, since one’s living body is situated and acts in the world – as moving images or animated graphics. In other words, the diagrammatic “moving images of thought” (Charles Sanders Peirce) could be materialized as concrete experimental systems: “We need no longer merely ‘reflect’ or ‘speculate’ concerning space-time models, we can put them to technical and practical experimental utilization.”<sup>12</sup>

The diagrammatically conceived map of the body demands a diagrammatic depiction. Flusser did not, to our knowledge, provide illustrations or sketches for this essay. However, there is a sketch by Flusser from the same year, among notes he took while visiting the influential conference “Open Circuits: The Future of Television” at MoMA, New York, January 23–25, 1974 (fig. 1). It depicts a comparison between a traditional “Western” temporal model of history conceived linearly (labeled in the diagram as “Dynamic in Historical Progress”) and Flusser’s “post-historical” model, in which future possibilities are centered on the subject in the present (“within Present”), ready to be selected and realized. Both models are well known in Flusser’s work and part of his anthropology.<sup>13</sup> Similar to his body model or map of the body the post-historical model depicted here conceives the subject as a circle, or sphere, while arrows coming from the future, or the outside

11 Flusser, *Toward a map of the body*, p. 6.

12 Ibid.

13 Cf. e.g., Vilém Flusser, *Into the Universe of Technical Images* (Minneapolis: University of Minnesota Press, 2011).

10 Flusser, *Ist ein Modell meines Leibes möglich?*, p. 1; transl. D.I.

world, enter its field of perception and living environment.

These are only some examples how Flusser's phenomenological approach can be discussed in context of diagrammatology.<sup>14</sup> For this publication the essay has been transcribed from a typewriter manuscript and was carefully edited: Only grammar and spelling inconsistencies, along with typos such as punctuation errors, were corrected. With these cautious adjustments we hope to have preserved the characteristic style of Flusser's writing. We are indebted to the Vilém Flusser Archive and its current research supervisor, Anita Jóri, for the permission to publish the essay.

Berlin, September 2022

Daniel Irrgang

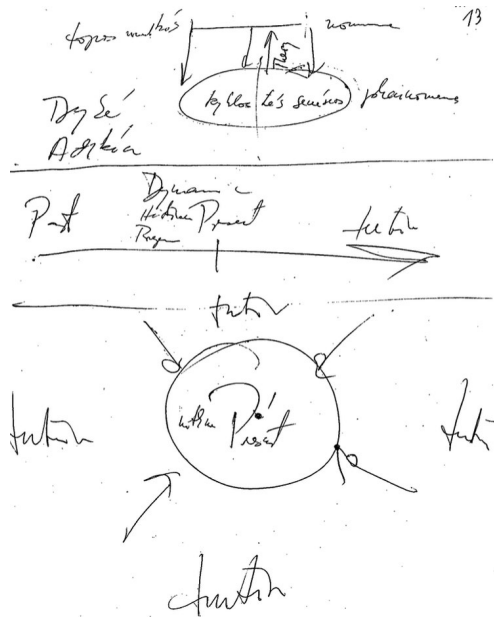


Fig. 1: Sketch by Vilém Flusser's on temporal models, scribbled on the back of the "Open Circuits" conference program (1974). Source: Vilém Flusser Archive, ref. no. Cor 55, 6, R, document 13.

14 For a more comprehensive approach see Daniel Irrgang, *Erweiterte Kognition. Zum diagrammatischen Zeichen als verkörpertem Denken* (Berlin 2022); parts of the preface are taken from this book and have, for this purpose, been translated and extensively reworked.



We are about to enter a new period in more than one sense of the term. For instance: We must remake all the maps of our world. We do not trust the existing maps any longer. Because they are, all of them, projections from a specific point of view, the so-called “objective” one. We can no longer assume that point of view in good faith. We must assume a different one: the point of view of our being-in-the-world. Now to look at the world from within implies seeing it in a way different from the view offered by world maps of our tradition. For instance: We can no longer see our bodies as things among other things in the world. We now see our bodies as mediations between ourselves and all the other things in the world. In fact, because all things are experienced by us through our body one way or another, we ought to make a map of our body before we can try to make maps of the things in the world. Of course, we need not throw away all the existing maps of the body (like the maps of anatomy, of physiology, and so forth). They may come in handy at a later stage of our effort to orient ourselves in the world. But as points of departure such maps are no longer useful. The question this paper poses itself is this: How could maps of the body projected from the point of view of our being-in-the-world (the phenomenological one) look like?

It is, first of all, a question of strategy. One possible strategy is this: One can make a catalogue of our experiences of our body. One can then try to find some structure which orders these experiences and call it “the body structure”. This

will be a sort of rudimentary map of the body. And with the help of such a map one can start cataloguing the things of the world as they are being experienced through the mediation of the body. To give an example for the possible results of such a strategy in the long run: I experience “sight”. I then find a structure within which “sight” can be located, for instance called “my eyes”. And then I try to make a catalogue of the things experienced through “my eyes” within the structure of my body, like “this typewriter” or “this text concerning Julius Caesar”. In the long run this will result in maps of the world. But this strategy has its drawbacks. It is theoretically problematic. The problems are very ancient (empiricism versus formalism and so forth) and cannot be easily “suspended”. And, most of all, it is practically unsatisfactory because it will bring results only in the very long run. And we are, understandably, impatient. We feel we must be able to orient ourselves in the world here and now, not in some far away future. There must be a better strategy. For instance, this one:

One can propose a provisional structure of the body. One can then try to locate the various body experiences within it. And correct the structure as one goes on. Such a map of the body could be used immediately as a provisional tool for mapping the world, as it is being experienced through body mediation. The proposal of one such possible body structure as a possible projection for a map of the body (and through it, of the world) is the purpose of this paper.

The body structure which this paper is going to propose is a space-time continuum and therefore not easily executable in the traditional two-dimensional map form. It is best to imagine it as a videotaped hologram in motion. This is how it wants to be read: as a raw sketch to be translated into more adequate means of communication.

Imagine a sphere with very thick walls and a small hole in its center. The sphere pulsates. It is within a context. In some places the context penetrates the sphere and is absorbed by it. In other places the sphere expels secretions which become parts of the context. The context is composed of elements which cluster around the sphere and become rarer as one advances toward an empty horizon. Let us now try to introduce labels into this proposed model: Let us label the wall of the sphere "my body", the hole in the sphere "myself", the context "my world", and the horizon "my death", and let us see how we can use such a model.

Let us first disregard the wall of the sphere (which is, of course, the purpose of the model). We can label the incoming influences from the context toward the sphere "my future" or "my problems". We can label the outgoing secretions "my past" or "my products". We can label the places of feedback between sphere and context "my presence in the world" or, more compactly, "my present". Let us now see how this will work as a map of my concrete being-in-the-world. For instance: A specific problem presents itself on a specific place of my body, coming out of my future. I shall call this specific

problem "a pain in my liver". Now before that pain presented itself (when it was still in my future), I had no experience of my liver (either as a problem or as part of my body). "The liver" is therefore an element which is experienced only as part of the problem "pain in my liver". Strictly speaking, it has no place within my body structure. But neither has it any place within the context of my body because when it is being experienced, it is being experienced as part of my body. The model has therefore failed us here, and we must improve it. A region must be introduced in it which lies between "my body" and "my world" (between the sphere and its context), a sort of no-man's-land which is both my body and my world and neither. We might label that region "the theoretical part of my body". (The painless liver is a theoretical, but not a concretely experimental, part of my body.) In this region things like proteins and genetic information may be located. And it may be organized this way: "Liver" is less theoretical than "genetic information" (nearer to the sphere wall) because I can experience it in pain, but "genetic information" I can experience only through more complex mediation. And this is only one example for the need to constantly refine the model.

Let us now try what can be done with the model on the inside of the sphere walls, the side opposing "myself" (the hole in the middle). It is obvious that we must allow for two aspects of it: one that brings in, and one that brings out information of the context. One can label the first aspect "experience" or "passion" and

the second one “commitment” or “action”. This may be imagined as a bundle of arrows. Some point from the wall into the hole coming from the context, others from the hole into the wall and through it at the context, and some point from the wall into the hole without coming from the context and from the hole into the wall without going into the context. Some of these arrows are fixed, others can be turned around. Now let us try to see how this will work as a map for our concrete body experience. “Myself” experience a specific arrow which brings in information from “my world”, and I shall call that arrow “my finger”. And “myself” experience the same arrow as turnable because “my finger” may also inform “my world” about “myself”. But this is not the whole matter. “Myself” can also finger “my finger” (there are ten fingers in my body structure and one can finger the other). Therefore, “my finger” is experienced by “myself” as being part of “my body” (a mediation between “myself” and “my world”). Not so with other arrows. “Myself” experience another arrow which brings in information from “my world” as “my eye”. “Myself” cannot turn it around. But what is more, “myself” cannot see “my eye” directly. (Although I have two eyes in my body structure, one cannot see the other.) Therefore, “myself” cannot experience “my eye” as being part of “my body”. In other words: “my finger” can be seen through “my eye” and fingered through “my other finger”, but “my eye” cannot be seen by “my other eye”, only fingered by “my finger”. I experience “my eye” as being part of “my body” only

through the mediation of other parts of “my body”. Now surely this important distinction must be shown in the map of the body. Possibly by introducing another intermediate region. A region which is neither “my body” nor “myself”, and both at the same time. “My eye” cannot be clearly distinguished from “myself”, but “my finger” can. (My finger is experienced as a tool, but not my eye). This new intermediate region may be labelled “the existential part of my body”. The eye is nearer to myself than is the finger, because it is existentially more myself than is the finger. My finger is more outside myself (more “world-like”) than is my eye (which is more “hole-like”). And this is another example for the need to constantly refining the model.

Now it is easier to try and see how one can use the wall of the sphere itself (the purpose of the model): as a system of elements which tend to become problem-like (theoretical) as one advances toward its context, and to become hole-like (existential) as one advances toward the hole in its center, but which are tool-like (body-like) within the core of the wall itself. Now this tool-like character of the core of the body (as exemplified by “my finger”) must not be allowed to veil the specificity of its organisation. The model must show that the body is not organized like a complex tool (for instance, like a public administration), but more like the Greek Pantheon (like an “organism” in which each part may take control over the whole system). It must show how the whole body can, at moments, become subjected to the eye, the finger,

the mouth, or the phallus, for example. So that in such moments the whole body may be conceived of as a complex eye or any other "organ". Just like the Greek Pantheon may be conceived of, at moments, as "appolonian", or "hermetic", or "aphrodisiac", and so forth. And at the same time the model must show that there is a constant interplay between the various "organs" of the body, a sort of hierarchy of organs in which each "organ" has its own function but may substitute other "organs" in part of the function. This double aspect of the body may be shown, in the model, to be the result of the two intermediary regions within which it is located. Thus: Seen from the "theoretical" side (the one between "my body" and "my world") the body appears as an organisation of organs. Seen from the "existential" side (the one between "my body" and "myself") it appears as a single, complex, but ever changing, organ. Which means that seen "theoretically" the body appears to be a thing of "my world" within which "myself" is hidden, and seen "existentially" it appears to be an extension of "myself" through the mediation of which "I am in the world". In other words: The map must show that "my body" is a region of overlap between "theoretical" and "existential" vision, that it is an overlap between two intermediate regions.

Let us now try to imagine the model, here proposed as a raw sketch, in the working (for instance, as a hologram moving transparently on a TV screen) and let us ask (a) what it would look like and (b) how it could serve as a tool for the mapping of our world.

(a) Obviously, it would look like a primitive organism in motion. Like a model of a gastrocoelum, for instance. It would show schematically its anatomy and its metabolism. Now this does not appear to be a happy result of an attempt to "suspend objective vision". It would seem, on the contrary, to be the result of traditional biology applied in a superficial way to existential thinking, itself superficialized in the process. But this would be a mistaken reading of the model. The similarity between the model proposed and a primitive living organism is not, if one looks closer, the result of an application of biological models, but is, on the contrary, a hint for the understanding of biological models. Thus, it shows that all biological models have "our body" as a model. It is not a fact, as biological models would lead us to believe, that we "understand" our body as one among the organisms which we find in our world. The fact is that we "understand" some of the things in our world to be organisms if we discover some similarities with our body structure within them. Not, therefore, is "my body" a member of the class "organism", but "organism" is a class of things which have my body for a model. The model proposed for my body is similar to primitive organisms because it is the underlying model for biology, not because it was taken from biology.

The proposed model is therefore not zomorphic but shows, on the contrary, that all biological models are anthropomorphic (if my body may be called anthropomorphic). This is how the model would look like under more careful reading.

(b) Now this suggests how the model may be used as a tool for the mapping of our world. In the case considered above it was used as a tool for the mapping of that region of our world for which biology is competent, the region of living organisms. This region may now be classed and “understood” as one composed of phenomena more or less similar to “my body”, and such a similarity would become the criterium for classification. But of course, such a use of the model proposed may be extended to all other regions of our world. For instance: That region of our world for which mechanics are competent may be classed and “understood” as one composed of phenomena in a motion more or less similar to the motion of my body, and such a similarity may become the criterium for classification. And it is easy to multiply such examples for the possible use of the proposed model as a tool for mapping our world. But what is so fascinating about it is the suspicion that the possible uses of the model exceed our imagination. In fact, one suspects that in the use of the model our world would, step by step, assume a new structure: the structure of our being-bodily-in-the-world. Now the word “new structure” may be a wrong term. Possibly the world had this structure for the Greeks (Aristotle is a good example) and this structure may have been covered up as objective maps of the world (objective science and so forth) were developed. In that case the model here proposed may serve as a tool for the removal (“suspension”) of more recent structures in order to rediscover, on a new level, a deeper

world structure. In sum: It may serve as a tool for phenomenological vision.

Now grave objections may be raised against both the premises and the feasibility of the proposed model. This paper cannot hope (nor even intend) to defeat them. But it must try to face at least some of them if it is to appeal to future research as it wants to. For this purpose, let us class some of the possible objections under three headings.

*A) Technical and practical difficulties:* What appears to be most problematic about the model from this point of view is the fact that it must be restructured at every step of its use. Consider this problem. It is not the problem of “objective” maps which get ever more complete as information is inserted into them (for instance, geographical maps or anatomical models). It is a problem which geographical maps would have if each new information would demand a reformulation of their structure (for instance, the Mercator projection). It may be asked whether a model is at all useful (and readable) if it must be changed at every step of its utilization.

One way to meet this objection is to say that at every step the model may be used as an admittedly provisional tool for mapping, and that this is after all the purpose of every model. But there is another, and far more interesting, way to meet that objection. It is this: We have now, and for the first time, means at our disposal to make space-time models. We are no longer condemned to imagine such models, we can now materially build them and work with them. We have

videotapes and holograms, for instance. We are no longer restricted to two-dimensional maps and three-dimensional structural models. And this means that we can now “think” in space-time in a way we previously could not. We need no longer merely “reflect” or “speculate” concerning space-time models, we can put them to technical and practical experimental utilization. So why should, we not try to do so? In fact, what this argument amounts to is this: Let us put our new means of communication into practice and see how far the objections are valid. The proof of the cake is in the eating. Now this does not, of course, defeat the objection. It merely postpones it. But to postpone an objection is a way to remove it.

*B) Epistemological objections:* The proposed model pretends to be one for an understanding (“episteme”) of the body and, through it, of the world. But if one looks at it one can see that it is itself the result of an underlying epistemology, and of one well known to our tradition. The fact that “myself” appear in the model as a hole and that the horizon of our context is left empty and called “my death” is revealing. In fact: The model here proposed is not a model for our bodily-being-in-the-world (as it pretends to be) but a model for a specific epistemology, and not a very good one. And this is not a very happy result for an effort to provide new means of orientation in the world.

There can be no doubt that the objection is valid. It must be admitted that the “knowing subject” is in fact being objec-

tified in the model (even if negatively as a hole) and that the “knowable object” is in fact included in the model (even if as a fluid region between the “nothing” of the knower on one side and the “nothing” of the horizon on the other). The hole model is an objectivation of the process of knowledge and therefore poses the question of the subject of such an objectivation (the “transcendence” of the manufacturer and user of the model). Seen thus, the model is in fact no help for the overcoming of existing epistemological models. It is one among them and cannot escape their problems, which are at the root of our present crisis.

But this is not a good way to read the model. The model is not meant to solve traditional epistemological problems, but to suspend them. And, more concretely, one very specific problem which has proved to be especially barren in the past: the “body-spirit” problem.<sup>15</sup> Now of course this problem is just an aspect of the wider one which may be called “subject-object”, and there is no need to stress the antiquity, ramifications, and ever renewed effort for a “superation” of it. But the model does not pretend to contribute to it one way or another. It wants to be used in spite of it. The phenomenological vision shows that the dichotomy “body-spirit” is not one to be found in actual body experience, it is an “explanation” of it. In other terms: The fact that the body is being experienced is explained by the

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15 Editorial note: Flusser here seems to refer to the “mind-body problem” and its long critical debate following the Cartesian dualism; cf. particularly Gilbert Ryle, *The Concept of Mind* (London 2000 [1949]).

theoretical concept “spirit”, and the experience itself is being objectified by the theoretical concept “body”. But the actual concrete fact is neither “spirit” nor “body”, but “my experience of the body”. However, the theoretical concepts are very ancient and deeply rooted and they cover up the actual experience, which makes it difficult to “map” it. The purpose of the proposed model is to put this dichotomy in brackets and thus allow a better “mapping” of the concrete experience of my body. This can be achieved not by doing away with the dichotomy but by pushing it one step further. In the case under consideration: The “body-spirit” dichotomy does not present a problem on the level of the model and its utilization itself, but on the level on which the projector and user of the model stands, a level that “transcends” the model. In other words: The model can be a tool for orientation without constantly invoking the “body-spirit” dichotomy, but that dichotomy must be invoked if the tool itself is in question. In this sense the epistemological objection is, indeed, valid (the model is, indeed, epistemologically doubtful), but in this sense the objection can be accepted: It does not interfere in the elaboration of the model but seems, on the contrary, to support it.

C) *Religious objections*: There is no sense in trying to deny or minimize the fact that the question of orientation within the body and, through it, in the world is a “religious” problem (whatever our point of view on “religion” might be). How I find myself in my body and, through it, in the world is at bottom how I find myself to-

ward my death, against which myself, my body, and my world are silhouetted like against a horizon. And how I find myself toward my death (how I face it or do not face it) is what might be best called a “religious question”. Now if one looks at the proposed model from this point of view, it can be read as follows: It shows my body and my world floating, so to speak, within “nothingness”, which itself appears in the model twice: in the center and enveloping it. Which means two things: (a) There is a specific religious tradition hiding behind the model (the Occidental tradition for which the “soul” is within the body and is of the same ontological dignity as “God” who transcends the world), and this specific tradition appears in the model as an emptiness after removal of “soul” and “God”. And (b) the empty places occupied in tradition by “soul” and “God” appear within the model, so to speak, as “negative objects” and therefore as profanations of the tradition, in the strict sense of the term “profanation”. This is the religious objection to the model, and it may be resumed as follows: The model first assumes the “death of God” (and of the “soul”), then it identifies the “death of God” with “my death”, and then it objectifies “my death” and thus covers up its essence (which its not being an “object”). The objection affirms, in other words, that the proposed model is one of a profanized and unduly objectified Western religious tradition, not, as it professes to be, one of my bodily being-in-the-world.

No doubt, the objection is valid. But it may be turned around and made to support the model, instead of attacking it,

this way: The fact that the model mirrors Western religious tradition proves that it is a model of our being-in-the-world, because we are, in fact, in the world in a way molded by Western tradition. The fact that it is a profanation of that tradition proves that it has succeeded in "suspending" that tradition (although, of course, not in abolishing that tradition). And the fact that it is an objectivation of that tradition proves that it is a model (namely an objectivation, even materialization, of a problem). Now if we turn the objection around this way, we may discover aspects of the model quite unprecedented during its elaboration (which is a way of saying that it is a useful model). For example:

The central myth of Western tradition is "God become a human body". We may consciously accept or refuse that myth, but the "Christian tradition" informs our being-in-the-world on deeper than conscious levels. We experience our body under the shadow of the "Incarnation". And the model brings this shadow to the surface. It shows that I am, in nature, *through* my body (it is through my body that I communicate with my world), and that I am in history *through* my body (it is through my body that I have past and future). Thus, the model becomes one of "Incarnation", a sort of experimental "Imitatio Christi". If the model is read this way, it may be seen as a last link in a chain of models (like the Byzantine "Pantocrator" and the Gothic "Crucifix", which now may be read as models of various experiences of being-in-the-body). The

two traditional models mentioned were methods for orientation in the world

in specific critical situations, and so is the proposed one. And similar examples for a possible "religious reading" of the model may be multiplied.

The point here argued is this: The model is not meant to contribute to the problem "soul and God", to its reformulation or, even less, to its "solution". It is not meant to be a "map for the salvation of the soul", or a "map for the abolishing of the myth of the soul". But it cannot help to have religious dimensions, because it is meant to be a "map for the mapping of our world". Therefore, the religious objection is valid in the sense that the model is useless (and therefore bad) as a religious (or anti-religious) model. But it is invalid (it supports the model) in the sense that the presence of a religious dimension in the model proves that it is phenomenologically a useful map for our bodily being-in-the-world

The three objections discussed above do not, of course, exhaust possible objections against this proposal. They merely suggest how very problematic the proposed endeavor is. But also, it is hoped, how fascinating it is. Let us now try to argue in favor of the endeavor. For at least two thousand years, ever since the origins of our civilization, we have specific difficulties to experience our body. These difficulties have been analyzed over and over again, but they persist, and are approaching a critical stage. On the one hand, we objectify our body ever more, which means that we understand it "theoretically" ever better and are ever better



able to manipulate it as an object. On the other hand, we are losing ever more the concrete experience of our bodily being-in-the-world, which means that on an existential level we submit ever

more passively to it. This is an important aspect of the present division of so-called “culture and anti-culture”. On the one hand, the “objective sciences” manipulate our bodies in many forms to become ever more refined, and thus tend to transform us into robot-like tools. On the other hand, we tend to abandon ourselves ever more to an alienated body-experience (through drugs and so forth). And there is a curious feedback between these two forms of our body alienation. One sustains the other. The barbarous glorification of body experience and the submission to it is the counterpart of the theoretical understanding and manipulation of the body. And the result is, of course, not only an alienated attitude toward our bodily being-in-the-world but also toward our world. This is an aspect of our crisis.

Now this aspect of the crisis is being met from two directions. On the one side, phenomenological studies of our body are being elaborated in order to de-objectify our attitude toward our bodily being-in-the-world, and the literature in this direction increases as the crisis becomes sharper. On the other side, new media are being put at our disposal which permit us to collect new types of information and to structure them in a new way, and they may be applied to the body problem. In other words: the question of whether we can orient ourselves within our body and

through it within our world may now be stated from a new point of view and it may be answered with new methods. Of course, this does not guarantee that new answers to the question may be found. But it does mean that we are here (as in so many respects) on the threshold of adventure. To transmit this sensation of adventure, and to infect some to participate in it, is the purpose of this paper.

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# SPLENDOUR IN THE GRASS

By Hana Yoo

*“Cows are efficient machines for the transformation of grass into milk [...]. Man may not recognize his own project in the cow, he may forget that the cow is the result of his manipulation of reality according to his own model, and accept the cow as something that is somehow a ‘given’.”*  
– Vilém Flusser.”

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The project started with inspiration from an experiment conducted on cattle at a dairy farm in Moscow, showing them a virtual image of peaceful grassland on a cow-customized VR headset. The article that describes this experiment implies the VR experiment reduces the anxiety of cows and has shown a possible increase in milk production.

