Unmaking: Against General Applicability

Critical Media Lab (Merle Ibach, Michaela Büsse, Felix Gerloff, Viktor Bedö, Shintaro Miyazaki & Jamie Allen)

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As belief in the applicability and efficacy of DIY production, open-source, and method sharing has broadened to include institutional hackathons and open-data-fueled and civic 'maker weekends', taking stock and articulating how certain approaches 'work' or 'do not work' within maker culture – and for progressive and expansive creator cultures more generally – continues to be essential. 'Making' is a key concept that frames a host of more specific practices, lending characteristic manual/moral, communal/communicational, aesthetic/ethical, and enacted/economic inflections and values. Even simple historical, traditional, technological, or digital acts of object and media creation, of art and design, but also of writing and thinking itself, can be recast as 'making'. What is it that happens to the thinking and doing of such activities, when such recasting is desired, chosen, projected, enforced, or assumed?

The use of, and reflection on, means of production and the shaping of materialities ignites potentials for understandings that are as fundamental and intrinsic as they are 'disruptive' and incisive to contemporary economies and assumptions of industrial societies. A fundamental difficulty arises through genealogies of making, as scenes, cultures, and epistemological framings, when such techniques become homogenized, universalized, and devoid of the specificity, situatedness, and necessarily tactical improvisations through which they needfully emerge. In the writings that follow, our contribution takes up both practical and theoretical considerations of critical making, and the always ambiguous and reactive stances for and against 'making' as a cultural lens, valuation, and rubric.

The specificity of diverse practices crumbles the edifice of 'making'. By recognizing the heterogeneity of *relations to* making, we are against its general applicability as concept, motivation, approach, and toolset. In these writings, we attempt means of breaking open 'making'. We recognize 'making' as a neoliberal, modernist shibboleth – even if, as a concept and motivation, it is still usefully distinct from centrally, mass-industrialist and productivist motivations, activities, and economics. Often a justificatory excuse that converts 'unnecessary' action into something necessary, that turns profligate endeavors into reasonable activities, it is the rhetorical edifice of 'making' itself that needs to be unconstructed, to be unmade. This process is necessary to determine which aspects of making and maker culture to keep, which we should just ignore, and which we should throw away. 'Unmaking' is