The utilization of technical apparatus in the welfare of both humans and animals have different purposes, e.g., cows for milk and meat production – humans for improving their quality of life. However, the subject-object relationship in the scientific experiment has strong similarities in the dynamic between the political system and the people. The assumption that presenting utopian images will reduce anxiety connects to the sovereign control of mental health and female reproductive labor being the ultimate catalysis for capitalism.

With various purposes, the endeavor to change perspective and overcome the boundary of visual perception has been technologically achieved, for instance in VR. However, it simultaneously reveals numerous limitations that oversimplify the individual's experience and relationship to their environment, along with not taking into account the psychological implications in their entirety. How could one embrace the complexity while detouring from the idea of "self"? Inspired by children's stories and human-animal metamorphosis in mythologies, the

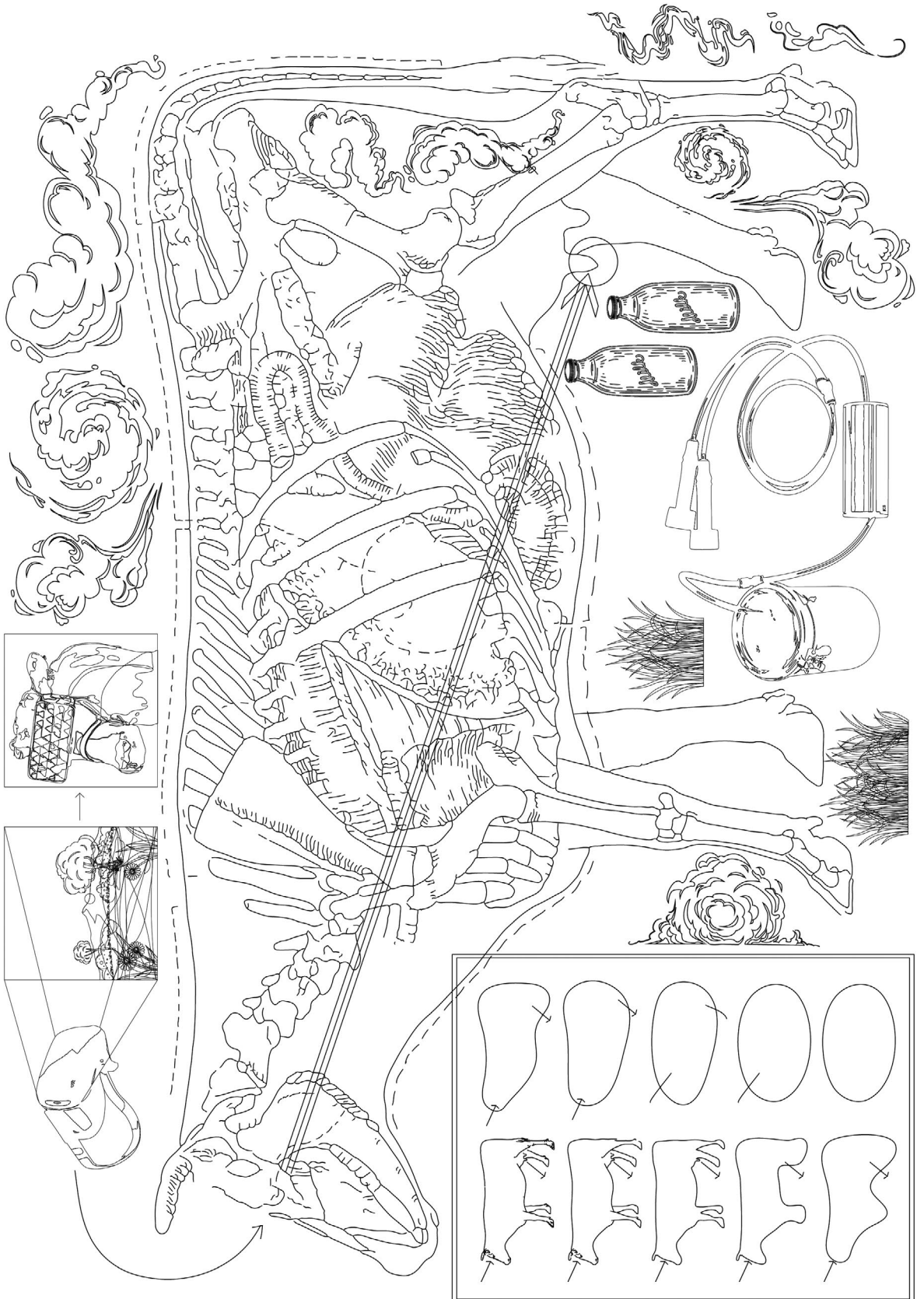
film and installation<sup>2</sup> take an extremely exaggerated anthropomorphic view of non-humans, which paradoxically reveal the position of humans to widen perceptions, whilst confronting limitations. The diagram shown here is an offspring of the multi-channel installation, ontologically investigating the cow as "apparatus" (Vilém Flusser) in the industrial processes of objectification.

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**Quote title page:** Vilém Flusser, *Natural Mind* (Minneapolis: Univocal, 2013), pp. 43ff.

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<sup>2</sup> "Splendour in the grass", 4K, color, stereo, 17:17 mins. (2020); "Highly comport, oddly anxious", 3D graphic meadow, color, 4 channel sound, 3 mins. (2020); <https://yoohana.net>.





# THROUGH THE AUTISM GLASS. BEHAVIOURIST INTERFACES AND THE (INTER)ACTION ORDER

By Daniela Wentz

*“Without the world becoming a sign, we do not possess it. And without the world becoming a sign, we cannot process it with a computer. In the sign, the world appears to us simultaneously as an object of cognition and of information processing. It is no wonder that the thought of artificial intelligence came up; the world constantly leads to signs. But we also have to attribute to the signs, the computational ones to begin with, the power to create the world from scratch.”*

*– Frieder Nake*

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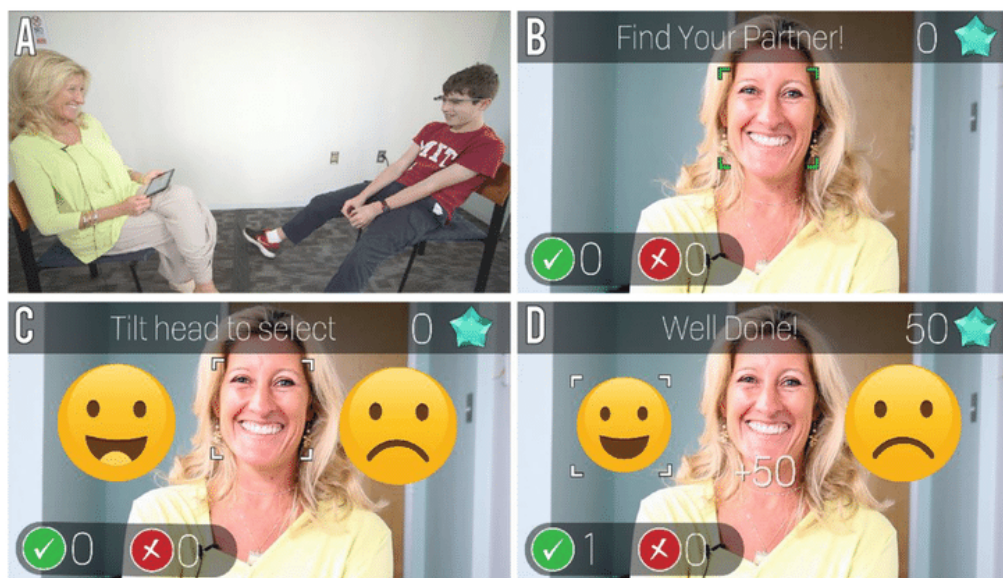


Fig. 1: Interface of Empowered Brain's App Emotion Charade, licensed under Creative Commons Attribution 4.0, Source: Vahabzadeh et al. 2018 (s. References).

*Empowered Brain* and *Autism Glass*, also known as *Super Power Glass*, are two marginally different digital technologies.<sup>2</sup> Their hardware comes in the form of Google's AR data glasses, which are equipped with software for facial recognition and emotion recognition, as well as various associated 'learning apps'. The purpose of these interfaces is for once not to enable a smooth and efficient interaction between human and machine, but literally to inter-face two humans and organise their interaction. The tools

**Quote title page:** Frieder Nake, Von der Interaktion. Über den instrumentalen und den medialen Charakter des Computers, in: *Die erträgliche Leichtigkeit der Zeichen. Ästhetik, Semiotik, Informatik*, ed. Frieder Nake (Baden-Baden 1993), pp. 165–189, here p. 165 (my own translation).

<sup>2</sup> For general information on the technologies, see the developer's websites: <https://autismglass.stanford.edu/>, access: July 25, 2022; <https://brain-power.com/empowered-brain/>, access: July 25, 2022.

are intended to be used in the context of therapeutic interventions for neurodivergent, especially autistic people. They are designed to practice 'socio-emotional skills' such as making and maintaining eye contact with others, recognising the other person's emotions, and performing 'appropriate' forms of social interaction. What these interfaces are – or better, what they do – can be described and analysed in terms of the diagrammatic with respect to several of their qualities. Operativity, processuality, a disposition to action and to transformation prove to be essential for an understanding of both, the diagram and the interface. It is mainly, but not only, the pragmatic notion of the diagram which conceives of it as a motor and order of forms of action, which I would like to bring into play in



this paper for some remarks on the logics and the politics of these interfaces.<sup>3</sup>

One of the apps on the *Empowered Brain* data glasses is called *Face2Face*. When the user looks through the glasses, she is prompted to search for a face. If a face is focused on and the gaze is held for a certain time, a progress circle around the face fills up and points are earned, the latter ones are displayed in one corner of the screen. Once the progress circle is full, the face appearing on the screen is decorated with an emoji as a reward and a star is earned. Many stars lead to the next level. Using the *Emotion Charade* app on *Empowered Brain*, the human counterpart of the wearer is instructed by means of a smartphone interface to facially depict a certain emotion. The glasses detect the face, which is signalled through small, frame-like signs, recognise the emotion portrayed and display two different emojis on the screen of the data glasses, right and left to the face, from which the wearer is supposed to select the 'correct' emoji, i.e., the one that matches the facial expression. This selection is performed through a gesture, namely tilting the head. Here, the correct reasoning is being rewarded with points and stars.

That the aesthetic appearance on the screen has diagrammatic qualities is

rather obvious. Like most other GUIs found on screens of all sorts, it can be accurately described and analysed already with a rather narrowly defined concept of the diagram, which locates the diagram within a genre theory and genealogy of scientific and technical images and their systemising and organising potentials. But also the 'action' on the screen can be defined in terms of the diagrammatic. Interfaces in general and GUIs in particular may in fact emphasise an important quality of the diagrammatic still too often overlooked in the debate about the diagram as a visual or pictorial genre, which is its pragmatic dimension. The specific potential of the diagram, as Charles Sanders Peirce argues, lies not only in its illustrativeness, but also in its explorativity, that is, in its offer not only to look at what is presented to the eye, but to handle it in an operative-experimental way. Diagrams in a Peircean sense are downright designed to entail actions and follow-up actions, such as inferences. Peirce, for whom the diagram plays a key role in his semiotic epistemology, emphasises the epistemic potential of the diagram and attests it a processuality that finds expression in the so-called 'diagrammatic reasoning' he proposed.<sup>4</sup>

In this sense of the diagram, the interface in question here realises or is involved in a whole series of interrelat-

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3 Further discussions of the technologies with concern to their genealogy (a) and modes of subjectification (b) can be found here: Daniela Wentz, Nudged to normal. Images, Behaviour and the Autism Surveillance Complex. *Digital Culture and Society* 7 (2022): 263–284; Daniela Wentz, Tales from the Loop. *Autismus, Technologien und Subjektivierung. Feministische Studien* 2 (2022), pp. 258–273.

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4 On "diagrammatic reasoning", see for instance here: Charles S. Peirce, *Collected Papers* (8 Volumes), vols. 1–6, ed. Charles Hartshorne and Paul Weiss (Cambridge, MA 1931–1935), abbreviated from now on as CP: CP 1.54; CP 2.778; CP 4.47; Charles S. Peirce, *The New Elements of Mathematics by Charles S. Peirce*, vol. 4, ed. Carolyn Eisele (The Hague and Paris 1976), pp. 313–330.

ed diagrammatic operations. First, the glasses model the face of the wearer's human counterpart as a part of the interface of interaction. For this purpose, they have to transform the face into a diagram, which then undergoes a machine learning process, which can also be described in diagrammatic terms. Every facial recognition and facial expression recognition proceeds diagrammatically. In this process, a three-dimensional image which is initially recognised as a face is transformed (usually, but not necessarily) into a two-dimensional image in which the focus is essentially on relations, such as distances or proportions between certain parts of the face. This is consistent with Peirce's notion, according to which the diagram usually omits irrelevant details, thus permitting to think more easily of the important properties.<sup>5</sup> The diagram thus abstracts to the relevant – he calls them intellectual – similarities between sign and object: "Many diagrams resemble their objects not at all in looks; it is only in respect to the relations of their parts that their likeness consists."<sup>6</sup> On this basis, in the case of facial expression recognition, the face diagram is then compared with other face diagrams stored in a database, each of which is annotated in terms of its expressed emotion. Here, the sought-after resemblance consists of certain deviations, defined as significant, from a

'neutral facial expression'. In the case of the *Emotion Charade* app, the recognised emotion on the facial interface is then again transformed into another, user-friendly emotion diagram, namely an emoji. The latter prompts the user to fulfil a similar task, which is to match "the components deemed significant"<sup>7</sup> with those of a second emoji and the focused face, i.e., the object of the diagram.

Besides these diagrammatic processes, even the most basic performance of this interface, the establishment of the relation between the two interaction partners, can be understood diagrammatically. In fact, interfaces and diagrams have been consistently and repeatedly described precisely as media of relationality. Just like Peirce, whose semiotic notion of the diagram I follow here, emphasises that diagrams serve primarily to establish and reveal relations, interface theorists like Brandon Hookway and Gui Bonsiepe describe interfaces first and foremost correspondingly in terms of relationality. The interface, in the words of Hookway, is "a form of relation",<sup>8</sup> in Bonsiepe's, it is "not a material object, it is the dimension for interaction between the body, tool and purposeful action."<sup>9</sup> In the context of the politics of these technologies I am interested in, this relationality is anything but

7 Ibid.

8 Brandon Hookway, *Interface* (Cambridge, MA 2014), p. 5.

9 Gui Bonsiepe, *Interface. An approach to design* (Maastricht 1999), p. 29. Also Alexander Galloway stresses the processuality and the active and activating quality of the interface: "It is always a process or a translation [...] a fertile nexus." *The Interface Effect* (Cambridge 2012), p. 33.

5 See for example Charles S. Peirce, "Short Logic: Chapter I. Of Reasoning in General", listed as MS 595 in the Robin Catalogue, 1895.

6 CP 2.282.

trivial, because diagrams and interfaces do not only endow and organize relationships, but at the same time render these relationships intelligible. As Jan Distelmeyer writes: “Interfaces not only represent the threshold between humans and computers: they are at the same time an expression of how humans, computers and their mutual relationships are thought of and understood. Interfaces provide images with which we learn to look at ourselves and our computer and world context.”<sup>10</sup> So what we learn here is that the relationship between the two interactants, as designed and expressed by the ‘autism glasses’, is a profoundly asymmetrical one. It entails two entirely different subject positions, one of which is considered as being deficient and one ‘normal’.

What the glasses are working on, however, is not simply the bridging of those differences, but their levelling by transforming one of the interactants. The order for (inter)action the interface gives its user is very clear and entirely based on behaviourist principles. In fact, it is the digital application of B.F. Skinner's experiments, the founder of radical behaviourism, on how to bring about desired behaviour and prevent unwanted behaviour by learning via consequences, i.e., rewards or punishments to certain kinds of actions, i.e., responses to stimuli. Skinner, who's philosophy has been said “to be a descendant of the pragmatism

of C. S. Peirce”,<sup>11</sup> developed his notion of “operant conditioning” or “reinforcement learning” along Peirce's pragmatic terms and his concept of habit formation. Without going into the numerous parallels and cross-connections between Peirce's pragmatism and Skinner's behaviourism here, it quickly becomes clear why Peirce's pragmatic idea, according to which “the identity of a habit depends on how it might lead us to act, not merely under such circumstances as are likely to arise, but under such as might possibly occur, no matter how improbable they may be. What the habit is depends on when and how it causes us to act”, must have been an inspiration for Skinner's own reflections.<sup>12</sup> The meaning and politics of these interfaces, their maxim, so to speak, lies in the habits that the interaction with them is meant to train. Those habits, holding eye contact, recognise and react to facial expressions, to be formed through operant conditioning by visual nudging, rewards and repetition, comply with a wholly normative notion of social (inter)action. Ultimately, this logic makes the glasses an almost ideal illustrative example for answering the question of how (behaviourist) UX design relates to (diagrammatic) UI design. In their interplay, behavioural therapeutic strategies and goals, which have played

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<sup>10</sup> Jan Distelmeyer, *Machtzeichen. Anordnungen des Computers* (Berlin 2017), p. 21 (my own translation).

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<sup>11</sup> John Staddon, *The New Behaviorism: Mind, Mechanism, and Society* (Philadelphia, PA 2001), p. 96. For very detailed analyses of Skinner's engagement with Peirce see the works of Roy Moxley: Sources of Skinner's pragmatic selectionism in 1945. *The Behavior Analyst* 24 (2001): 201–212; Some more Similarities between Peirce and Skinner. *The Behavior Analyst* 25 (2002): 201–214.

<sup>12</sup> CP 5.400.

the dominant role in the “treatment” of autism for decades, undergo an almost uncannily seamless automatization process.

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# POINTING, MUTUAL INTELLIGIBILITY, AND THE SEEING SUBJECT IN HCI

By Jonathan Zong

*“Users, who select data objects by looking and pointing, are simultaneously also the objects being seen, selected, and acted upon by computers.”*

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A grainy video depicts a man sitting in an Eames lounge chair, facing a wall-sized projection screen. As he points at the screen, a cross-shaped cursor “tracks” where he points. The man issues a few voice commands, creating four symbols with distinct colors and shapes at various positions. When he points to a symbol and then to a new location, he says “put that ... there,” relocating the symbol to the new location. After the man executes a series of increasingly complex voice commands, the system malfunctions. “Ah, shit,” he says as the video ends.



Fig. 0: Chris Schmandt, “Put-That-There” (November 2, 1979), MIT Media Lab Speech Interface group video collection. Source: <https://www.youtube.com/watch?v=RyBEUyEtXQo>.

Created in 1979, the “Put-That-There” system was part of an MIT research project on ways to access and manipulate data spatially using pointing. “Put-That-There” exemplifies how the field of human-computer interaction (HCI) has constructed the human subject. The

researchers conceived of data – represented in the demo as circles, squares, and triangles – as “inhabiting a spatially definite ‘virtual’ world,”<sup>1</sup> which computer users could access through a multisensory technical apparatus. The researchers hoped to immerse users in an information environment where users could see and move data around. To make user interactions legible to the computer, researchers needed to grapple with questions about how to represent people in virtual space. The creators of “Put-That-There” aspired for users to think of data as objects they could sense, “bodied forth in vision, sound, and touch”<sup>2</sup>. But to do so, they also needed ways for computers to understand users computationally – as humans bodied forth in data.

This essay proceeds in two parts. In the first part, I situate HCI’s subject – the user – in conversation with prior theories about how visual media constructs seeing subjects. “Put-That-There” was designed according to theories in HCI about interaction as a feedback loop of perception and action between users and computers. Past theories in film and photography argued that the act of seeing establishes a strict spatial division between subject and object.<sup>3</sup> Being able to observe something in an image meant that the observer was not part of the image. I argue that interactivity com-

1 Richard Bolt, *Spatial Data-Management* (Cambridge, MA 1979), p. 12

2 Ibid.

3 Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA 1990).



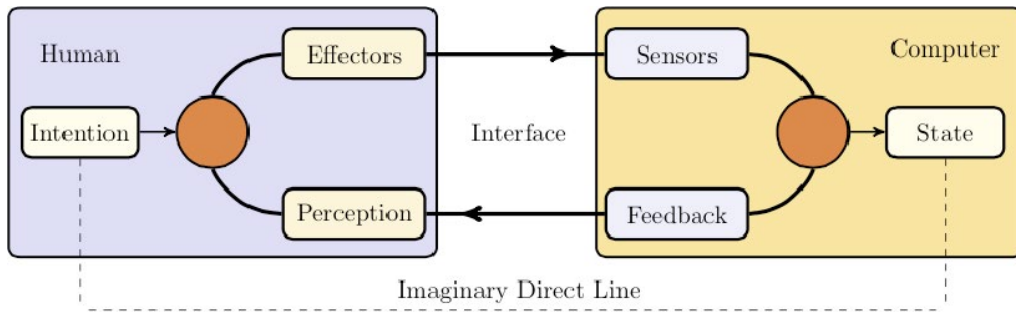


Fig. 1: HCI model of interaction. Source: <https://www.semanticscholar.org/paper/Empowerment-as-a-metric-for-Optimization-in-HCI-Trendafilov-Murray-Smith/3c37fcd2bb95f498b7c181c7e5180e9433d8ffcb/figure/0>.

plicates this strict division. In interactive systems, it is now possible for the user to act on visual representations of virtual objects.

In the second part, I dig into a specific way interactivity complicates this division. Interactivity reconfigures the relationship between subject and object: from a unidirectional relationship of observation to a bidirectional relationship of mutual intelligibility. By positioning the user within a feedback loop, HCI establishes symmetry between the user and the computer. Users who act on data are also *acted upon* by data. To make this argument, I give an account of some fundamental operations in interaction – including selection and identification – and suggest that they establish common perceptual ground between human and machine interlocutors. Pointing devices, such as the computer mouse, play an important role in enabling users to manipulate data. But because interaction is bidirectional, these same operations enable computers to manipulate people.

## Part I: Situating the User in the History of the Seeing Subject

### Modeling Users as Information Processors

Computers are containers of virtual worlds populated by data objects. As such, they can only perceive the external world through input devices such as computer mice, which translate physical actions into electronic signals. Similarly, they can only make virtual objects perceptible to human observers by creating sensory representations, using output devices like screens.

Computers sense the world through inputs and outputs, but HCI researchers have also conceptualized people as I/O machines. Influenced by cognitive science and cybernetics, the field theorizes interaction as a feedback loop between

a user and a system.<sup>4</sup> In this model, the user is essentially an information processing machine. The user has a sense input (e.g., eyes), a control (some cognitive map of their goals and intentions), and an articulatory output (e.g., the ability to move a computer mouse).

The term “user,” though seemingly referencing personhood, is best understood as the particular way HCI’s underlying theoretical framework constructs the subject. HCI researchers constructed this model in order to make the concept of a person operationalizable in computer systems. To be understood by machines, humans had to conform to a machine-like schema of input and output. As a result, Lasse Scherffig writes, “the human trained to perform in front of the computer became the model for the thinking human in general – a human acting as a computer”<sup>5</sup>. In order to perceive and act on data objects in the virtual world, people need to adopt the subject position of users – behaving in ways that allow them to become read as data themselves.

### How the Computer Sees Us

The idea that technologies rearrange how we think about human sense faculties is not new. Before scholars asked these questions about computers, there were similar, historically preceding debates about other forms of media such as

film. For instance, Jean-Louis Baudry argues that the technical systems and cultural practices that go into producing film (the cinematic apparatus) are not merely neutral, but have ideological effects that construct the spectator as a subject.<sup>6</sup> Because film viewers see through the perspective of a single monocular camera, and their body stays still while the camera seems to jump to different locations and times, theories of film have assumed a spectator that sees “with a single and immobile eye”<sup>7</sup>. Just as HCI theorists argue that users’ access to virtual worlds is limited by the technical sensory apparatus available to computers, film theorists recognize the particular way that the camera, editing, and projection afford a limited way of experiencing cinematic worlds.

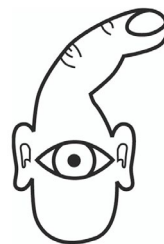


Fig. 2: “How the computer sees us.” Source: Dan O’Sullivan and Tom Igoe, *Physical Computing: Sensing and Controlling the Physical World with Computers* (Boston 2004).

HCI’s interaction model is continuous with these prior attempts to theorize how sociotechnical apparatuses

4 Lasse Scherffig, There Is No Interface (Without a User). A Cybernetic Perspective on Interaction. *Interface Critique Journal* 1 (2018): 58–80.

5 Ibid., p. 67.

6 Jean-Louis Baudry, Ideological Effects of the Basic Cinematographic Apparatus. *Film Quarterly* 28/2 (1974): 39–47.

7 Erwin Panofsky, *Perspective as Symbolic Form* (New York 1991), p. 29.

shape people's experiences. Baudry's "eye-subject" has been succeeded by, for instance, Dan O'Sullivan and Tom Igoe's illustration of "how the computer sees us" – as a single eye augmented with a single finger.<sup>8</sup> As bizarre as it looks, the eye-finger-subject is illustrative of the way the field of HCI thinks about the human sensorium in terms of interface modalities. The eye and ears represent the human perceptual capacities that computers often use to output data, by rendering it visible or audible. The single finger represents a primary way computers receive human input: through pointing, or through the mechanical actuation of mouse and keyboard buttons. The illustration lacks a mouth – perhaps the authors did not want to distinguish different mouth functions like speaking and tasting – but the fact that the illustration is somewhat contrived is also the point. The idea of conforming a person's body to an apparatus is necessarily contrived.

### Positioning the Body in Relation to Data

Like "Put-That-There," a *camera obscura* is a room with a person inside. Light from outside the room passes through a pinhole into the otherwise dark space and projects an inverted image opposite the pinhole. As a predecessor to contemporary photographic technologies, the *camera obscura* has been an important case for theorizing vision. In *Techniques*

*of the Observer*, Jonathan Crary explains how the camera enforces a spatial division between subject and object: "the camera obscura *a priori* prevents the observer from seeing his or her position as part of the representation"<sup>9</sup>. That is, if one is situated inside the camera apparatus and able to observe the visual image captured from outside, one cannot be an object represented in the image – and vice versa. Crary notes that "the body then is a problem the camera could never solve except by marginalizing it into a phantom in order to establish a space of reason"<sup>10</sup>.

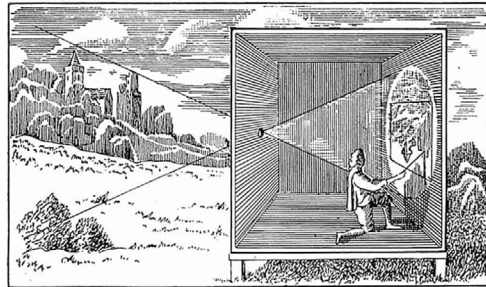


Fig. 3: Illustration of a camera obscura. Source: <https://magazine.artland.com/agents-of-change-camera-obscura/>.

Graphical user interfaces, and the broader project of interactivity in HCI, complicate this strict spatial division of subject and object. The "media room"<sup>11</sup>, as the MIT researchers called the setting of "Put-That-There," is formally similar to a *camera obscura* – an enclosed technical apparatus containing both an observer and

<sup>8</sup> Dan O'Sullivan and Tom Igoe, *Physical Computing: Sensing and Controlling the Physical World with Computers* (Boston 2004).

<sup>9</sup> Crary, *Techniques of the Observer*, p. 41.

<sup>10</sup> Ibid.

<sup>11</sup> Bolt, *Spatial Data-Management*, p. 12.

an image projected onto a wall. The chair at the center of the room might draw comparisons to the cinematic spectator's seat, immobilizing the user. But in the space of the graphical interface, the presence of the user is represented by a cursor. The cross-shaped cursor in "Put-That-There" tracks the intersection of the imaginary line extending out from the user's index finger with the image plane on the wall. Its jittery movement as the user's liveness keeps their hand continually in motion visualizes some element of what Crary calls a "spatial and temporal simultaneity of human subjectivity and objective apparatus"<sup>12</sup>. The cursor is a data object, and is positioned inside the virtual space of the screen just like other data objects; yet it represents and is controlled by the user. Unlike the *camera obscura*, the user sees themselves within the image despite occupying a separate space from the objects being represented. Reading "Put-That-There" in the historical lineage of photography and film helps us recognize the interactive cursor as a site where the computer user departs from prior constructions of the seeing subject.

## Part II: Establishing Mutual Intelligibility through Interaction

### Selection as a Building Block of Interaction

Cursors are fundamental to human-computer interaction because they allow the user to identify which data objects, out of all the objects in their field of perception, to act upon. In computer science, "selection" refers to an operation for querying a subset of data from a larger dataset. A selection is defined using a logical restriction on data attributes that evaluates to true or false. In the below example, the full "Person" dataset in the left column contains a list of 5 people. The right column contains a selection of people whose age is greater than or equal to 34. The "is greater than or equal to" logical restriction neatly cleaves the original dataset into two subsets: one which satisfies the restriction, and one which does not. Conventionally, we say that those 34 and older are *included* in the selection and the others are *excluded*.

When a user of "Put-That-There" points at a shape and says the word "that," they are specifying a selection that includes the indicated data object. The selection is defined using an implicit logical restriction: data points with a spatial position equal to that of the cursor. Interface designers leverage pointing as a way to

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<sup>12</sup> Crary, *Techniques of the Observer*, p. 41.

select data objects by their position in space. To enable pointing-based selection, interfaces often spatialize data that is not necessarily inherently spatial. In the physical world, no two objects can occupy the same space at the same time. By designing interfaces such that this property also holds, spatial position can be made to serve as an identity.

Person			$\sigma_{\text{Age} \geq 34}(\text{Person})$		
Name	Age	Weight	Name	Age	Weight
Harry	34	80	Harry	34	80
Sally	28	64	Helena	54	54
George	29	70	Peter	34	80
Helena	54	54			
Peter	34	80			

Fig. 4: An example of selection. Source: [https://en.wikipedia.org/wiki/Selection\\_\(relational\\_algebra\)](https://en.wikipedia.org/wiki/Selection_(relational_algebra)).

### Human-Computer Interaction as Joint Attention

Because selection allows users and computers to refer to objects in the same environment, it creates the common context that makes interaction possible. In *Plans and Situated Actions*, Lucy Suchman writes that “interaction, or communication – I’ll use the two interchangeably – turns on the extent to which my words and actions and yours are mutually intelligible”<sup>13</sup>. For Suchman, human-computer interaction is only made possible

by establishing a common ground for perception and action. When a user of “Put-That-There” points at a data object using the cursor, the computer is able to use the resulting selection as a proxy for understanding the user’s intent to apply subsequent voice commands to the selected object.

Some scholars have theorized attention as a selection of features out of a perceptual environment for the purpose of informing action.<sup>14</sup> In the interaction loop, because the user and a computer reference the same selection, they can be understood as attending to the same features of the virtual environment. When people communicate in physical space, pointing often expresses an invitation to joint attention – inviting others to redirect their attention to an indicated location. It might be a foundational way of expressing such an invitation – for instance, babies learn to point before they can speak.<sup>15</sup> Pointing at objects using cursors similarly facilitates joint attention between the user and the computer.

Where previously the seeing subject was often conceived of as a passive observer of the world, the user and the computer are constructed as equal, active participants within a feedback loop. Philosophers have theorized joint attention as a form of collective intentionality, which figures the world as “perceptu-

14 Wayne Wu, Attention as Selection for Action, in: *Attention: Philosophical and Psychological Essays*, eds. Christopher Mole, Declan Smithies and Wayne Wu (Oxford 2011), pp. 97–116.

15 Sotaro Kita, Pointing: A Foundational Building Block of Human Communication, in: *Pointing: Where Language, Culture, and Cognition Meet*, ed. Sotaro Kita (Mahwah, NJ 2003), pp. 1–8.

13 Lucy Suchman, *Plans and Situated Actions: The Problem of Human-Machine Communication* (Cambridge 1987), p. 3.

ally available for a plurality of agents ... [establishing] a basic sense of common ground on which other agents may be encountered as potential cooperators”<sup>16</sup>. Because interaction is a feedback loop, human attention and action is necessarily followed by machine attention and action.



Fig. 5: “Pointer Pointer” (2012) by Studio Moniker, an interactive website that surfaces an image of a person pointing to the location of your cursor. Source: <https://pointerpointer.com/>.

### Biometrics as Selection over Users

Where selections initiated by users allow humans to focus computer attention for the purpose of interaction, selections initiated by computers are increasingly used as a way to focus computers’ gazes upon people – for computers to determine who is human. Users perform selection through pointing, typing, and other forms of motion. But in addition to specifying selection, these movements often generate additional data as software records measurements of activity during everyday use – often without users’ knowledge. Logs of mouse move-

ments, records of keystrokes, amount of time spent on a webpage; Melissa Gregg compares this excess data to sweat, which “literalizes porosity” and is a “means by which the body signals its capacity to ‘affect and be affected’”<sup>17</sup>. Biometric data collected in the background of computer use is then used to select, differentiate, identify, and classify people – and to eventually target them more effectively.

Biometric profiles exemplify the process through which computers model and process humans as data objects – more precisely, objects assembled from the accumulation of data. For instance, proponents of digital psychiatry claim to be able to use biometric signals to diagnose and pathologize.<sup>18</sup> As a result, a market for biometric software that collects large amounts of data on key press timing has emerged in digital health-care. This software models the user as a collection of behavioral facts. It defines logical criteria through which computers can define selections of users on the basis of these facts. As anthropologist Beth Semel notes, “diagnoses also operate as vectors of social control” as people are partitioned into categories of well and unwell, deserving and undeserving of

16 David P. Schweikard and Hans Bernhard Schmid, Collective Intentionality, in: *The Stanford Encyclopedia of Philosophy* (2020).

17 Melissa Gregg, Inside the Data Spectacle. *Television & New Media* 16 (2014), pp. 37–51; <https://journals.sagepub.com/doi/full/10.1177/1527476414547774>, access: September 15, 2022.

18 Jonathan Zong and Beth Semel, Form, Content, Data, Bodies: Jonathan Zong and Beth Semel on Biometric Sans. *Somatosphere* (February 9, 2021); <http://somatosphere.net/2021/form-content-data-bodies.html/>, access: September 15, 2022.

clinical attention.<sup>19</sup> Inclusion and exclusion in these selection criteria consequently affect people's ability to navigate digitally-managed healthcare systems. Users, who select data objects by looking and pointing, are simultaneously also the objects being seen, selected, and acted upon by computers.

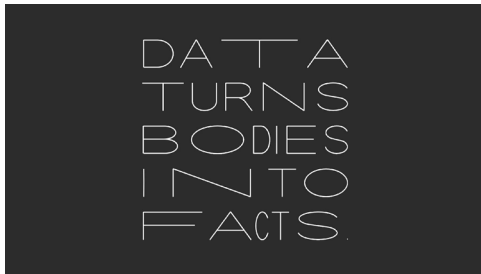


Fig. 6: "Biometric Sans" (2018) by Jonathan Zong, an experimental typography system which elongates letterforms in response to the typing speed of the individual. Source: <https://jonathanzong.com/blog/2020/05/31/biometric-sans-and-public-display-embodied-writing-in-the-age-of-data>.

## Conclusion: The One Divides into Two

Selection and identification – in other words, pointing things out – form the basis of human-computer interaction. These operations facilitate the feedback loop that is central to the field's understanding of the user as a subject. These

19 Beth Semel, *The Body Audible: From Vocal Biomarkers to a Pnenology of the Throat*. *Somatosphere* (September 21, 2020); <http://somatosphere.net/2020/the-body-audible.html/>, access: September 15, 2022.

operations are really the same operation of differentiation: to identify or select an object, one must articulate criteria that differentiate that object from others. Identifying a single object out of many requires criteria of inclusion and exclusion that cleave the space of possible referents into a binary partition – "this" and "not that".

This act of setting boundaries and creating binaries is fundamentally digital. Anthropologist Gregory Bateson defines the elementary unit of information as "a difference which makes a difference"<sup>20</sup>. Digital computers encode information in bits, which are basic units of differentiation. Alexander Galloway defines the digital as "the one divides into two," or more precisely, "any mode of representation rooted in individually separate and distinct units"<sup>21</sup>. Galloway's definition helps us see photography and film as predecessors to digital computers, because those media established subject and object as distinct binary units. Just as 0 can never be 1, the seeing subject could never be an object of representation. Drawing binaristic distinctions of inclusion and exclusion, interior and exterior, virtual and actual – these form the basis of working with computational media.

Yet, in conceiving of interaction as a feedback loop, HCI has constructed the user at various times as both subject and object of interaction. Where the re-

20 Gregory Bateson, *Form, Substance, and Difference*, in: *Steps to an Ecology of Mind* (San Francisco 1972), pp. 448–466.

21 Alexander Galloway, *Something About the Digital* (2015); <http://cultureandcommunication.org/galloway/something-about-the-digital>, access: August 2, 2022.

lationship between the subject-object binary was once a strict division, the two are cast by interaction as a set of roles that are adopted in turn. A user might select data objects, then be selected as a data object in turn. The user points, and the computer points back. Pointing is possible because difference exists, because there is something *else* to point at. Pointing is digital in this sense, and in the more literal sense that it happens using “the hand and its digits”<sup>22</sup>. However, Scherffig observes that “interaction fuses bodily activity and perception into one experience”<sup>23</sup>. The pointing finger is inextricable from the seeing eye. In this fusion, I see an attempt by human-computer interaction to work against the dominant tendency of digitality – to reconstitute the one from the two.

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22 Lisa Nakamura, Indigenous Circuits: Navajo Women and the Racialization of Early Electronic Manufacture. *American Quarterly* 66/4 (2014), pp. 919–941.

23 Lasse Scherffig, *Feedbackmaschinen. Kybernetik und Interaktion*. Dissertation, Academy of Media Arts Cologne (2017); <http://lassescherffig.de/publications/books/feedbackmaschinen-kybernetik-und-interaktion/>, access: August 2, 2022.

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# SEA SOMA

By Dora Đurkesac

*“The sea is an environment to exercise the feeling of immersion and encounters. It evokes the embodied knowledge unknown to the screen surfaces.”*

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The sea squirt swims freely in the sea until permanently attached to a rock. It digests the nervous system, now useless in static life. This creature provoked a theory that the brain evolved among species following the complexity of bodily movement.

Intelligence is usually associated with the brain, and in the realm of computing belongs to math and logic. The embodied cognition is still too complex to translate into an artificial one. Meanwhile, the collaboration between the mind and algorithm is evolving, and *soma* acquires the anatomy of sitting, hunched back, *tech neck*, or *text claws*.

Humans are developing flat encounters that belong to the infosphere and data cycles. The experience of the world is filtered through touchscreens and designed content. Smartphones are both objects of liberation and tools of domination. Acquired habits, such as compulsive information seeking or 2617 touches a day, are now part of the product. The wish to connect or the mere fact of being bored or lonely are usable internal triggers for hook models developed by UX design. The emotion and attention are navigated by the brain that is rewarded with a dose of dopamine.

How do we return to the idea of touch as vision, known to be our earliest mode of interaction and feeling of the world? How does dance intertwine the inner and outer stimuli, and how does skin become the interface between them? How do we find peace with a lack of in-

put or nourish digital relationships to repair neurons? One could embrace the hybrid world's contradictions, merge with the screens and fully embody the static creature. Or rehearse haptic communication and extend algorithmic intelligence – perhaps through liquidity and somatic encounters.

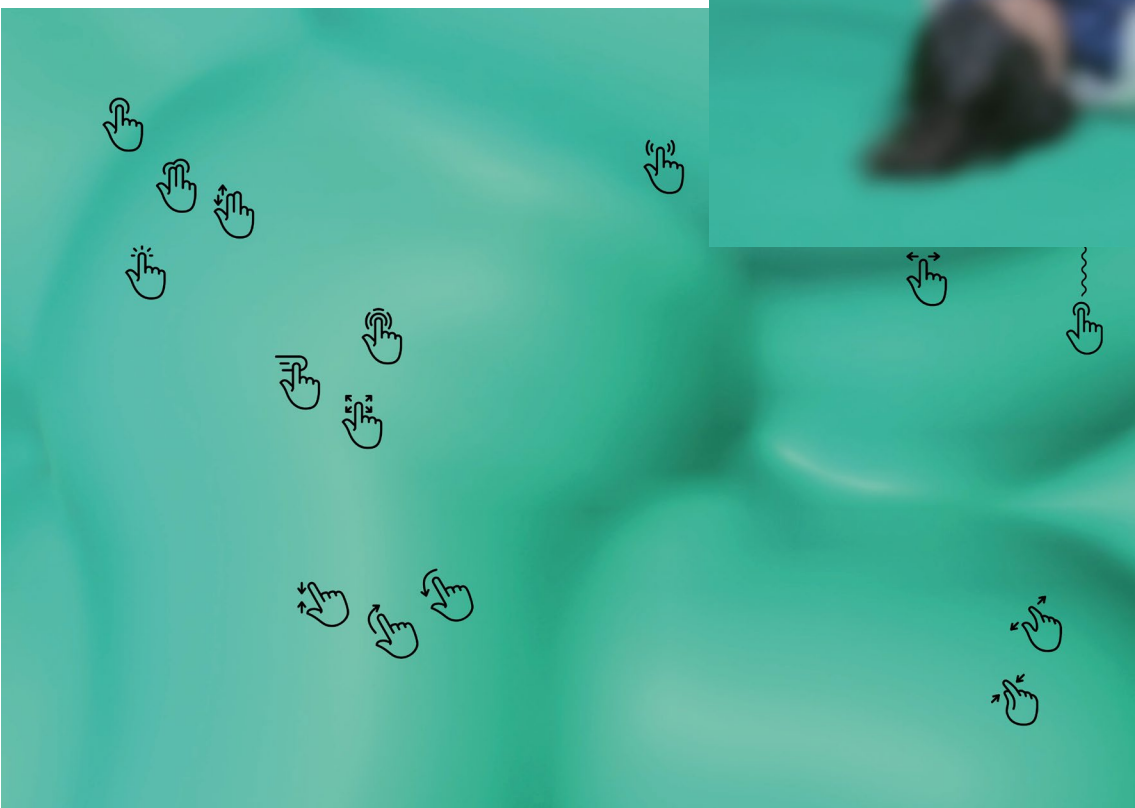
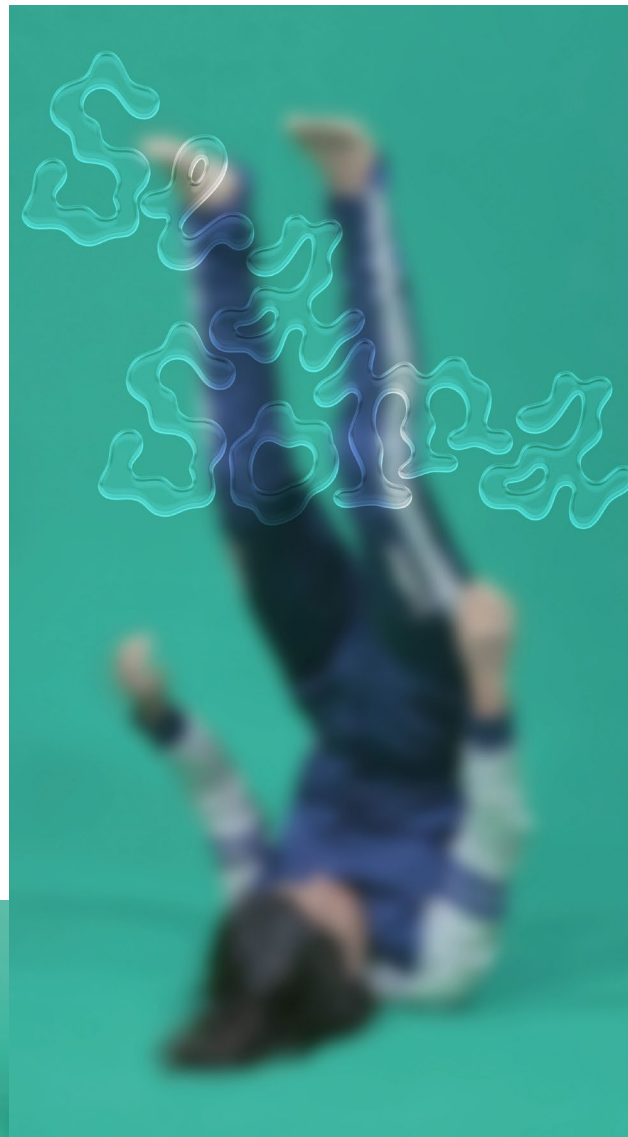
The seawater and a touchscreen bring together two experiential and conceptual opposites. One is the feeling of interconnectedness in the seawater through the body. The other is the fragmentation of senses through data, screens, and algorithmic content. The sea is an environment to exercise the feeling of immersion and encounters. It evokes the embodied knowledge unknown to the screen surfaces. The porosity and dissolution of the boundaries oppose the perceptive habit of self-containment.

Intelligent transformations happen in the challenges of these encounters. The dancer as a researcher explores embodied cognition. As a static body attached to the infosphere, she experiences the world only through sight and sound. She is rediscovering skin as an interface and vision as touch, static and floating movements. Dance practice highlights the ever-changing collaborations and adaptations through movements.

Every organism is a different intelligent infrastructure bound to its body, movement rules, or sensorial interaction. Embodied cognition brings us closer to other species. It provokes thinking and acting through complex

systems of an animal, human, or even algorithmic or machine soma. Algorithms and mobile apps could be our collaborators, and their media transformations as the nature of digital cycles. Perhaps, those are the tools contributing to the potential development of future forms of imagination, a somatic extension? Digital objects that, through their translations, follow communication, create physical sensations, or even experiential spaces?

“Sea Soma” proposes intelligence as digital immersion, floating, screen architecture, algorithmic fiction, phone creatures, tactile encounters, and dance explorations.



"Sea Soma" is a fictional ecosystem exploring water and digital objects as healers of somatic senses. It focuses on embodied cognition and opposes the mind-oriented perception of intelligence. It observes the static screen-based life and contemplates the digital as a sufficient experiential substitute. Its elements are a sea squirt, algorithmic sounds and images, dancer researcher, transparent screens, and mobile phones on neck holders. In collaboration with algorithms and a dancer, explorations of the sea and soma materialize through text-to-image-to-sound models. With the help of mobile apps, a video maker, and a UX designer, vision as touch is explored through the process of 3d scanning, filtering, and designin touchscreens and interfaces. Sea Soma encompasses these multimedia explorations as a sensorial installation for practicing vision as touch.

The visuals are a diagrammatic narration of the described ideas. They consist of diverse elements, e.g.:

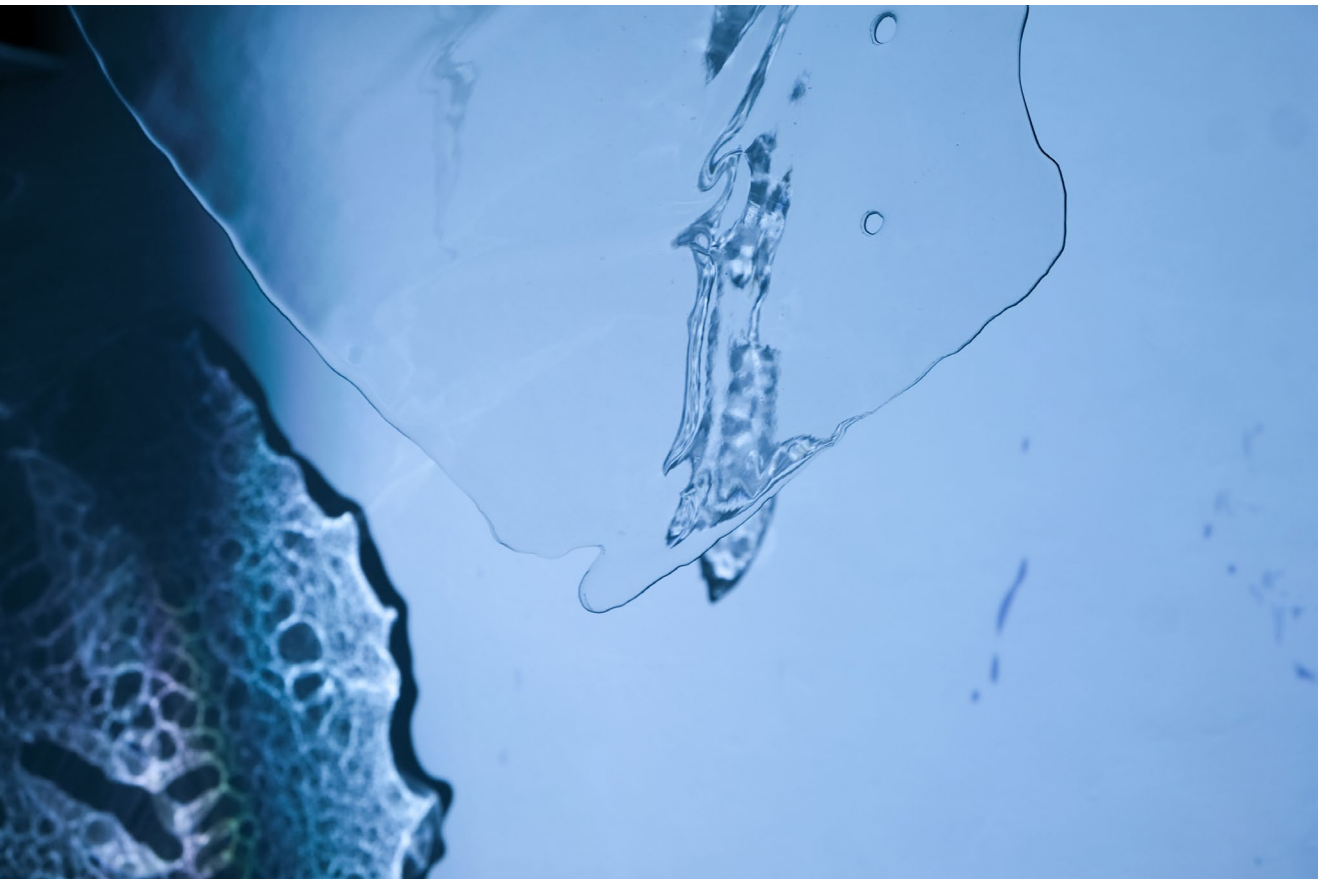
- touchscreen icons used in interface design
- 3D models made by 3D scanning of a dancer with the Polycam app
- text-to-image models made with the Wombo Dream app
- the generated text made with Rytre.me
- 3D model/trace of touch made with Putty 3D
- found images and drawings

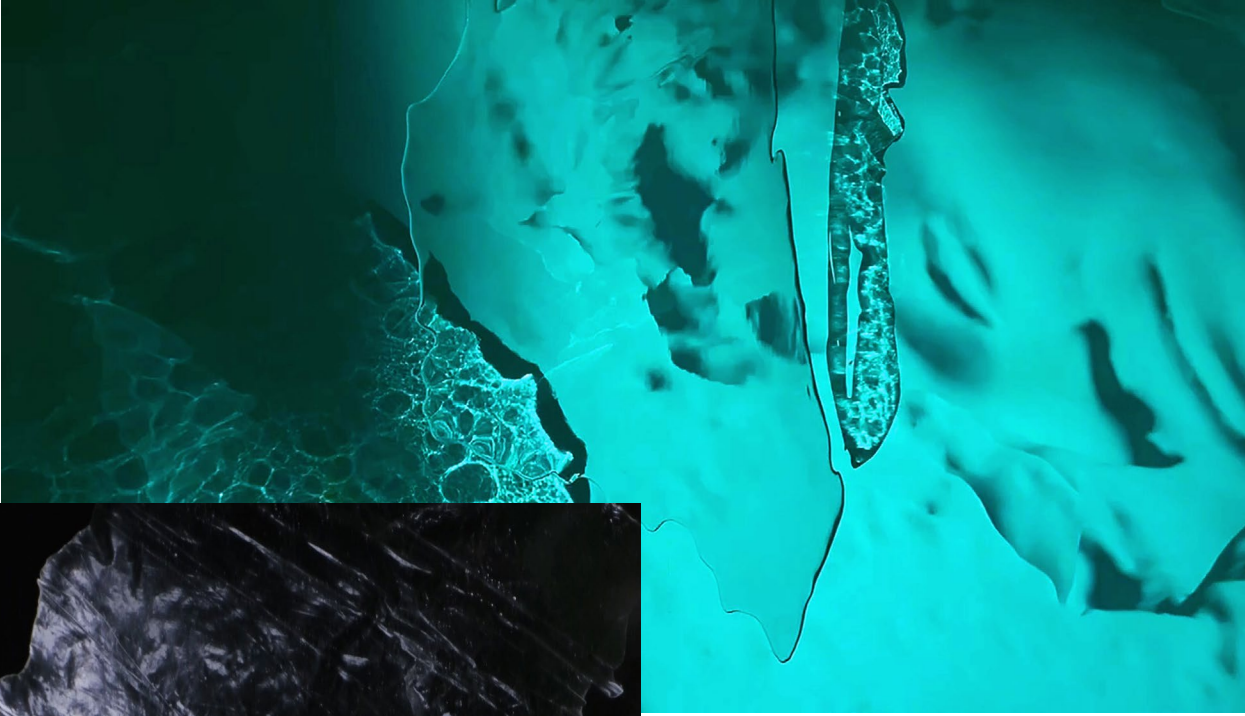
### **Credits**

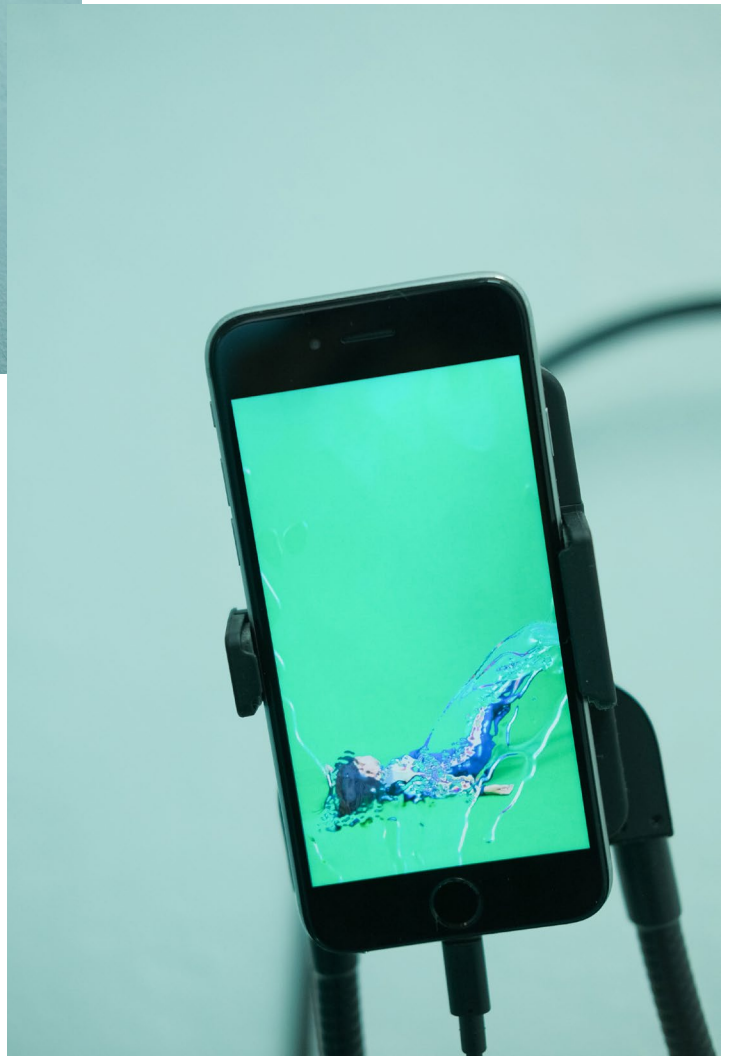
Editing: Alannah Stritch

Photos: Stella Horta

Text consultancy: Nina Gojić  
and Vinicius Jatobá

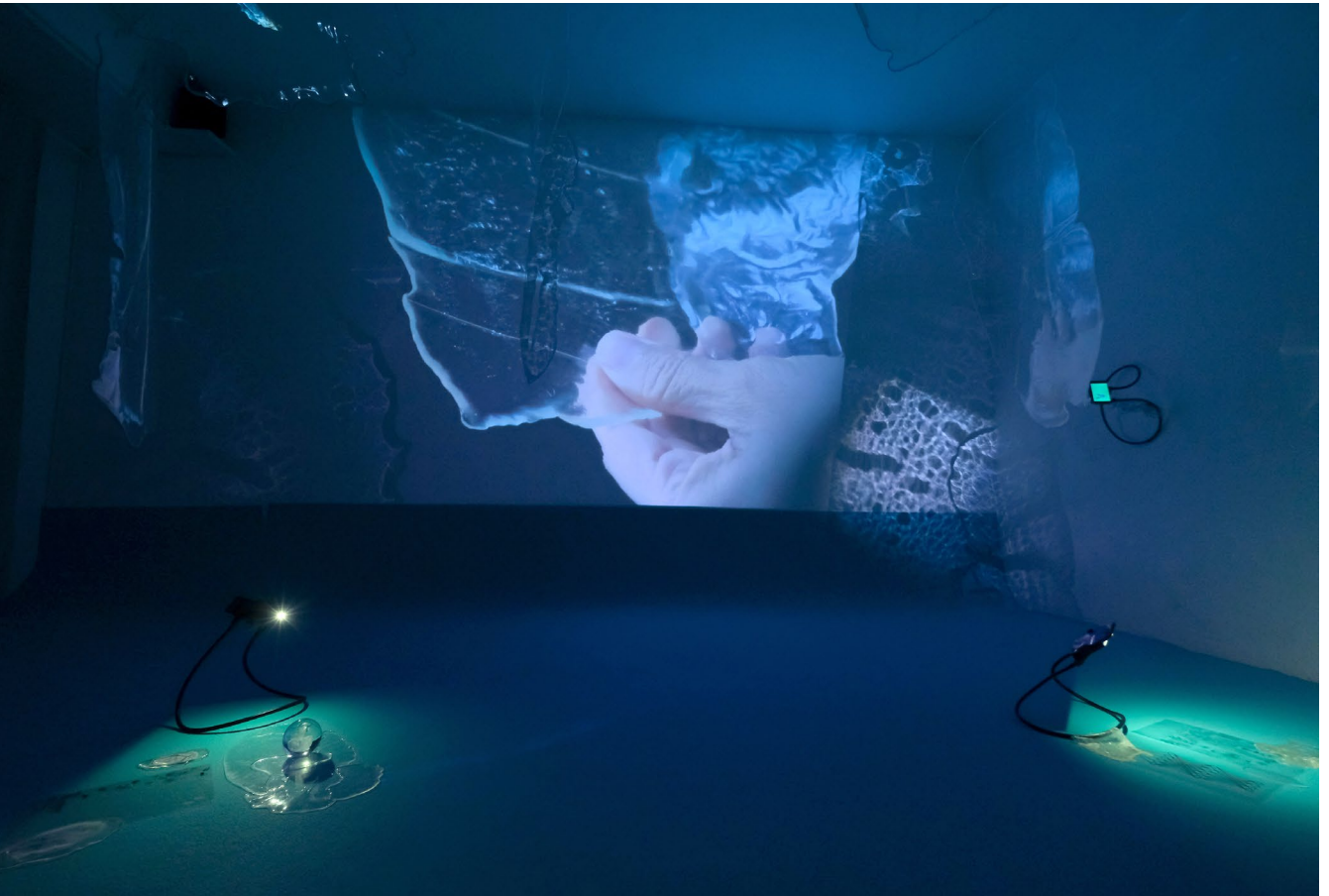


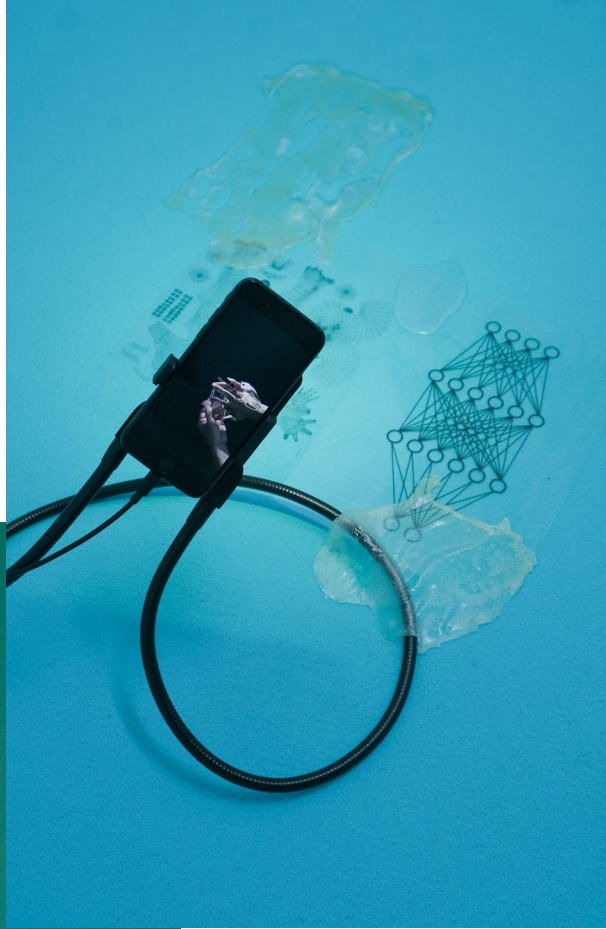
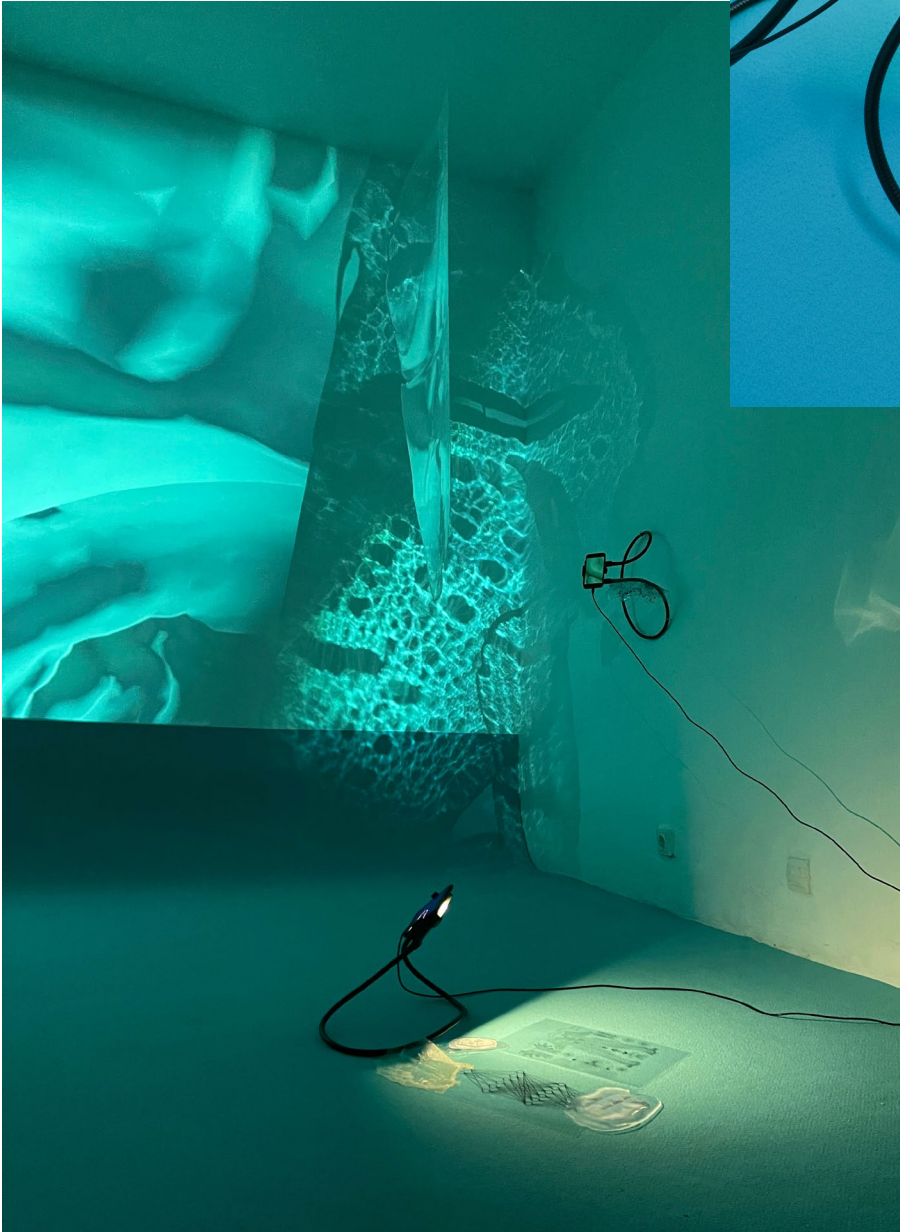














# RADIO IN MIND – A CONVERSATION WITH FRIEDRICH KNILLI

By Maria Knilli, in cooperation with Lena Knilli (*hear*, a video collage)

*“Inventions are repetitions. Inventions are things lying around  
somewhere as clutter. Whereas the existence of media is limitless.  
The needle that pierces, the process of a stitch, is not an invention,  
but a new existence.”*

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## The Cut

Our father, the media researcher Friedrich Knilli, lived for his work.<sup>1</sup> At the age of 91, he moved to a nursing home – an abrupt cut. Yet he wanted to continue his work. His vision was so impaired, though, he could neither type nor write by hand. His voice was too faint for a dictation machine. He requested help. I visited regularly from Munich. Hardly had I entered the room, when the text work began.

His new reality at the nursing home and his dealing with his impending death gave Friedrich Knilli cause to explore the connection between his adventurous childhood in a tailor's family in provincial Styria and his work as an avant-garde media researcher and author in Berlin.

As he formulated, I wrote down and asked pertinent questions; the result was: "Radio in Mind – A Conversation with Friedrich Knilli".

I usually found my father with his eyes shut, with large black earphones on his striking, bald skull. He listened to the radio, day and night: RBB, 88.8 MHz.

On 1 February 2022, two weeks after announcing the completion of this text work, Friedrich Knilli died.

Maria Knilli, spring 2022

*Translated from German by Lonnie Legg.  
Supported by VG Wort with funds from the scholarship program NEUSTART KULTUR (A NEW START FOR CULTURE) of the Federal Commissioner for Culture and Media, 2021.*

Facing page:

Stills from the video collage *hear*

Lena Knilli

Collaged drawings, 40 x 40 cm, paint marker on tracing paper and paper

Photos: Caio Kauffmann, Andrea Siegl

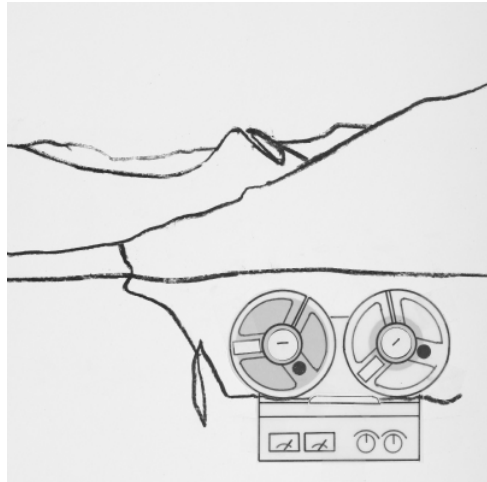
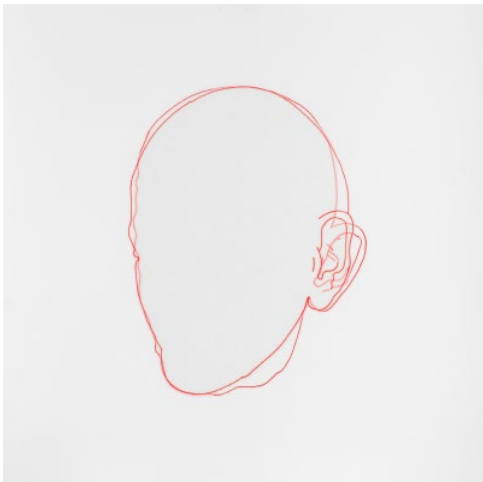
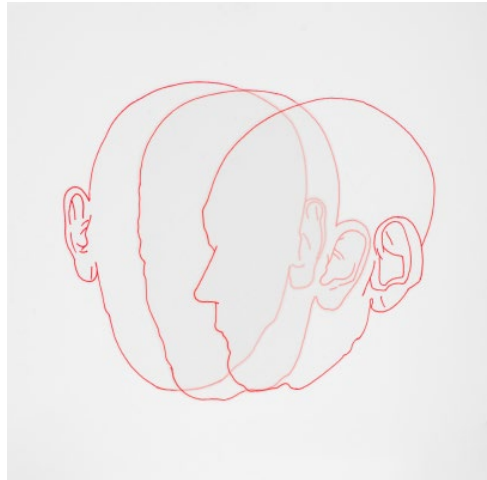
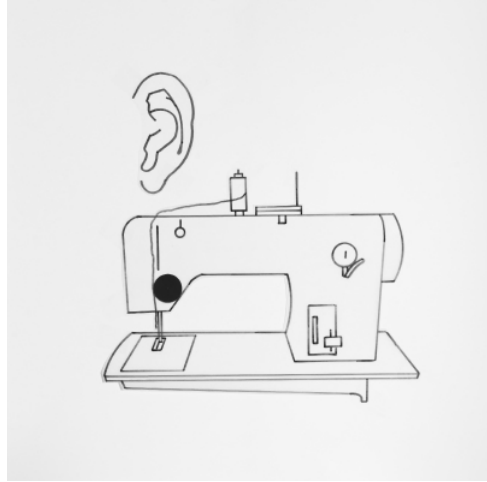
© Bildrecht, Vienna 2022

The video collage can be accessed online via [vimeo.com/user64743858/hear](https://vimeo.com/user64743858/hear) or QR code:




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<sup>1</sup> **Editorial Note:** We thank Maria and Lena Knilli for entrusting us with the publication of this very personal obituary for their father. For further reading on Friedrich Knilli's pioneering role in German media studies see Friedrich Knilli im Gespräch mit Siegfried Zielinski, in: *Zur Genealogie des MedienDenkens*, ed. Daniel Irrgang and Florian Hadler (Berlin 2017), pp. 15–25. For an overview of Knilli's lifelong investigations into how National Socialism could persuade others to participate, directly or indirectly, into its murderous course see Siegfried Zielinski, Friedrich Knilli zum 90. Geburtstag. TU Berlin press release; <https://idw-online.de/de/news?print=1&id=730982>, access: November 4, 2022. Into such investigations Knilli also included the entanglements of his own family history in Austria; see his experimental radio feature "Höllenfahrt – Profiteur der Arisierung: Josef Knilli in Graz" (Deutschlandfunk Kultur, 2018).



**Prologue:** E-e-e-e-e. M-m-m-m-m. Bam, bam, bam. No dreams, dreams. Maria, not Joseph. Fritzy, Fritz, Itzy. Tailor's workshop. Mass media. Junk in space. E-e-e. Fierce, fierce, fierce light.

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**Radio Jingle: *RBB 88.8<sup>2</sup>... Eighties... Ninties... 100% dancing... Nonstop*** (with music)

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**Father:** A small mountain, at its foot stood our house. At 167 Badgasse.<sup>3</sup> Ours was the smallest house. It was a working-class neighborhood, with communists and *Schwarze* (Austrian colloquialism for political conservatives), and the only Nazis were the Knillis.

**Daughter:** What did the house look like?

**Father:** A small block: ground floor only, with a kitchen and two rooms. The three steps from the yard led straight into the kitchen. And there was an attached shed, divided into an outhouse and an entrance to the cellar, where rabbits were kept. In the smaller room my grandmother and my grandfather lived, and the larger room was divided up into a private part for my mother and a second part containing the tailor's workshop. And the at-

tic was packed with Grandfather's books, wrapped in paper.

In the kitchen stood a stove, which filled a quarter of the room. Wood was used for all the heating and cooking. A little stand beside the stove held a bucket containing the water we pumped from a well in the yard, and a washbasin.

The tailors sat with us during the meals. And sometimes my grandmother cooked meat, and I got the best pieces.

**Daughter:** Why was that?

**Father:** Because I was the family darling. And I was coddled by Grandmother.

In Badgasse I was the leader, although I was the smallest. I was feared by all the boys, because I fought with them in the small alleys, on the way to the main square. They were stronger than me, but I still fought with them. And I had the most ideas.

At the end of the alley there was a smithy, and we sat for hours outside that smithy, watching the shoeing of the horses.

**Daughter:** Who is "we"?

**Father:** The children from the alley. Boys and girls. The others were proletarian children, I was a noble little tailor.

Fehring's main square was another scene of my activities.

**Daughter:** What activities?

**Father:** On the main square, I provided water to the Jews driven out of Hungary.

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<sup>2</sup> Station identification of Radio Berlin Brandenburg (88.8 megahertz).

<sup>3</sup> Alley in Fehring, southeastern Styria, Austria.



And the Hungarian military were ordered to assemble at the war memorial. They were very elegant Hungarians. They had to surrender. I went over and took each man's bayonet and pistol.

**Daughter:** You did?

**Father:** I was very proud. It was great walking around with so many weapons.

\*\*\*

**Radio Jingle: 100% dancing... Nonstop... RBB 88.8** (with music)

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**Father:** What year were you born?

**Daughter:** Fifty-nine.

**Father:** I guessed as much. Unforgettable.

\*\*\*

**Radio Jingle: RBB 88.8... 100% dancing** (with music)

\*\*\*

**Father:** My ambition was dominant from my very childhood. My social position. That I was accepted as the leader in Badgasse I owe to my ambition. And that continued at BULME<sup>4</sup> and at the TU<sup>5</sup>. How it came about, I can't say. But the fact is,

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4 Higher-level technical secondary school in Graz-Gösting.

5 Technical University of Berlin.

when something mattered in Badgasse, I was asked. Ambition and self-importance were in one hand, in mine.

**Daughter:** Because your father was absent?

**Father:** It has to do with trickery and theft. To steal something somewhere was very important to me. For example, at Lorenzoni's, a large department store, I stole chocolate and grub – that's what we called it.

**Daughter:** Why?

**Father:** That's how I gained influence and power.

**Daughter:** What is your earliest childhood memory?

**Father:** I mustn't put up with anything. In the room where my grandfather slept and worked, I learned a great deal about the world. He read to me a lot: fairy tales, novels, and Nazi literature. I slept in the bed beside my grandfather, in which my grandmother also slept. Grandfather slept in an "ironing bed" –the ironing was done on the bed during the day. At night, when the boards were removed, it was a bed. Grandmother could neither read nor write, but was very diligent in business matters.

**Daughter:** What was Grandfather's work exactly?

**Father:** Sewing and mending. For example, a farmer went to this sort of tailor to have his *Rock* (Austrian term for a man's jacket) repaired.

**Daughter:** And Grandmother?

**Father:** My grandmother ran the household and helped the farmers with their garden and field work. She had saved small coins and kept them in cigarette boxes on her nightstand. I stole from her, and she just laughed. She was very impressive. When buying meat she cursed the butcher, blaming him for cheating.

**Daughter:** Are you a similar type of person to her?

**Father:** I'm a type of person who resembles both of them, Grandfather and Grandmother. Grandfather, in his reflectiveness and knowledge. Grandmother, in her success.

**Daughter:** And your mother?

**Father:** She stands for stupidity and propriety. Example: When we had to leave the house because of the invading Russians, we moved to live with a winegrower in Höflach<sup>6</sup>. Upon our escape, with one cow, Grandmother and Mother took along bedding and clothing, and I scolded them for leaving behind flour, meat, and wine. The women then changed their load due to my objection.

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6 Village near Fehring, southeastern Styria.

**Daughter:** How old were you?

**Father:** Fourteen or fifteen.

**Daughter:** What type of person was your father?

**Father:** I didn't know him. In my family's opinion he was a rogue who seduced a young woman. He was a gendarme, and she was in Fehring<sup>7</sup> with an illegitimate child and was mocked as a whore because of it.

**Daughter:** By whom?

**Father:** By everyone. I visited him with Monika<sup>8</sup> once, in Mürzzuschlag<sup>9</sup>. He was no longer a policeman but already a low-level town clerk, and had no time for a conversation with me and my fiancée or wife.

**Daughter:** He paid alimony for you?

**Father:** He had to, it was a long struggle.

My later life was also a struggle – as an accountant, mechanical engineer, writer, and media researcher. But the crucial thing was my discovery of the medium. In contrast to all my colleagues' raptures, my discovery is the discovery of the medium – the fact that, in literature and the radio play, the key element is not content or subject matter, but the medium.

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7 Town in southeastern Styria.

8 Monika Kraker-Rülcker (1933–2015), psychotherapist, Friedrich Knilli's first wife and mother of his three daughters.

9 Town in northeastern Styria.

**Daughter:** In literature the letters?

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**Father:** Yes. With radio play: not what one hears, but that one hears. I got that from Fehring, as well. Because there the blah-blah was not what counted either, but the matter: the fact that someone was killed, for example. It is these two things coming together: In Baden-Baden,<sup>10</sup> I discovered the medium; whereas in Fehring, dealing with the medium, the tool, was one's everyday reality. Dealing with scissors, an iron, was similar to dealing with apparatuses, machines in Baden-Baden. That's why it's no wonder I studied mechanical engineering.

**Daughter:** I'm not sure I understand.

**Father:** It's quite simple, because it's about reality, not presumption. With a pair of pliers you have something in your hand, or with a hammer.

**Daughter:** What are the pliers with a radio play?

**Father:** The radio play is a *Schallspiel* (sound play). It sounds. The word *Schallspiel* is one key term and concrete poetry the other. The *Schallspiel* is the result of wires sounding, amplifiers glowing.

Yes, this is how it ends: with summarizations. Has someone come in?

**Daughter:** Yes.

**Father:** My discovery in West Germany, at the Südwestfunk radio studio in Baden-Baden, was that I could actually sense the signals in my body and was interested not in the monitor room but in the technology. What interested me was the amplifiers, the tape machines. Then I could actually sense with my whole body; and what went on in the monitor room was of no value whatsoever to me.

**Daughter:** The content?

**Father:** You might say that, but the word "content" is too imprecise, because even in the engineering room, where I felt the vibrations, I felt a content – not a story but vibrations on my upper arm or back. That is to say, those are physical sensations that have nothing to do with stories – where the sensation is caused by the vibrations, in whatever part of the body. And this all reminded me of experiences at the Süddeutscher Rundfunk in Stuttgart,<sup>11</sup> with Helmut Heißenbüttel,<sup>12</sup> who formed rows of letters and derived the meaning of the words from the medium of the word, as well as of Ferdinand Kriwet,<sup>13</sup> in Bremen.

**Daughter:** I don't understand what the medium of the word is.

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<sup>10</sup> Central location of former state broadcasting company Südwestfunk (now part of Südwestrundfunk), Germany.

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<sup>11</sup> Central location of former state broadcasting company Süddeutscher Rundfunk (now part of Südwestrundfunk), Germany.

<sup>12</sup> Helmut Heißenbüttel (1921–1996), writer.

<sup>13</sup> Ferdinand Kriwet (1942–2018), writer.

**Father:** The medium of the word is an expression that tries to say, it's not about the content that one presumes in the word, but about the material value of the word.

An example of such a sequence might be: „Yesterday, yesterday, yesterday, yesterday, yesterday, today again.“

And here the sense of the words would be meaningless, but the words themselves incredibly meaningful. And here it's not about just the vibration, but about much more.

The best comparison would be the stage, that the words appear like actors. On a stage, what fascinates is not the play-acting, but the actor's existence as a medium. For example, here at the old people's home, the men and women who fill the corridors, fill them with their 50 centimetres of chest and 130 centimetres of height. And when you measure it that way, you're actually measuring the medium, the human being as a medium. And what I invented and discovered at Südwestfunk was media studies.

**Daughter:** May I ask a question? Your example contains a certain meaning, a reference.

**Father:** But yesterday and today, what counts is not the reference, but the fact that it exists as a physical presence. What matters is the physics and biology of the word.

“Yesterday, yesterday, yesterday, yesterday, yesterday, today again.“

Air vibrations are set in motion, bodily vibrations, the head, the mouth, it is an

abundance of events that have nothing to do with the customary content of the word.

And that reminds me of Fehring, where people also lived through action. And through tools. And by that I mean the plane, the pliers, the saw. The entire body. In Badgasse, when someone ran up and down, then you saw this monster, the human being running. And not someone with a specific name. For example, outside the house at 167 Badgasse stood so-called “Lafferin”, for hours, not begging but just standing there, like a unique work of art. “Lafferin” was of average height, slender, somewhere in her mid-fifties. She spoke little. But she looked at the world, with big eyes. As if she were waiting for someone. She was demented, and when she entered the house, she was a new piece from somewhere.

Like the sort of pieces you might find among lunar rocks whizzing around on their own. They're not filled with the superficial meaning attributed to them, but with the force of a novelty. For example, rocket research was always of great interest to me because of the bit of absurd reality that it made visible.

The subject of media studies is always, quite concretely, the medium and not the message. The medium is already the message.

**Daughter:** Yet, in your example you choose two words that refer to time.

**Father:** Because it's what the dumbest person understands.

**Daughter:** But the dumbest person, I, that is, says: There is referential content, which I must first push aside.

**Father:** You must dispense with it.

One can describe it totally naively, but that is also wrong. If I permit the letters “*y-e-s-t-e-r-d-a-y*” as a word and also allow the line, another existence form, and also allow the sequence of lines, all being realities, then I can rightfully ask: Today again? And with “*t-o-d-a-y*” I’ve inserted a new reality form, not just any one, but one that didn’t exist before.

My concept of media involves a heap of junk, flying to the moon and disintegrating on the way. With this flight, I am setting foot on realities that never existed before. The innovation, the novelty, the flash that one sees in the sky, that’s the surprise. And one can ask oneself how long it can go on like this, with the flashes, with the heap of sand.

**Daughter:** Can you give me another example?

**Father:** In Fehring, in Badgasse, there were constantly new examples. Suddenly the entire alley is full of water – where does it come from, where does it go, and what is it, actually?

**Daughter:** And another linguistic example?

**Father:** You’ll find linguistic examples in Ferdinand Kriwet’s or Franz Mon’s<sup>14</sup>

works. They pretend to arrange the words in graphs of some kind – but that’s not what they’re doing, they’re creating reality. This means it’s always about the new reality, which with a single movement is suddenly there. As if you’re on the moon and reach out and then you’ve got a heap of sand in your hand. It’s constantly about existence. Just as “Laffer-in” stands in Badgasse, embodying an incredible existence. She is the piece of stone that is flung from a volcano. A particular access to reality. In Fehring that was of constant interest to me.

**Daughter:** Up to what age did you live in Fehring?

**Father:** Until the age of ten.

And my acting provocative before age ten already began in church. That was my urinating behind the altar. And with the cross, which one wears or displays, whether that is reality. Actually, for the whole duration of my life, I have been researching reality. Researching what – when I look out this window – actually exists.

**Daughter:** And what actually exists? Now?

**Father:** I haven’t a clue. It’s all deception. Reality is even more real when I mount a rocket and fly to the moon; then I’ll be approaching reality.

**Daughter:** Why the moon?

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<sup>14</sup> Franz Mon (1926–2022), writer.

**Father:** Because at the moment that's the greatest distance. I can give you another example. When, for example, as a tailor's apprentice (an apprentice not by office but by doing), I used a needle to sew on a hook, I was shaping reality. With a stitch. Not because the hook didn't exist before, but because the stitch created a movement, like a shot into space. A shot, once fired, can't be stopped.

My church attendances were constant challenges: to test reality in religion, to discover God, and to expose the priests' slogans as lies and incredibilities.

You see, everything I created in media studies revolved around existence: Is this actually something that is new and exists, or is it merely an invention?

**Daughter:** I don't understand the difference.

**Father:** Inventions are repetitions. Inventions are things lying around somewhere as clutter. Whereas the existence of media is limitless.

The needle that pierces, the process of a stitch, is not an invention, but a new existence.

Inventions belong to junk of the Earth. Media are not.

**Daughter:** Do you mean such inventions as the computer, as well?

**Father:** Yes. The computer is junk of the Earth.

What makes it a medium is its indestructible parts: vibrations, for example,

or other physical processes that cannot be stopped.

Media studies, and all the words involved in this context, are always concerned with what exists.

That's why, already in Fehring, for example, "Lafferin" was so important to me, because she existed. In the most primitive form. She stood in the middle of the street, in the winter and in the summer, freezing, starving – similar to a piece of ember in a volcano.

My radio play "Höllenfahrt"<sup>15</sup> was one of those attempts to enter this insignificant hole called Earth. At the moment, I guess it's the primary thing.

**Daughter:** What?

**Father:** I was always interested in the unknown parts of the Earth. That was it.

**Daughter:** Could you add something about urinating behind the altar?

**Father:** It was an attempt to challenge the existence of God.

**Daughter:** How so?

**Father:** To wait and see what happens if I pee, or whiz, or whatever you call it, in the most sanctified space – and nothing happens. Or at confession, when I offered lies of sins I had never known, and the priest in the confessional said, you're lying, you can't have experienced that. And

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15 "Höllenfahrt – Profiteur der Arisierung: Josef Knilli in Graz", radio feature by Friedrich Knilli (Deutschlandfunk Kultur, 2018).

without saying anything, I stood up and left. What always matters is the reality of reality: How real is the world we live in? Such fields as philosophy, religion usually describe only the surface of reality. That's why the mystics are intriguing observers.

And when I set out from Fehring and wind up in Berlin, then it's an attempt to approach that piece of reality that I got to know in Fehring.

I can't describe enough my surprise upon finding a piece of moss in the forest. Already as a child. Or a small ant hidden in a piece of wood.

And the term medium in "media studies" has nothing to do with television, radio, or books, but it is constantly about the discovery of reality. About movement in space.

A fine example of media studies is a circus artist who creates totally new movements with his hands and feet, which then fly around in the air somewhere – as movement in space.

**Daughter:** How do you define the word "medium"?

**Father:** Hard to say. It certainly says nothing about the devices that one today calls communication machines. I would say: an ever-new form of existence. It's all about existence. That's why the circus artist is so impressive and the theater play is so comical.

**Daughter:** Is "Lafferin" a medium?

**Father:** Yes. She exists only as a medium.

**Daughter:** And the ant, too?

**Father:** [Nods.] And the church too. Because it contains parts of a reality that are indestructible. "Medium" refers to those things that are indestructible – like fire, air, water. The wind.

**Daughter:** And the human being?

**Father:** I guess he is vulnerable.  
What time is it?

**Daughter:** 11:38.

**Father:** They serve lunch at twelve. Do you have any more questions?

**Daughter:** Just a sec'. I've got to let that sink in.

**Father:** For example, in Faust, when he descends into hell, it really becomes an interesting topic the moment he vanishes with neither spirits nor Devil, when he just steps into that merciless hole in the Earth.

Actually, the medium is always concerned with the ultimate instance. Wherever your steps take you, you come upon some piece of existence that remains unknown to you. And I experienced this twice – once in Fehring, with "Lafferin", and the second time in Baden-Baden, in the engineering room.

**Daughter:** That was strenuous.

**Father:** It was pleasant, your letting me talk so freely.

My grandfather told me about reality, when he read books to me in his tailor's workshop. Whereas next door I slept in the bed beside my grandmother and three devout Virgin Mary pictures hung above us. And coins lay in the ashtray. And I always snitched, whenever I could, a schilling coin, and my grandmother grinned.

Or my grandmother sat in Opernring Café in Graz,<sup>16</sup> with a glass of wine and a sausage. And when the waiter asked her to pay all she replied was: My son Pepi (Austrian diminutive of "Josef") owns the shop down the street, he'll pay.

What fascinated me, you see, was not the philosopher but the beggar. The monk. Who assumed the risk of living.

**Daughter:** It was good today, our conversation.

**Father:** Whenever I talk about media studies, I am a dilettante.

**Daughter:** Now lunch?

**Father:** Yes, please.

I need to also mention how I experienced your birth. I'll tell you that later.

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**Radio Jingle: *Saturday night... 100% dancing..., nonstop... RBB 88.8*** (with music)

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<sup>16</sup> State capital of Styria.

**Daughter:** May I switch off the radio?

**Father:** Please do.

**Daughter:** I keep thinking about your flight to the moon.

**Father:** The flight to the moon consists of a heap of scree that sorts itself over time and deteriorates. What remains is pure movement in space. That's a subject for science and religion.

And a central question is: What does movement without stone mean?

**Daughter:** Does that question have an answer?

**Father:** Religious people have one.

**Daughter:** And you?

**Father:** I say there has to be something. Otherwise, one can't explain this madness.

**Daughter:** That there has to be something once the stone is depleted?

**Father:** Yes.

**Daughter:** What could it be?

**Father:** That is our logic.

**Daughter:** Whose logic?

**Father:** Our Christian-tinged logic. And the various religions or philosophies deal



with it differently. Every interpretation that tries to explain the rest is mysticism.

For example, the indestructibility of the cross. The cross can't decay, it exists in eternity. Thus begins religion.

**Daughter:** Who says the cross can't decay?

**Father:** The followers. There are followers of various forms of incorruptibility. Christ can't decay.

**Daughter:** You're saying that?

**Father:** Says religion.

It's all part of the great historical teachings of mysticism. And when I talk about the medium as a medium, I'm talking about mysticism.

When I'm standing in the engineering room in Baden-Baden, experiencing the vibrations in my entire body, I'm a mystic. And what I just said is in the tradition of Ferdinand Weinhandl,<sup>17</sup> who finds in nature this remaining part that we keep talking about, while hiking in nature.

**Daughter:** Okay, in your view, what is this remaining part?

**Father:** Unknown. When you enter the history of mysticism, you find many different solutions for this so-called remaining part.

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<sup>17</sup> Ferdinand Weinhandl (1896-1973), psychologist and Friedrich Knilli's thesis supervisor.

**Daughter:** Yes.

**Father:** Canonization is one such remaining part. Someone who views canonization as possible is dealing with this remaining part. Saints are such people.

It is a philosophical position on the fringe of mystical explanations. And this is reflected in the metaphoric content of Goethe or Nietzsche. Goethe believed in spirits that go on existing. Nietzsche said, there is a hole and I'm going to vanish in it forever.

\*\*\*

**Father:** My grandfather's name was Josef. I wasn't there when he died. It was in 1945. I was galloping on a borrowed horse from Fehring to Auffen<sup>18</sup> for a can of schnapps. When I returned, I found Badgasse empty. It was dreadful.

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**Radio Jingle: *RBB 88.8... Eighties..., Ninties... 100% Soul*** (with music)

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**Father:** My grandmother's name was Maria. She died with her arms spread like a saint.

**Daughter:** With her arms spread?

**Father:** Yes, and a radiant face.

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<sup>18</sup> Village forty kms from Fehring, in southeastern Styria.

**Daughter:** And how were her arms spread?

**Father:** [*Spreads his arms, stretching them upward.*] Spread like Holy Maria in church.

With limp arms, her daughter-in-law lay in her bed. Grandmother needed nursing, her son Franzl had to marry a young woman who would take on this nursing. My grandmother died, radiant, with her arms spread; her daughter-in-law committed suicide.

**Daughter:** Why do you think she did?

**Father:** Because she felt used. There was no love between Franzl and the young woman. It was nursing abuse.

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**Radio Jingle: *RBB 88.8 ... Berlin and the world at nine*** (with music).

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**Father:** We talked about concrete poetry, Heißenbüttel, Kriwet, and Mon. During the night, it occurred to me that concrete poetry was practically an extension of Karl Bühler<sup>19</sup>. I had written a longer booklet about concrete poetry, and then attached a quote by Karl Bühler. Bühler had examined the individual vowels and consonants, as well as the resulting *Wortfarben* (word tones). Bühler got very heavily into the perception of words and

sentences and developed a psychology of the various *Sprachstände* (linguistic categories).

And the concrete connection is that Heißenbüttel and Kriwet also operated with such terms. They used letters in such a way that they only make sense through their current position, thus making them autonomous. Or they used letters in such a way that they make sense only through their connection with other independent orders. In their view, letters of this sort are vulnerable, because their ambiguity is too great.

And that's actually how it was for me too in our conversation yesterday about the flight to the moon. One assumption would be that the flight to the moon can stand for itself as a flight. The other assumption would be that it needs help and will crash without it. And the flight to the moon that flies alone is comparable to the letters that can stand alone.

That means, when I was putting together the brochure on concrete poetry, I had a connection to Bühler, but not yet this connection to the moon. [*Laughs.*]

**Daughter:** You rascal! You're always putting on a show.

**Father:** It may be the case that one is underway with the autonomous letter and a letter that needs a second one and the autonomous letter flies on alone and loses the second letter.

It may be the case that two letters are underway: They look like one, in reality

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<sup>19</sup> Karl Bühler (1879–1963), German linguist.

they are two; one can continue to exist, the other one drops off.

The basic idea is that in concrete poetry this system – of stand-alone and composed – works. And that the ambiguity comes from the letters and not from the words. And that is very rare in these linguistic investigations. Bühler approached these fiddly studies as a psychologist.

And my claim is that I see the relationships in outer space similarly.

For the movement, we have now found a body: the *selbständige Laut* [autonomous sound], or *Selbstlaut* [vowel].

**Daughter:** Specify such a sound.

**Father:** *i, e, a.*

Most consonants aren't. The word *Selbstlaut* itself expresses that they can stand alone.

And they fly along in the movement and may possibly, upon further investigation, be the movement.

Do you understand what I'm saying?

An *i*, moseying around alone. [*Grins.*]

**Daughter:** [*Laughs.*]

[*They both laugh.*]

**Father:** It was through concrete poetry that I came upon Karl Bühler – that they write single letters and, by putting them in different lines, assign meaning to them. And the moment they change positions, the meaning changes. And they call that a poem.

In Bühler's work, stringing together certain consonants creates a darkness, the consonants make it darker, because they constantly depend on other sounds. The more consonants, the darker.

And, crazy me, I'm comparing it to the flight to the moon, where it grows steadily brighter, because the consonants drop off and more and more vowels become necessary. Vowels brighten the flight.



*SPECIAL SECTION:*

**INTERFACES AS  
EXPERIMENTAL  
ARRANGEMENTS**

The design and functioning of interfaces can be understood in several respects as an experimental arrangement in which the relationship between different actors and process levels – for example between hardware and software, APIs and/or human users – is modelled and updated, sometimes in real time. Throughout, cultural assumptions, technical constellations, and design decisions are guiding these diverse, conscious and unconscious interaction processes.

Inherently, the process of interaction and interface design carries presuppositions about conceivable interactions which are inscribed in the design process, and consequently subjected to various forms of experimental testing on the way from development to evaluation. The spectrum ranges from the codification of the experimental dimension of interface and interaction design itself (e.g., in various 'labs') to forms of usability testing reminiscent of social experiments. An 'experimental' dimension, however, is also evident in the permanent evaluation and updating of the various possibilities of the actors involved during an interface interaction. Media environments in this context are not only to be thought of from the point of view of the perception or positioning of a human subject, but in particular from the point of view of the affordances mediated by interfaces. In addition to practices of an 'experimental' (deviant, unusual) use of interfaces, it is particularly important to discuss the extent to which interfaces are not only objects of experimentation, but also contribute to establishing and stabilising experimental

configurations within a digital media culture at large.

This special section on interfaces as experimental arrangements discusses concrete case studies on the basis of which this negotiation of different actor potentials at and in interfaces becomes apparent. Especially in the application domains of sensor technology and artificial intelligence, the relationship between human/world/non-computer and computer is shifting towards new input logics and practices. Traditional command structures and input forms familiar from established personal computing paradigms are currently being replaced by relationships in which what matters most are the hardware-software relationships created for them, ready for sensing, as 'actors.' What becomes an input for these sensory computer forms, when and how, is decided by the hardware-software relations that have to be programmed in advance. Thus, the question is raised when the 'experiment' of making the world or some form of environment readable begins in each case and how it is balanced in a concrete interface situation.

A first contribution to the section by Timo Kaerlein traces the development from the distributed testing of web interfaces in the field of e-commerce by means of A/B testing with randomized groups of users to current approaches of sensor-based and data-driven testing environments. He argues that the epistemology, politics, and ethics of web testing infrastructures and its concurrent cultures of experimentation serve as blueprints for a sensor-based experimentation in the wild which situates

(often unsuspecting) 'users' in far-reaching experimental setups.

Another site of interfaces as experimental arrangements is the so-called 'science fiction prototyping,' which Christoph Ernst explores critically in his contribution. Science fiction prototyping is an attempt at an experimental form of interface design, in which an orientation towards science fiction literature, understood as an 'experiment', is used as a guiding principle of design to imagine and evaluate the development of interface prototypes. The contribution gives a concise overview of this approach and problematises it from a media theoretical perspective, focusing in particular on the question of the mediality of future interfaces.

Popular application contexts such as the smartphone app FaceApp also raise the question – as Sabine Wirth discusses in her contribution – of how such commercial offerings, which force a playful-experimental approach to the photographic image, simultaneously become effective as surveying and data collection practices. In the case of FaceApp, this results in a tension between the creation of a prognostic, future image, which is generated with the help of artificial neural networks, and the further – controversially discussed – collection of biometric user data.

Christoph Ernst,  
Timo Kaerlein  
and Sabine Wirth





# DECONTEXTUALISING 'SCIENCE FICTION PROTOTYPING'

By Christoph Ernst

*"The 'experiment' has expanded and mutated into a global usability testing case."*

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# Overview

Scenarios demonstrating future user interfaces are an essential part of the public discourse about conceivable futures of digital media technologies. Think, e.g., of the central role of 'tech-demos' and especially of 'demonstrators' – which can be regarded as a form of 'prototype'<sup>1</sup> – for the mobilisation of sociotechnical imaginaries of the future.<sup>2</sup> In such imaginaries of future digital media technologies, the display of futuristic and speculative user interfaces plays a crucial part. It should be noted, however, that the role of interfaces in these well-known public mediations is connected to various design methods. These methods articulate, condense and test ideal-typical and normalised notions of future interfaces. One of these methods is called 'science fiction prototyping,' or in short 'SF prototyping.' In the following remarks I want to give

a short summary of some of the central ideas of this concept and decontextualise them, using ideas from media theory. Central to this decontextualization is the notion of 'experiment.' Instead of a functionalist approach, 'science-fiction-prototyping' will be understood as ongoing experimental process within mediated discourses on future user interfaces and society as a whole.

## SF prototyping

The concept of SF prototyping was developed in the late 2000s by Brian D. Johnson.<sup>3</sup> Johnson originally worked out his ideas at Intel and currently holds a practice professorship at Arizona State University's 'School for the Future of Innovation in Society.'<sup>4</sup> It since has received some attention and expansion.<sup>5</sup> The concept is about developing methods to anticipate future technological innovations. In a process of blending fact and fiction, 'prototypes' for future interface technologies are made conceivable. The concept is designed especially for the

1 The text is part of a series of publications on the issue of imagining future interfaces within the context of technology demonstrations. Almost all theoretical contexts cited in this text are explored in more detail in previous publications, see Christoph Ernst and Jens Schröter (eds.), *(Re-)imagining new media. Techno-imaginaries around 2000 and the case of 'Piazza virtuale' (1992)* (Wiesbaden 2021); Christoph Ernst and Jens Schröter, *Die Zukunft vorstellen – Technologie-Demonstrationen in der Geschichte digitaler Medien. Technikgeschichte* 88/1 (2021): 79–105; Christoph Ernst and Jens Schröter, *Media futures. Theory and aesthetics* (London 2021).

2 On the notion of "sociotechnical imaginaries," see Sheila Jasanoff, *Future imperfect. Science, technology, and the imagination of modernity*, in: *Dreamscapes of modernity. Sociotechnical imaginaries and the fabrication of power*, ed. Sheila Jasanoff and Sang-Hyun Kim (Chicago, IL and London 2015), pp. 1–33. Analogies between prototypes and demonstrators can be developed by using the model proposed in Patrice Flichy, *The internet imaginaire* (Cambridge, MA and London 2007), p. 10.

3 [https://en.wikipedia.org/wiki/Science\\_fiction\\_prototyping](https://en.wikipedia.org/wiki/Science_fiction_prototyping), access: August 2, 2022, 11:00pm.

4 Brian David Johnson, *Science fiction prototypes Or: How I learned to stop worrying about the future and love Science Fiction. Intelligent environments* 2 (2009): 3–8; Brian David Johnson, *Science fiction prototyping. Designing the future with science fiction* (San Rafael, CA 2011).

5 Tiina Kymäläinen, *Science fiction prototypes as a method for discussing socio-technical issues within emerging technology research and foresight. Athens Journal of Technology & Engineering* 3, 4 (2016): 333–347; Jan Zyburá, *Science fiction prototyping as a tool to turn patents into innovative marketable products. Ambient intelligence and smart environments* 18 (2014): 235–246.

tech industry. It consists of several basic assumptions:

First, SF prototyping is a form of reflexive storytelling. It starts, as Johnson points out several times, in “science fact”. As a genre, science fiction is seen as a form of worldbuilding. Science fiction solves the problem of what a technology might look like and what can be done with it practically.<sup>6</sup> As such, science fiction is a resource which can be used to imagine and not, as Johnson insists, to predict the future.<sup>7</sup> Prototypes are considered fictional objects, i.e., they are either real objects with fictional applications or fictional objects from the start. Hence, a prototype doesn’t have to be an existing material object in the real world. Fictional stories, e.g., in films or games, can be regarded as ‘prototypes’ as well.<sup>8</sup> In consequence, prototypes can take different shapes, from already functional prototypes via cinematic objects to all kinds of ‘proxies’ such as patents.

The central epistemic operation of SF prototyping is an act of ‘imagining.’ Johnson follows here the widely held assumption, that imagination connects (science) fact and (science) fiction.<sup>9</sup> SF prototyping is understood as a methodologically controlled process of imagina-

tion for different groups of actors. As a method, SF prototyping serves an “opportunity recognition process.”<sup>10</sup> In the first step it serves the “capitalization of opportunities” and then in the second step the development of marketable products.<sup>11</sup> SF prototyping is a mirror-inverted complement of product development. If product design is, as Jan Zyburawrites, “knowledge based”, then SF prototyping is “imagination based.”<sup>12</sup> Accordingly, discourses on “design fiction” describe related undertakings.<sup>13</sup> It is interesting how these basic assumptions of SF prototyping are claimed to be implemented. Here the term ‘experiment’ comes into play. What does this ‘experiment’ within SF prototyping consist of? As an ‘experiment,’ SF prototyping claims to move a prototype in an act of a “future transformation” into a “future context” and then maps this prototype back to factual reality.<sup>14</sup> The shift to a “future context” is considered a “forward simulation scenario.”<sup>15</sup> It is unfolded alongside the development of prototypes during (knowledge based)

6 Johnson, *Science fiction prototyping*, pp. 22, 25.

7 See Johnson, *Science fiction prototyping* for these general assumptions of his method. See also Kymalainen, Science fiction prototypes. Kymalainen connects SF prototyping to the methods of emerging technology research foresight.

8 Johnson, *Science fiction Prototyping*, p. 12.

9 This idea has been developed in literary theory, see e.g., Wolfgang Iser, *The fictive and the imaginary. Charting literary anthropology* (Baltimore, ML and London 1993).

10 Zyburawrites, Science fiction prototyping as a tool, p. 236.

11 See esp. Zyburawrites, Science fiction prototyping as a tool.

12 Ibid., p. 240.

13 Julian Bleecker, Design fiction: A short essay on design, science, fact and fiction (2009); [https://drbfw5wfjlxon.cloudfront.net/writing/DesignFiction\\_WebEdition.pdf](https://drbfw5wfjlxon.cloudfront.net/writing/DesignFiction_WebEdition.pdf), access: August 3, 2022, 09:10am; Linda Praxling, Design fiction as norm-critical practice, in: *Interactivity, game creation, design, learning, and innovation. 6th international conference, ArtsIT 2017 and second international conference, DLI 2017. Heraklion, Crete, Greece, October 30–31, 2017 proceedings*, eds. Anthony L. Brooks, Eva Brooks and Nikolas Vidakis (Cham 2018), pp. 490–499.

14 Zyburawrites, Science fiction prototyping as a tool, p. 239.

15 Ibid., p. 236.

empirical case studies. The procedure is regarded as an integrative method that is iterative-evolutionary and consists mainly of feedback loops. The goal of the method is to identify “undetected use cases” and “future markets.”<sup>16</sup>

There are three aspects I want to note. First, the ‘experiment’ is a thought experiment, but as such a social practice. Second, the experiment consists of several procedures. It can be workshop-based with sketches, it can consist of different writing styles, playing with Lego bricks, making short films, etc. All these practices are understood as deliberate alienations from the given context of meaning of a technology. Third, the goal of the experiment is to identify something marketable as ‘new.’ The gain of knowledge is not only seen with regard to the form of a technology, but above all also of the practices of handling it. Accordingly, user interfaces are a prime topic of SF prototyping, with corresponding papers bearing titles such as “Towards an Agenda for Sci-Fi inspired HCI Research.”<sup>17</sup> The bottom line is that SF prototyping can be regarded as part of what Kodwo Eshun has called the “future industry” developing since the 1960s.<sup>18</sup> For further discussion I would like to pick out the no-

tion of ‘objects’ resp. ‘prototypes’ and the associated ‘experimental’ epistemology.

## Diegetic prototypes

SF prototyping is closely related to design fiction and other practices in which real interface prototypes are shown in fictional contexts as fully functional technologies. Explicitly, Johnson considers science fiction films as forms of SF prototyping, his introductory example being *WarGames* from 1983, but he discusses many other examples (*2001 – A Space Odyssey* etc.) as well.<sup>19</sup> Yet, SF prototyping develops, interestingly, not a very precise idea of the performative power of future interfaces depicted in science fiction movies. Better concepts can be found in Science and Technology studies. Specifically, highly conventionalized genre movies, such as most Hollywood science fiction blockbusters, are considered showrooms for so-called “diegetic prototypes.” The term was introduced by David Kirby to describe how the form and use of new technologies, and this holds specifically for interfaces, are normalized in fictional contexts. Kirby gives six characteristics of diegetic prototypes:

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<sup>16</sup> Ibid., p. 244.

<sup>17</sup> Omar Mubin et al., Towards an agenda for sci-fi inspired HCI research. *ACE 16: Proceedings of the 13th international conference on advances in computer entertainment technology*, Article no. 10, pp. 1–6. 10.1145/3001773.3001786.

<sup>18</sup> See Kodwo Eshun, Further considerations on Afrofuturism. *CR: The New Centennial Review* 3, 2 (2003), pp. 287–302, here p. 291; Ernst and Schröter, *Media futures*, pp. 39–40.

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<sup>19</sup> Johnson, *Science fiction prototyping*, pp. 1–3; 55–80. An authoritative study on user interfaces in films is Nathan Shedroff and Christopher Noessel, *Make it so. Interaction design lessons from science fiction* (Brooklyn, NY 2012).

- ‘performative artifacts’ (Lucy Suchman): demonstration of technological possibilities of a prototype,
- social contextualisation: situating the prototype in a social context (e.g., a user community),
- ideal usage scenarios: ideal typical benefits of the prototype for users are displayed,
- normalised use: the use of the prototype is presented as ‘normal’ and ‘natural,’
- social relevance: the social relevance of the prototype is characterised,
- real need: a real need for the prototype is created.<sup>20</sup>

The classic example for this process is the gestural user interface in Steven Spielberg’s *Minority Report* (2002). The now well-known user interface was developed, among others, by John Underkoffler, who worked as a consultant on the set of the film and helped creating the functional prototype shown in the film. From the history of the *Minority Report*-interface it is possible to point out three very distinct issues: first, the diegetic prototypes are introduced by ‘scientific consultants’ in Hollywood.<sup>21</sup>

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20 The characteristics are discussed more detailed in David A. Kirby, *The Future is Now: Diegetic prototypes and the role of popular films in generating real-world technological development*. *Social Studies of Science* 40/1 (2010): 41–70; David A. Kirby, *Lab coats in Hollywood. Science, scientists, and cinema* (Cambridge, MA and London 2011), pp. 193–218. See also Ernst and Schröter, *Media futures*, pp. 48–49.

21 On the role of scientific consultants in Hollywood see David A. Kirby, *Science consultants, fictional films, and scientific practice*. *Social Studies of Science* 33, 2 (2003): 231–268; David A. Kirby,

These specialists work in the broader context of the future industry, e.g., in the MIT Media Lab. Second, while the interface in *Minority Report* was already a showstopper when the movie premiered in 2002, it became a canonical example for the anticipation of future UI five years later, when Apple’s iPhone and its touchscreen was presented eloquently by CEO Steve Jobs in 2007.<sup>22</sup> Hence, it was *ex post* that the full dimension of the original SF vision was realized as a ‘resource.’ Accordingly, in 2010 Underkoffler staged his own presentation of the original (real) prototype of the interface which inspired the (fictional) interface in *Minority Report*. And not surprisingly, he uses it in his later presentation in almost the same way as Tom Cruise’s character uses it previously in the film.<sup>23</sup> Third, in the design of the UI in *Minority Report*, certain functional contexts were deliberately removed, while others were emphasized. Most prominent was the decision to emphasise the enhancement of human inference skills in the famous scenes, where Tom Cruise’s character performs his analytical work.

Diegetic prototypes clearly belong to the future industry. However, as a theo-

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Scientists on the set: Science consultants and the communication of science in visual fiction. *Public understanding of science* 12 (2003): 261–278; David A. Kirby, *Lab coats in Hollywood*.

22 *Minority Report* has been discussed endlessly. On the canonical status of the user interface in *Minority Report* see Shedroff and Noessel, *Make it so*, pp. 95–97. See also Ernst and Schröter, *Media futures*, pp. 86–91.

23 John Underkoffler, *Pointing to the future of UI* | John Underkoffler, <https://www.youtube.com/watch?v=b6YTQJvzwll&t=658s>, access: August 2, 2022, 6:00am.

retical concept, they read like a more precise version the 'experiment' that comes with the methodology of SF prototyping. Using this connection of the notion of diegetic prototypes as a classic *tertium*, it is possible to confront the 'experiment' in SF prototyping on the one hand and with the notion of 'experiment' in media theory. Especially with *Minority Report* as an example, another reading of experimentation and prototyping is possible. The film does not simply show a user interface in action – that is, a whole 'functioning' media scenario – but it does so by using the specific means of the medium 'film.'

## Film as an experimental arrangement

The mediality of film is relevant in the context of SF prototyping insofar as cinematic media always play with temporality or even experiment with temporalities. In the case of *Minority Report* this dimension of the meaning of the movie is part of a depiction and problematization of future forms of predictive technologies. According to a media-philosophic understanding of film developed, among others, by Lorenz Engell one can ask to what extent film does not simply show diegetic prototypes but also experiments with them. In consequence, film *as such* is understood as an 'experimental arrangement.'

The premises of such a media-philosophical reading are well known in German media studies since the late 2000s. Engell's basic idea is to claim, that film is 'thinking.' Not only do viewers ('users') think with the film, but the film thinks with us (or even for itself). Important premises for this assumption can be derived e.g. from Engell's essay *Versuch und Irrtum. Film als experimentelle Anordnung*.<sup>24</sup> The basic idea can be explicated in different ways. What is said in a film follows from systems of rules (codes) which can be changed in the process of technical mediation. If the notion of 'agency' is attributed,<sup>25</sup> then one can state that rules defined by human actors for the medium can themselves be changed or transformed by an 'agency' of the medium in the process of cinematic mediation.

It is possible to back this claim by using an analogy to the history of sciences which Lorenz Engell relies on. In his work on experimental arrangements, Hans-Jörg Rheinberger has stated, referring to François Jacob,<sup>26</sup> that "experimental systems" in the natural sciences are 'machines for the production of the future.' Rheinberger notes:

*As the smallest [...] working units of research,*

24 Lorenz Engell, *Versuch und Irrtum. Film als experimentelle Anordnung. Zeitschrift für Ästhetik und Allgemeine Kunstwissenschaft* 57/2 (2012): 297–306.

25 On the notion of 'agency' from the perspective of German media theory see Berenike Jung, Klaus Sachs-Hombach and Lukas R.A. Wilde (eds.), *Agency postdigital. Verteilte Handlungsmächte in medienwissenschaftlichen Forschungsfeldern* (Cologne 2021).

26 Cf. François Jacob, *The Possible and the Actual* (Seattle, WA 1982).

*experimental systems are set up to give yet unknown answers to questions that the experimenter is likewise not yet in a position to pose clearly. They are 'machine[s] for making futures,' as Jacob once said. Experimental systems are not arrangements for checking and at best for giving answers, but specifically for materializing questions. In an indissoluble entanglement, they bring forth both the material entities and the concepts embodied in them: they 'appear packed together.'*<sup>27</sup>

Relying on Jacques Derrida's philosophy, for Rheinberger an experimental system is not only seen as an arrangement in which different material and sign-like 'orders' are intertwined. The experiment is understood as something which draws its own meaning from an unpredictable future. Not only the meaning of the 'new' object *in* the experiment is defined by its future meaning, but also the meaning of the experiment as an experiment.

Such an understanding of film as an experimental arrangement can be combined with the concept of diegetic prototypes. By referring to media philosophy something that is left out of the concept of diegetic prototypes and hence the notion of the prototype in SF prototyping becomes visible. The 'normalization' which is attributed to blockbusters like *Minority Report* heavily depends on the medium in which the 'prototype' is presented in. The 'prototyping' of future interfaces in movies itself depends on the mediality –

or even 'futurity' – of the medium 'film' as the interface of an experimental arrangement. In addition to a media philosophical perspective, one can say with Richard Grusin that a film like *Minority Report* is part of a media regime in which, through the representation of predictive media technologies as a diegetic object in the medium of film, the "premediation" of the future through media becomes tangible.<sup>28</sup> *Minority Report* in this sense shows more than an interface, it shows its integration into a set of anticipated media practices. However, at the same time there are remarkable gaps between the future user interface displayed in *Minority Report* and the media regime in which it is embedded as a normalized interface in the context of the imagined fictional society and its media.

## AI as a supplement

First and foremost, it is worth noting that the media practices on display in the film have nothing to do with artificial intelligence. The 'processors' and 'algorithms' predicting the future in *Minority Report* are human beings, so called "precogs." The exegesis of their visions is done through the interface in a form of hermetic image analysis. In contrast to the reality of future media that the film oth-

27 My translation, quote taken from Hans-Jörg Rheinberger, *Experimentalsysteme und epistemische Dinge. Eine Geschichte der Proteinsynthese im Reagenzglas* (Göttingen 2001), here p. 22.

28 Cf. Richard A. Grusin, *Premeditation: Affect and mediality after 9/11* (Basingstoke 2010). For a more detailed discussion see Ernst and Schröter, *Media futures*, pp. 49–57.

erwise shows – e.g., advertising, which is highly personalized using biometric technologies – there is nothing to suggest artificial intelligence or otherwise computer-based automatised information processing. The potency for prediction (the 'agency') is in the hands of the users of the interface. According to John Underkoffler, Spielberg simply wanted it that way because it emphasizes human analysis work and his previous film *A.I.* had already dealt with the subject of AI.<sup>29</sup> Yet, this decision is symptomatic. On the one hand the film shows a high-tech, automated surveillance state, on the other hand the process of prediction in the film represents a machine-free scenario described in the film with religious metaphors. How does this play out in light of an expanded notion of film as an experimental arrangement?

One possible answer would be to point at the critique of ideology, deconstruction or related theories. According to such a reading, diegetic prototypes are pragmatic extensions of design processes such as SF prototyping. They do not only show an interface technology, but at the same time generate an imaginary around that interface. In *Minority Report* it is the imaginary that the 'prediction' of

the future consists in the translation of human visions of the so-called precogs into analytical action by Tom Cruise's character. This 'normalization' associated with the notion of diegetic prototypes gives a (completely) false picture of the possibilities of control over the interface. If the absence of a user interface automated by AI is the issue, then this is an absence that is masked relative to the agency associated with the diegetic prototype. The film is, in a way, disguising an AI based control state (by hiding it in the open of various scenes). While human agency is highlighted by using the interface, at the same time, other representations of interfaces in the film are pushed in the 'background'. This is where the industry wants to operate these technologies in the real world as well.<sup>30</sup> In consequence, the diegetic prototype establishes an agency of future prediction tied to the human use of the user interface. However, this context is implicitly transcended and thus the human-centred interface decontextualised. The film addresses what Derrida might have called a suppressed 'supplement:' highly automated processes of predictive analytics and adaptive behaviour of interfaces, which are not exclusively but most of the times based on machine learning and hence AI.

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29 See Underkoffler's various comments on the process of working on *Minority Report* in his talks: Pointing to the future of UI | John Underkoffler (2010), <https://www.youtube.com/watch?v=b6YTQJVzwl&t=658s>, access: August 2, 2022, 6:00am; John Underkoffler (Oblong) | TNW Conference | New UI as professional superpower (2016), <https://www.youtube.com/watch?v=hyNJii14l-Jk&t=142s>, access: August 3, 11:00am; John Underkoffler: Sci-Fi Interface design in the real world (2019). <https://mindandmachine.libsyn.com/34-john-underkoffler-sci-fi-interface-design-in-the-real-world>, access: August 3, 2022, 10:30am.

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30 See the canonical, yet problematic vision of ubiquitous computing Mark Weiser, The computer for the 21st century. *Scientific American* 265/3 (1991): 94–104. For criticism of this concept see Paul Dourish and Genevieve Bell, *Divining a digital future. Mess and mythology in ubiquitous computing* (Cambridge, MA and London 2011).



While not wrong, this ideology critical resp. deconstructive reading doesn't reveal the whole story. A media philosophical interpretation of the film as an experimental system broadens the perspective, especially if one reads the medium film itself as an 'interface' for the anticipation of a future media regime. This interpretation is based on the mentioned above assumption: There is a difference between the 'normalized future of the user interface' in the film (the 'diegetic prototype') in the experiment, and the mediating power of the interface of the film itself as an experimental arrangement.<sup>31</sup> What does this mean for the status of the experiment?

## Revising SF prototyping

Again, I want to point out three implications. The first one is quite trivial, because it only hints at the media technological shift in the wake of recent inventions in machine learning. The supplement of AI in *Minority Report* has always been visible, it has always been 'performed' and subsequently 'predicted' in film. It just hasn't generated and mobilised as much imaginative potential as the famous, human-centred gesture-based interface in the film. This is remarkable because the debate about so-called 'intelligent user

interfaces' is quite old. After the rise of machine learning based on artificial neural networks, the situation is different. AI-based technology is everywhere today, but before the advent of machine learning in media technologies and their interfaces in the mass market it was rather a smaller niche. Second, the relationship between interfaces and experimental arrangements has to be rethought. If one understands an 'interface' with Branden Hookway as a "form of relation," then the interface maintains and monitors a relation between humans and machines and thus enables a transmission or communication.<sup>32</sup> In this regime, the operative process of film is also an interface process; after all, a well-known point in film theory. The insight gained by the connection with the concept of experimental arrangement, however, is that not only the content of an experiment draws its value from the future, but also the experimental arrangement itself. We can not only determine *ex post* the futurity of the prototype but also what was the insight-gaining mechanism of the experimental arrangement itself, or more radically: what the experimental arrangement even was to begin with. This is a point that cannot be underestimated especially in the age of intelligent user interfaces, because 'usability testing' in a weak sense is operationally always the case today.

To put it more precise: The 'experiment' has expanded and mutated into a global

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31 On the notion of film as an interface see Seung-Hoon Jeong, *Cinematic interfaces. Film theory after new media* (New York, NY and London 2013).

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32 Branden Hookway, *Interface* (Cambridge, MA and London 2014), here p. 5.

usability testing case. 'User experience' today becomes almost synonymous with what Apple calls "intelligent systems experience,"<sup>33</sup> as user interface prototyping advances via machine learning and AI into an ongoing process in society. As Jean Baudrillard already pointed out in the late 1980s and early 1990s, social reality has surpassed science fiction in its own futurity.<sup>34</sup> The old notion of 'SF imagination,' underlying concepts like SF prototyping, is no longer suitable to 'imagine' future technological realities.

*[...] simulation simulacra: based on information, the model, cybernetic play. Their aim is maximum operationality, hyperreality, total control. [...] To the third...is there yet an imaginary domain which corresponds to this order? The probable answer is that the 'good old' SF imagination is dead, and that something else is beginning to emerge (and not only in fiction, but also in theory). Both traditional SF and theory are destined to the same fate: flux and imprecision are putting an end to them as specific genres. There is no real and no imaginary except at a certain distance. What happens when this distance, even the one separating the real from the imaginary, begins to disappear and to be absorbed by the model alone?*<sup>35</sup>

One does not have to subscribe to everything Baudrillard claims in his philosophy.<sup>36</sup> Nevertheless, this statement

has a lot to it. Under the condition of what Sascha Dickel has fittingly called "prototyping society,"<sup>37</sup> a different version of SF prototyping should be developed. This understanding of SF prototyping should be rooted not only in a different understanding of what 'science fiction' is in the first place, but in a substantially revised understanding of the material and social conditions which mobilise imaginaries associated with media technologies like future user interfaces.

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33 Apple Developer, Design for Intelligence (June 22, 2020); <https://developer.apple.com/news/?id=mb3c4r4r>, access: August 3, 2022, 10:30am.

34 Jean Baudrillard, Simulacra and Science Fiction. *Science Fiction Studies* 18/3 (1991): 309–313.

35 Ibid., p. 310.

36 Cf. Ernst and Schröter, *Media futures*, pp. 35–40.

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37 Sascha Dickel, *Prototyping Society. Zur vorausselenden Technologisierung der Zukunft* (Bielefeld 2019).

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# CULTURES OF EXPERIMENTATION: TESTING INFRA- STRUCTURES IN THE WEB AND BEYOND

By Timo Kaerlein

*“Testing – and crucially: experimentally intervening by tweaking the environmental settings – becomes a feature of everyday life when people routinely interact with ‘smart’ devices and data-intensive media technologies that capture data about their use for constant interpretation and adaptation.”*

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In the summer of 2020, when individuals and governments all over the world were still coming to terms with what would later turn out to have been the first wave of a global pandemic, the web optimization company Optimizely published an e-book titled *Top COVID-19 Experimentation Ideas*. Targeted at businesses it is aiming “to take the lead in the post-pandemic landscape.”<sup>1</sup> Since “[l]ockdown measures have driven more people online”,<sup>2</sup> Optimizely posits optimistically, the pandemic creates “a once-in-a-lifetime chance for us all to experiment”<sup>3</sup> with changing customer behaviour patterns, new types of users altogether, and a general growth of online communication and consumption. Whereas businesses were still having a hard time figuring out how to adapt to the changing circumstances of digital media use, the authors of the industry guide have a reassuring message for them: “In the middle of all this uncertainty, let’s also remember that there are still certainties around which we can reshape our digital strategies.”<sup>4</sup>

What are these certainties the digital customer experience experts allude to? Leading business consulting firms all agree, or so the authors want their readers to know, that success in the digital economy can be traced back to a single formula: Experimentation. Testing the performance of different versions

of web interfaces against each other on live websites, which might include the tweaking of seemingly insignificant parameters like the precise placement of images and texts or the colour of dialog boxes, has indeed become a standard practice for companies that aim to generate value online. This includes major e-commerce companies, social media platforms, and news websites. To be sure, these practices have not emerged with the pandemic but have been a defining feature of the World Wide Web since the early 2000s. The development of testing infrastructures has gone through a process of professionalisation in the 2010s, with specialised firms employing sophisticated statistical methods and suites of web tools to provide experimentation platforms-as-a-service for web-operating businesses. In today’s web environment, two users of a website will rarely see the exact same version of it but will instead be subjected to a never-ending series of tests, adaptations, and performance measurements. Often the language of usability testing is employed to characterise the practice of confronting controlled user segments with slight variations of a website under live conditions. But it is worth inquiring a little deeper into the epistemology, politics, and ethics of web testing infrastructures, not least in order to be able to comprehend their implications for the world in front of the screen.

To this end, I will begin with giving a brief overview on the recent history, contemporary practice, and knowledge claims of digital experimentation plat-

1 Optimizely, *Top COVID-19 Experimentation Ideas* (2020), p. 3.

2 *Ibid.*, p. 5.

3 *Ibid.*, p. 7.

4 *Ibid.*, p. 4.

forms and testing infrastructures. Having accomplished this, I will then observe a shift in the parameters and subject configurations of these testing regimes that mirrors a broader development in human-computer interaction (HCI) and customer experience design: from cognitive framings of users as goal-oriented rational actors to an understanding of users as suggestible, affect-driven test subjects that can be subtly nudged towards desired action-paths.<sup>5</sup> The conclusion attempts to situate the portrayed development in the light of recent analyses of the ubiquity of testing in computational environments. It also sketches the trajectories of sensor-based testing infrastructures beyond the web.

## A/B testing and beyond: On the prevalence of digital experimentation platforms

A/B testing different versions of web interfaces has become a standard web design practice since the late 1990s – and according to one protagonist, “one of the

most sacred practices in tech.”<sup>6</sup> Big tech companies like Google, Microsoft, Amazon, Facebook, but also more specialised enterprises in the travel and entertainment sector or financial industries engage in “online controlled experimentation”<sup>7</sup> to evaluate the impact of interface design choices on customer behaviour. To this end, live customer traffic is routinely divided into parallel test groups, all the while measuring the impact of different design choices on key-performance indicators (KPIs) like conversion rates or retention times. The overall rationale behind using A/B testing and similar approaches for many companies operating online is an orientation towards data-driven decision-making based on live data from actual user interactions. An “experimentation culture”<sup>8</sup> (as opposed to a mere infrastructure operating in the background) does not only comprise tools and platforms but has quite far-reaching implications for organisational

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6 Alex Weinstein, The dark side of A/B testing. *VentureBeat* (April 13, 2019); <https://venturebeat.com/2019/04/13/the-dark-side-of-a-b-testing/>, access: August 11, 2021, 3:30pm. For a concise overview of the main elements of an A/B testing architecture see Ron Kohavi and Roger Longbotham, Online Controlled Experiments and A/B Testing, in: *Encyclopedia of Machine Learning and Data Mining*, ed. Claude Sammut and Geoffrey I. Webb (New York 2017), pp. 1–8.

7 Aleksander Fabijan, Pavel Dmitriev, Helena Holmstrom Olsson, and Jan Bosch, Online Controlled Experimentation at Scale, in: *Proceedings of the 44th Euromicro Conference on Software Engineering and Advanced Applications* (2018), pp. 68–72.

8 Ya Xu, Nanyu Chen, Adriaan Fernandez, Omar Sinno, and Anmol Bhasin, From Infrastructure to Culture, in: *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, ed. Longbing Cao, Chengqi Zhang, Thorsten Joachims, Geoff Webb, Dragos D. Margineantu, and Graham Williams (New York 2015), pp. 2227–2236, here p. 2227.

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5 Florian Hadler and Daniel Irrgang, Editorial: Navigating the Human. *Interface Critique Journal 2* (2018): 7–16.

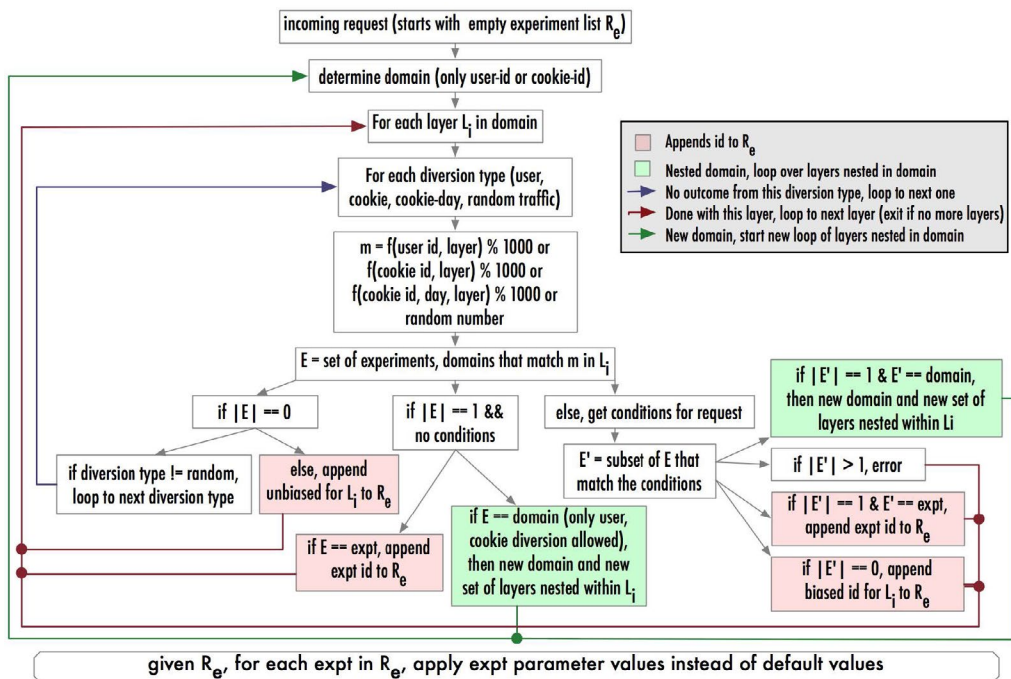


Fig. 1: Logic flow for query requests in Google’s overlapping experiment infrastructure. Source: Tang, Diane, Ashish Agarwal, Deirdre O’Brien, and Mike Meyer, Overlapping Experiment Infrastructure: More, Better, Faster Experimentation, in: *Proceedings of the 16th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (New York: ACM Press, 2010), pp. 17–26, here p. 22.

processes, leadership styles and business strategies. Leading authors in the field of web experimentation posit their approach explicitly against outdated HiPPO-based managerial cultures (the acronym stands for “Highest Paid Person’s Opinion”),<sup>9</sup> championing instead an evidence-based approach that feeds on large amounts of data.

Major companies often develop in-house experimentation platforms to test the performance not only of visual website elements, but also of different ma-

chine learning algorithms like recommendation engines that preselect visible content based on user profiles and preferences. At Google, where “experimentation is practically a mantra,”<sup>10</sup> an overlapping experiment infrastructure has been implemented as early as 2007. The approach builds on already established multi-variate testing schemes that allow for the inclusion of several test factors in parallel,<sup>11</sup> and partitions the various

9 Ron Kohavi, Roger Longbotham, Dan Sommerfield, and Randal M. Henne, Controlled Experiments on the Web. *Data Mining and Knowledge Discovery* 18 (2009): 140–181, here p. 178.

10 Diane Tang, Ashish Agarwal, Deirdre O’Brien, and Mike Meyer, Overlapping Experiment Infrastructure, in: *Proceedings of the 16th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (New York 2010), pp. 17–26, here p. 17.

11 Kohavi et al., Controlled Experiments on the Web, pp. 158–163.



testing dimensions – e.g., user interface changes, algorithmic variations – into layers of subsets that are designed not to interfere with ongoing experiments in other subsets.<sup>12</sup> Its dimensions are staggering (see fig. 1): At any given point in time, several *billion* possible combinations of test factors are presented to various test groups in parallel, all the while keeping the website's basic functions operational.<sup>13</sup> It is self-evident that no human can make sense of the results of such deeply integrated testing architectures, and the designers readily acknowledge that their scope and flexibility is indeed limited by semantic bottlenecks since it's impossible to understand what exactly is being tested in any given configuration.

Due to the increasing complexity of testing infrastructures in the web (and the increasing demand for fast and reliable data), recent years have seen a process of professionalisation with a range of companies entering the market that offer experimentation platforms-as-a-service, also to medium-sized enterprises. These tie in with existing services of web analytics and search engine optimisation, thus allowing businesses to

implement their own individually configured testing architectures. Providers such as Google Optimize, VWO, AB Tasty, and Optimizely develop new statistical methods of continuous monitoring and sequential testing, which make possible, for example, the adjustment of the sample size during a running experiment or the parallel testing of a large number of (computer-generated) hypotheses without the need for human oversight.<sup>14</sup> In web-based experimentation cultures, we can thus observe a *detritorialisation of the experimental situation* as such, which as a distributed process can no longer be clearly localised and progressively coincides with practices of use.

## Who or what is being tested? From usability optimisation to large-scale experiments on users

Not only does the deterritorialisation of the experimental situation refer to the ubiquity of testing practices in web environments (i.e., a matter of scale), but also

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12 Tang et al., *Overlapping Experiment Infrastructure*, pp. 19–21.

13 The paper by Tang et al. doesn't include details on the number of conducted experiments, but Kohavi et al. 2013 report on their work with online based experiments at Microsoft's Bing search engine that references "30 billion possible variants of Bing" in a 2-week testing period. The scale of experimentation at Google is likely to be much higher. See Ron Kohavi, Alex Deng, Brian Frasca, Toby Walker, Ya Xu, Nils Pohlmann, *Online Controlled Experiments at Large Scale*, in: *Proceedings of the 19th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (New York 2013), pp. 1168–1176, here p. 1168.

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14 Leo Pekelis, David Walshy, and Ramesh Johari, *The New Stats Engine* (Optimizely Whitepaper, undated).

to the scope of their declared purposes and test factors. A particularly notorious example is the widely discussed so-called Facebook emotional contagion study: In January 2012, almost 700,000 Facebook users became unwitting participants in a large-scale experiment to determine the effect on user behaviour of a deliberate manipulation of the number of emotionally positive or negative posts in their respective news streams. Scientists from Cornell University and the University of California, as well as members of the Facebook Research Team, published the results in 2014 and stated the existence of an emotional contagion effect: “[The] results indicate that emotions expressed by others on Facebook influence our own emotions, constituting experimental evidence for massive-scale contagion via social networks.”<sup>15</sup> The study quickly sparked controversial discussions because Facebook users did not give informed consent to be included as test subjects, no ethics committee approved its conduct, and risks, such as exposing depressed users to increased negative emotional content, were not considered.<sup>16</sup> Facebook initially maintained that the experiment was essentially nothing more than a usability study, conducted to improve services and provide rele-

vant content to users who had already signed an extensive terms-of-service agreement. The company even went so far as to retroactively update their terms of service to include research as a legitimate scope of internal operations – four months after the controversial experiment had been performed.<sup>17</sup>

The Facebook emotional contagion study has been placed in a direct line of tradition with the Milgram and Stanford Prison psychological experiments, with the crucial difference that the experimental situation of the Facebook case is not framed at all by some laboratory setting but takes place “in the wild” and completely without the knowledge of the participants.<sup>18</sup> While it shares this trait with the majority of experimentation practices in web environments discussed above, it is striking that the purpose of this experiment is decidedly not the improvement of user experiences but the subtle modulation of users’ non-conscious affective orientation. Luke Stark has pointed out how the Facebook emotional contagion study but also the large-scale psychographic data profiling based on Facebook data undertaken by Cambridge Analytica in 2016 are rooted in a longstanding “co-development of the psychological and computational scienc-

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15 Adam D. I. Kramer, Jamie E. Guillory, and Jeffrey T. Hancock, Experimental Evidence of Massive-Scale Emotional Contagion through Social Networks. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* 111 (2014), pp. 8788–8790, here p. 8788.

16 David Shaw, Facebook’s flawed emotion experiment. *Research Ethics* 12/1 (2016): 29–34; Raquel Benbunan-Fich, The ethics of online research with unsuspecting users. *Research Ethics* 13, 3/4 (2017): 200–218.

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17 Alex Hern, Facebook T&Cs introduced ‘research’ policy months after emotion study. *The Guardian* (July 1, 2014); <https://www.theguardian.com/technology/2014/jul/01/facebook-data-policy-research-emotion-study>, access: August 11, 2021, 5:30pm.

18 Timothy Recuber, From obedience to contagion. *Research Ethics* 12/1 (2016): 44–54.

es.”<sup>19</sup> The examples demonstrate how “the clinical psychological subject, a figure amenable to testing and experiment, has been transformed into the scalable subject of social media platforms, structured and categorised by companies like Facebook and universalised as a facet of the lived experience of the digital everyday.”<sup>20</sup> With this shift towards the psychometric profiling and micro-targeting of users for economic but increasingly also for political aims, the experimental culture of large-scale testing infrastructures firmly embedded in today’s online environments has gained a new urgency and is no longer adequately addressed in terms of usability testing and user experience optimisation.<sup>21</sup>

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19 Luke Stark, Algorithmic Psychometrics and the Scalable Subject. *Social Studies of Science* 48/2 (2018): 204–231, here p. 206.

20 Ibid., p. 220f.

21 See Zeynep Tufekci, Engineering the Public. *First Monday* 19/7 (2014) on “real-time, inexpensive and large-scale testing of the effectiveness of persuasion and political communication”, already employed in Obama’s 2007 presidential campaign. A more technically oriented proof-of-concept for psychometric micro-targeting using Facebook data is elaborated in Till Blesik, Matthias Murawski, Murat Vurucu, and Markus Bick, “Applying big data analytics to psychometric micro-targeting”, in: *Machine Learning for Big Data Analysis*, ed. Siddhartha Bhattacharyya, Hrishikesh Bhaumik, Anirban Mukherjee and Sourav De (Berlin, Boston: De Gruyter, 2018), pp. 1–30. It is this journal’s declared intention to study interfaces “beyond UX”, i.e., to inquire about their history, embedded power relations, and cultural significance. Somewhat ironically, it turns out that interface designers are themselves not primarily “interested in the enhancement of usability, in mere ergonomic questions of design and architecture and in the optimization of user orientation or user experience.” (Florian Hadler, Beyond UX. *Interface Critique Journal* 1 (2018): 2–8, here p. 6)

## Ubiquitous testing: Sensor-based experimentation in the wild

Furthermore, and this is the last point I would like to argue, the practice of testing and live experimentation on unsuspecting users is currently being extended beyond the borders of the World Wide Web into (mostly urban) public spaces with the help of environmentally embedded sensor media. In line with established notions of ubiquitous computing,<sup>22</sup> the Internet of Things,<sup>23</sup> and ‘living lab’ approaches in ‘Smart City’ frameworks,<sup>24</sup> public spaces are increasingly interwoven with semi-autonomous, sensor-equipped devices like ‘intelligent’ cameras, motion sensors, autonomous cars, drones, and similar technologies. Noortje Marres and David Stark, who also discuss the example of psychographic profiling based on Facebook data, have drawn attention to the circumstance that the epistemology and practices of testing in online environments ‘spill over’ into the social world at large. They conclude that sociologists need to

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22 Mark Weiser, The Computer for the 21st Century. *Scientific American* 265/3 (1991): 94–104.

23 Florian Sprenger and Christoph Engemann (eds.), *Internet der Dinge* (Bielefeld 2015).

24 Jennifer Gabrys, Programming Environments. *Environment and Planning D* 32 (2014): 30–48.

pay more attention to the ways regimes of testing operate not just *in* but *on* social life, i.e., “[w]hereas we traditionally think about testing taking place *within a setting*, today’s engineers are *testing the settings*.”<sup>25</sup> While in traditional field tests the prior existence of a field is presupposed, the types of technology-intensive testing increasingly encountered today create their own test environments by working through and acting upon social environments. Testing – and crucially: experimentally intervening by tweaking the environmental settings – becomes a feature of everyday life when people routinely interact with ‘smart’ devices and data-intensive media technologies that capture data about their use for constant interpretation and adaptation. It stands to reason that the established cultures of experimentation in web-based environments outlined above act as a model and inspiration for the plethora of practices of testing and live experimentation witnessable in data-infused real-world environments, not the least because many of the major commercial actors are active in both domains. In a 2012 *Wired* article on the state of the art of A/B testing in web design, author Brian Christian speculated on its prospects of being applied to the physical reality outside the web: “Many web workers, having tasted of the A/B apple, can no longer imagine operating in any other environment. Indeed, they begin to look with pity on the offline world, a terrifying

place where each of us possesses only one life to live rather than two (or more) in parallel.”<sup>26</sup> Ten years on, the ubiquity of real-time testing and experimentation in data-saturated environments has become an integral element of digital cultures – and its implications for the conduct of everyday life are just beginning to unravel.

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25 Noortje Marres and David Stark, Put to the Test. *The British Journal of Sociology* 71 (2020): 423–443, here p. 435.

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26 Brian Christian, The A/B Test. *Wired* (April 24, 2012); <https://www.wired.com/2012/04/ff-abtesting/>, access: August 11, 2021, 6:00pm.

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# INTER|FACE EXPERIMENTS: FACEAPP AS EVERYDAY AI

By Sabine Wirth

*“FaceApp presents itself as a second-order experimental arrangement in which the pleasurable practice of experimenting with one’s own appearance, so invitingly provided by the user interface, is used to further develop the underlying surveillance technology.”*

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Since the proliferation of mobile digital cameras and especially smartphones, the variability of the photographic image has become the rule rather than the exception.<sup>1</sup> Popular image editing programs and apps have made the rapid modification of digital images an everyday standard. Their user interfaces provide editing functions to everyday users that were previously only accessible to experts. Specifically for editing facial images, apps such as Snapchat, WhatsApp, Instagram, Facetune, TikTok, and many more offer a whole range of functions that make this variability of the digital image available at the touch of a finger, ranging from humorous masking to photo-realistic facial edits. A new impetus within this culture of everyday photo editing is currently coming from applications that increasingly offer AI-based editing functions for experts as well as non-experts: Apps and programs like Luminar AI, Prisma, Leawo PhotoIns, Lunacy, Topaz, Quik.ai, Claid.ai, or autoRetouch promise AI-based functions such as automatically removing objects in the background, altering the appearance of body parts and faces or applying other major changes that formerly took many editing steps in programs like Photoshop. Another ex-

ample in this row is FaceApp, an app that attracted a lot of attention shortly after its release in 2017. It will serve as the main example here because it demonstrates how AI-based image and video editing functions are implemented into everyday 'consumer software,' making machine learning technologies available for non-expert users within the specific framework of what Pold and Andersen call a "controlled consumption culture."<sup>2</sup> FaceApp's success was accompanied by a broader privacy controversy that points to the general entanglement of everyday interface culture and the current popularization of AI technologies, which allows us to critically discuss app user interfaces as experimental arrangements between everyday life and "surveillance capitalism."<sup>3</sup>

## More than filters: FaceApp as "predictive technology"

Released in 2017 by the Russian startup Wireless Lab (now renamed FaceApp Technology Limited), the image and vid-

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1 Shanks and Svabo for instance describe this development as a shift from the single image to photography as a mode of engagement, see Michael Shanks and Connie Svabo, *Mobile-Media Photography: New Modes of Engagement*, in: *Digital Snaps: The New Face of Photography*, ed. Jonas Larsen and Mette Sandbye (London 2014), pp. 229–231. Martin Hand highlights variability (as well as manipulation and ephemerality) as central categories of the materiality of digital images and the practices connected to them, see Martin Hand, *Ubiquitous Photography* (Cambridge, MA 2012), p. 59.

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2 Søren Bro Pold and Christian Ulrik Andersen, *Controlled Consumption Culture: When Digital Culture Becomes Software Business*, in: *The Imaginary App*, ed. Paul D. Miller and Svitlana Matviyenko (Cambridge, MA 2014), pp. 17–33.

3 See Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York 2019).



eo editing app FaceApp allows users to perform a range of elaborate photo and video edits such as aging or rejuvenating faces, morphing two faces together, adding complex facial expressions such as smiles, or applying the controversial “gender swap” feature. In journalistic reviews FaceApp features were mainly celebrated for their supposedly realistic results – an aesthetic also referred to as a “somewhat creepy level of realism.”<sup>4</sup> With 16.8 million downloads in the Google Play Store (Android) and 7.3 million downloads via the Apple App Store (iOS), the app experienced a second major download wave in July 2019, which at times made FaceApp number one in the app download charts.<sup>5</sup> FaceApp presents itself as an everyday AI product that offers elaborate computer vision and machine learning technologies to everyday users and is designed to deliver fast but high-quality results: „No more hours spent on photoshop“<sup>6</sup> – as the developer website advertises.

After installing FaceApp on a smartphone, the user has the option to upload photos from the phone’s photo library, take selfies directly with the app, use images from the Internet (e.g., of public figures) or selected demo images as templates to test and play with the available

image editing functions. Most of the features offered are related to specific and small-scale modifications of the face’s appearance (such as changes to eyes, nose, lips, cheeks, face shape, hairstyle, hair colors, skin shades, etc.) or applying different makeup styles. Similar to other popular photo editing apps, a whole range of manually controllable photo edits (regarding brightness, contrast, saturation, etc.) or features like changing the background, adding certain effects, and image cropping options are also offered alongside. While the first mentioned functions mostly focus on smaller changes to the facial image, the editing functions FaceApp became famous for cause more fundamental transformations of the source image: These include the “old” and “young” edits, the “gender swap” function, or the morphings offered under the “face swap” label which superimposes the image information of two faces and uses transitions to merge them into a new face (see fig. 1).

Although the user interface suggests similar functionality to popular photo filters or filter presets by making editing available quickly and easily at the tap of a finger, the FaceApp features apply deep AI-based modifications to the photographic source image. Therefore, the term filter no longer seems appropriate here.<sup>7</sup> As Yaroslav Goncharov, founder and CEO of FaceApp Technology Limited, told TechCrunch.com in 2017, Face-

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4 Devin Pickell, What Is FaceApp? The Technology Behind this AI-Enabled Mobile App. *G2 Learn Hub* (July 17, 2019), <https://learn.g2.com/faceapp>, access: September 3, 2022.

5 See Matthias Brandt, FaceApp trendet wieder. *Statista* (22.07.2019), <https://de.statista.com/infografik/18734/downloads-der-faceapp-weltweit/>, access: October 3, 2022.

6 FaceApp, <https://www.faceapp.com/>, access: August 25, 2022, 10:00am.

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7 See Ulrike Bergermann, Shirley and Frida. Filters, Racism, and Artificial Intelligence, in: *Filters + Frames: Developing Meaning in Photography and Beyond*, ed. Katja Böhlau and Elisabeth Pichler (Weimar 2019), pp. 47–63, here p. 56.

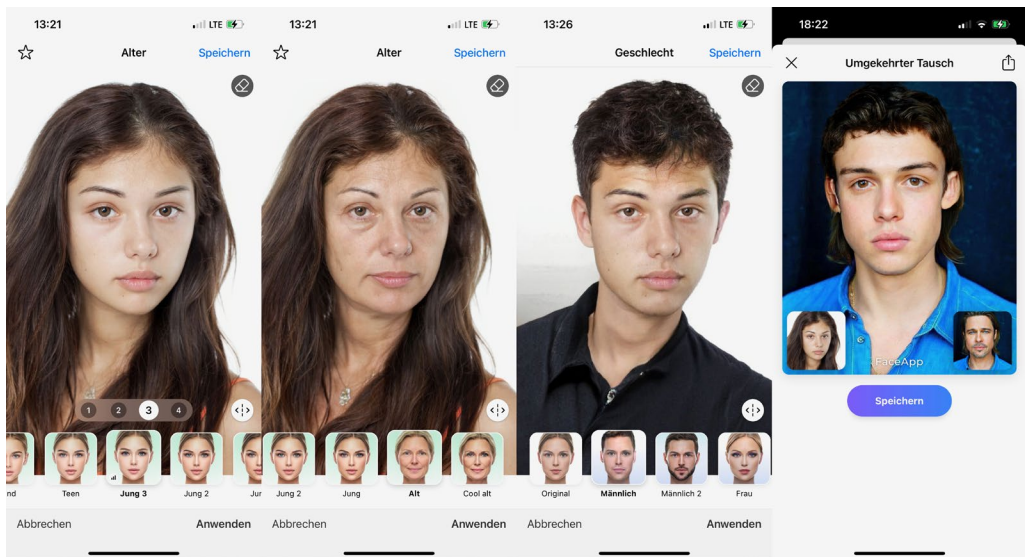


Fig. 1: FaceApp features “young,” “old,” “male,” and “face swap/morphing” applied to a demo image offered in the app user interface. Source: FaceApp, Version 10.4.4 (40730) installed on iPhone 13/iOS 15.4. Screenshots by S.W., August 5, 2022

App uses machine learning techniques, more specifically “deep generative convolutional neural networks,”<sup>8</sup> to process users’ selfies and portrait images. Although the functionality of FaceApp is not fully disclosed by the developers, based on Goncharov’s statements, some aspects of the machine learning methods used for the functionality of FaceApp can be highlighted. As Andreas Sudman summarizes, the term Machine Learning (ML) is used as an umbrella term for various algorithms that extract statistical patterns from complex data to predict a result  $y$  for an input  $x$  without being ex-

PLICITLY programmed for this task.<sup>9</sup> Deep Learning is a subfield of ML in which Artificial Neural Networks (ANNs) are often (but not exclusively) used and which process information through a network structure of interconnected artificial neurons that are organized in various layers. This architecture allows the ANN to achieve a defined learning goal quasi automatically by successively optimizing itself with the help of a learning algorithm called “backpropagation.”<sup>10</sup> Convolutional Neural Networks (CNNs), which FaceApp uses according to Goncharov, are specialized ANNs targeted at data with a grid-like topology like image data

8 Natasha Lomas, FaceApp Uses Neural Networks for Photorealistic Selfie Tweaks. *TechCrunch* (February 8, 2017), <https://techcrunch.com/2017/02/08/faceapp-uses-neural-networks-for-photorealistic-selfie-tweaks/>, access: August 5, 2022.

9 See Andreas Sudmann, The Democratization of Artificial Intelligence. Net Politics in the Era of Learning Algorithms, in: *The Democratization of Artificial Intelligence: Net Politics in the Era of Learning Algorithms*, ed. Andreas Sudmann (Bielefeld 2020), p. 12.

10 Ibid.

processed as a 2D grid of pixels.<sup>11</sup> CNNs prove to be particularly efficient in extracting crucial image features and are therefore able to significantly reduce the memory requirements for the model.<sup>12</sup> To understand in basic terms how CNNs work and how they deal with images, the main steps of the learning process should be briefly highlighted:

*A labeled input, an image, for instance, is passed through the interconnected layers of the network, until it reaches an output layer where a prediction regarding the input image is made, depending on the task set for the system. Such a task could be to classify an image according to certain categories, find the boundaries of an object in an image, or other problems from computer vision. An evaluation function (called 'loss function' in machine learning) then measures how far off the prediction of the system is. This information 'flows back' through the network, and all its internal connections are adjusted accordingly.<sup>13</sup>*

In this sense, FaceApp's image processing functions are much more than image filters that merely modify pixel values. Each image is translated into a multidimensional vector in the first step and potentially becomes the basis of an

adaptation – a redistribution of weights of the different neurons within the network.<sup>14</sup> When applying the FaceApp image processing functions, the CNN transfers specific features to the respective portrait image or selfie that have previously been extracted from the training data set. The applied image recognition methods enable an exact application of the automated feature modifications, which in the result achieve the already mentioned photo-realistic effects. This way, FaceApp manages to retain certain individuality markers of the respective face, although the image is otherwise fundamentally changed.<sup>15</sup> For users, this creates the illusion of an aged or rejuvenated version of their personal faces.

FaceApp participates in the general promise of AI technologies to make things predictable.<sup>16</sup> Prognostics forms a central element of ANNs, since it is always a matter of predicting an outcome for a newly inserted value – one that is not already part of the training dataset. In the form of “predictive analysis,” AI technologies currently present themselves in many areas of professional and private life as a future medium or medium of the future, in that they present the future as a computational and techno-economic

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11 See Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning* (Cambridge, MA 2016), p. 317. In 2012, the Large Scale Visual Recognition Challenge (LSVRC), organized annually by the image database project ImageNet, was won for the first time by a CNN, which was able to reduce the previous error rate from 26.1 to 15.3 percentage points. Since then, CNNs have become 'state of the art' in the field of AI-based image recognition. See *ibid.*, pp. 23–24.

12 *Ibid.*, p. 322.

13 Fabian Offert and Peter Bell, Perceptual Bias and Technical Metapictures: Critical Machine Vision as a Humanities Challenge. *AI & Society* 36 (2021): 1133–1144, here pp. 1134–1135.

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14 See *ibid.*, p. 1135.

15 See Debojyoti Chakraborty, In Depth of Faceapp. *Medium* (April 16, 2020), <https://medium.com/analytics-vidhya/in-depth-of-face-app-a08be9fe86f6>, access: August 5, 2022.

16 See Andreas Sudmann, On the Media-Political Dimension of Artificial Intelligence: Deep Learning as a Black Box and OpenAI. *Digital Culture & Society* 4/1 (2018): 181–200, here p. 193.

regime.<sup>17</sup> FaceApp's so-called "aging"-feature can be read as a popularized condensation of this prognostic promise. In fact, it can be said that all of FaceApp's AI-based image processing functions adhere to this prognostic paradigm by generating potential facial images that are aesthetically possible or acceptable in certain respects (e.g., by satisfying the requirement of photo-realism). Through the resulting image, these AI-based predictions receive a materialization, which in turn can become a template for further image or body practices.

On second glance, the fundamental future-orientedness of ML methods reveals a paradoxical constellation: The potential facial images produced by FaceApp are based on the CNN's prior evaluation of large training datasets in which it extrapolates what "old," "young," "male," "female," or "smiling faces" are most likely to look like. In doing so, CNNs do not learn exact patterns but rather the statistical distribution of these patterns.<sup>18</sup> Image generation using FaceApp functions therefore involves a complex interweaving of different temporal levels: the past acquisition of the faces of the training dataset according to probability values, the instantaneity of image creation and editing "with just one tap," and the future-oriented optimization logic of the ANN, in which each newly injected case can potentially contribute to an ad-

aptation of the decision-making process (learning phase) or can subsequently become data material for the future expansion of training datasets.

## Everyday AI: Popular user interfaces as experimental arrangements

FaceApp can serve as an example of how everyday interface cultures are currently being intertwined with AI technologies. The app provides a user interface that ensures easy access to ML-based image processing and encourages playful interaction. It links ML-based methods with everyday practices and at the same time becomes a nexus for comprehensive data practices. The intertwining of "intimate interface[s]"<sup>19</sup> and extremely regulatory mechanisms that turn personal data into currencies can be singled out as a typical feature of the current "controlled consumption culture,"<sup>20</sup> according to Pold and Andersen. One can easily ask if FaceApp also follows the goal "to turn cultural software into the perfect consumer object and use it as bait for increasing control and surveillance."<sup>21</sup> So

17 Christoph Ernst and Jens Schröter, *Zukünftige Medien. Eine Einführung* (Wiesbaden 2020), p. 89.

18 See Matteo Pasquinelli and Vladan Joler, *The Nooscape Manifested: AI as Instrument of Knowledge Extractivism*. *AI & Society* 36 (2021): 1263–1280, here p.1268.

19 Pold and Andersen, *Controlled Consumption Culture*, p. 31.

20 Ibid.

21 Ibid.

what is the price for the easy availability of 'smart' photo editing? Not long after the second major download wave in 2019, privacy concerns about FaceApp were raised. As Forbes Magazine reports, there was even an official warning from the US Federal Bureau of Investigation (FBI) regarding the app which was assessed as a potential spying tool.<sup>22</sup> On the one hand, it was suspected that the facial images are not processed on the end-user devices due to the required computing power of the AI features, but rather copied and uploaded to the cloud of the provider without users being explicitly informed about it. Concerns were also raised that the iOS app would access the smartphone's photo library even if users had not enabled access and that it could access other images unnoticed. It was also feared that the algorithmically captured facial images and the associated personal data would be transferred to Russian servers, but founder Yaroslav Goncharov denied this in an interview.<sup>23</sup> These privacy issues could be discussed just as much with regard to other platforms like Instagram or Facebook. In the case of FaceApp, these questions took on a particularly explosive nature because, first, it is a Russian provider and, second, it involves facial images that are cap-

tured biometrically *en masse* and fed into databases and artificial neural networks. Moreover, it is reasonable to assume that the images processed by FaceApp are most likely used to further train the underlying ANNs or to expand training databases. Thus, FaceApp presents itself as a second-order experimental arrangement in which the pleasurable practice of experimenting with one's own appearance, so invitingly provided by the user interface, is used to further develop the underlying surveillance technology.

As the FaceApp example illustrates, the automated recognition and processing of faces or facial images is not only used on a large scale in the context of surveillance and security technologies. ML methods and computer vision also play an increasingly significant role in commercial software applications. Automated face and object recognition or facial expression analysis are already implemented by default in many social media platforms such as Facebook, TikTok, Instagram, Snapchat, Tinder or in photo sharing, photo organizing, and photo editing applications of popular operating systems for smartphones, tablets, or laptops.<sup>24</sup> Machine learning and especially deep learning are proving to be enormously profitable for companies such as Google, Microsoft, Meta, IBM, Baidu, Apple, Adobe, Netflix, NVIDIA, and NEC, which manage large amounts of data and whose business model is based

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22 See Kate O'Flaherty, The FBI Investigated FaceApp. Here's What It Found. *Forbes* (December 3, 2019), <https://www.forbes.com/sites/kateoflahertyuk/2019/12/03/fbi-face-app-investigation-confirms-threat-from-apps-developed-in-russia/#36a8671745bc>, access: August 5, 2022.

23 See Natasha Lomas, FaceApp Responds to Privacy Concerns. *TechCrunch* (July 17, 2017), <https://techcrunch.com/2019/07/17/faceapp-responds-to-privacy-concerns/>, access: August 5, 2022.

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24 See Taina Bucher, Facing AI: Conceptualizing 'FAIce Communication' as the Modus Operandi of Facial Recognition Systems. *Media, Culture & Society* 44/4 (2022): 638–654, here p. 643.

on predicting user behavior and preferences.<sup>25</sup> This most recent stage in the development of digital media cultures is defined by the automated computer-based analysis of all online content and has been referred to with terms such as big data, information retrieval, data science, data mining, data extractivism – or more general: media analytics.<sup>26</sup> In addition to data collection and analysis, identification and authentication, ML-based technologies are increasingly taking over aesthetic decisions in the age of media analytics, as Lev Manovich highlights:

*AI plays a crucial role in this new global cultural ecosystem, suggesting to people whom to follow and what to see, helping them edit media they create, making aesthetic decisions for them, determining how many people will see their content, deciding which ads will be shown to them, etc.*<sup>27</sup>

This raises the prospect of a future media environment in which texts, images, video or audio content, as well as social interactions such as comments, chats, likes, or re-posts are increasingly (co-) generated by non-human generative processes. App and platform economies, exemplified here by FaceApp, intertwine media analytics and data extractivism with the generative dimension of ML processes. Their user interfaces thereby

function as popular media within which these different forms of agency are entangled without being fully transparent about their scope and aim. The playful affordance of trying things out (like applying FaceApp editing functions to one's selfie) constitutes an everyday experimental arrangement in which the effective variability of the digital image (and its practices) can be celebrated. Drawing on the idea of mobile photography as "a mode of engagement,"<sup>28</sup> the user interface can be understood as the audio-visual formation that triggers this engagement. Together with this first order experimental arrangement a second order experimental arrangement comes into play: Everyday user interfaces such as FaceApp become the gateway for higher-level data practices – such as the project of automated capture and readability of human faces<sup>29</sup> or the further development of ML algorithms. Within the history of visual media and especially photography this shift towards automation marks a decisive turning point and has been addressed with terms such as "ubiquitous photography,"<sup>30</sup> "smart pho-

25 See Goodfellow, Bengio, and Courville, *Deep Learning*, p. 25.

26 See Lev Manovich, Media Analytics & Gegenwartskultur, in: *Machine Learning: Medien, Infrastrukturen und Technologien der Künstlichen Intelligenz*, ed. Christoph Engemann and Andreas Sudmann (Bielefeld 2018), pp. 269–288, here p. 269.

27 Lev Manovich, *AI Aesthetics* (Moscow 2019), p. 37.

28 Shanks and Svabo, *Mobile-Media Photography*, p. 236.

29 The project of making human faces automatically readable refers to a long continuity in media history. The first attempts to generalize image capture and reading, to standardize image formats and, in particular, to evaluate facial images *en masse* can be identified as early as the end of the 18<sup>th</sup> century; see Roland Meyer, *Operative Porträts. Eine Bildgeschichte der Identifizierbarkeit von Lavater bis Facebook* (Konstanz 2019), p. 33 and pp. 39–41.

30 Hand, *Ubiquitous Photography*; as well as Arild Fetveit, The Ubiquity of Photography, in: *Throughout. Art and Culture Emerging with Ubiquitous Computing*, ed. Ulrik Ekman (Cambridge, MA 2013), pp. 89–102.

tography,<sup>31</sup> or “computational photography.”<sup>32</sup> As scholars like Sarah Kember have highlighted, it is especially within vernacular culture that it becomes evident that the current history of photography is rewritten by „technoscience industries.”<sup>33</sup>

## Conclusion

As the short discussion of FaceApp as “everyday AI” has shown, popular smartphone applications and their user interfaces can be seen as experimental arrangements in more than one way. For contemporary visual culture, the commercialization of AI technologies and their entanglement with pleasurable interface practices opens a new historical stage in which ML processes are used not only to evaluate but increasingly to generate content, thus taking on autonomous aesthetic and curatorial agency. Apps like FaceApp are by no means free spaces of play and pleasure. The seemingly joyful practice of using FaceApp functions to manipulate selfies and portraits is always connected to excessive data practices that remain opaque for most users. In this respect, FaceApp’s interface can be described in Galloway’s sense as thresholds that make certain

functionalities accessible and trigger material transformations, but at the same time are always an effect of superordinate power contexts that directs their functioning.<sup>34</sup> By creating “predictive images” that seek to deliver on the prognostic promise of ML applications, FaceApp simultaneously participates in the economic regime of “knowledge extractivism.”<sup>35</sup> In recent years, it has become increasingly clear that algorithms and machine learning methods are not neutral or supposedly ‘objective’ technologies (if there is any such thing to start with), but can lead to serious errors and biases that have social and political implications.<sup>36</sup> It therefore remains to be asked what normative impact apps like FaceApp have in digital image cultures and how their readymade editing functions yield an algorithmized aesthetics that gives new scope to various forms of discrimination.

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31 Sarah Kember, *Face Recognition and the Emergence of Smart Photography*. *Journal of Visual Culture* 13/2 (2014): 182–199.

32 Sy Taffel, *Google’s Lens: Computational Photography and Platform Capitalism*. *Media, Culture & Society* 43/2 (2020): 237–255.

33 Kember, *Face Recognition and the Emergence of Smart Photography*, p. 184.

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34 See Alexander R. Galloway, *The Interface Effect* (Cambridge 2012), p. vii.

35 Pasquinelli and Joler, *The Nooscope Manifested*, p. 1266.

36 See *ibid.*, p. 1264. For the justified demand for an ethics of artificial intelligence see Rainer Mühlhoff, *Automatisierte Ungleichheit: Ethik der Künstlichen Intelligenz in der biopolitischen Wende des Digitalen Kapitalismus*. *Deutsche Zeitschrift für Philosophie* 68/6 (2020): 867–890.

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<b>CHRISTOPH ERNST &amp; DANIEL IRRGANG</b> EDITORIAL: DIAGRAMMATIC OPERATIONS	7
<b>JOHANNA DRUCKER</b> DIAGRAMMATIC INTERFACE	17
<b>JAN DISTELMEYER</b> WHICH OPERATIVITY? ON POLITICAL ASPECTS OF OPERATIONAL IMAGES AND SOUNDS	23
<b>KIM FREDERIC ALBRECHT</b> POST_NETWORK	35
<b>NINA FRANZ</b> TACTILITY, SOUND AND DIAGRAMMATICS. ULTRA- SOUND IMAGING AS AN INTERFACE TO THE WOMB	43
<b>ALEKSANDRA DOMANOVIĆ</b> DUPLEXES	51
<b>VILÉM FLUSSER</b> TOWARD A MAP OF THE BODY	69
<b>HANA YOO</b> SPLENDOUR IN THE GRASS	83
<b>DANIELA WENTZ</b> THROUGH THE AUTISM GLASS. BEHAVIOURIST INTERFACES AND THE (INTER)ACTION ORDER	87
<b>JONATHAN ZONG</b> POINTING, MUTUAL INTELLIGIBILITY, AND THE SEEING SUBJECT IN HCI	95
<b>DORA ĐURKESAC</b> SEA SOMA	107
<b>MARIA KNILLI, WITH LENA KNILLI (HEAR)</b> RADIO IN MIND – A CONVERSATION WITH FRIEDRICH KNILLI	117
<b>SPECIAL SECTION</b> INTERFACES AS EXPERIMENTAL ARRANGEMENTS	133
<b>CHRISTOPH ERNST</b> DECONTEXTUALISING ‘SCIENCE FICTION PROTOTYPING’	137
<b>TIMO KAERLEIN</b> CULTURES OF EXPERIMENTATION: TESTING INFRA- STRUCTURES IN THE WEB AND BEYOND	149
<b>SABINE WIRTH</b> INTER FACE EXPERIMENTS: FACEAPP AS EVERYDAY AI	159

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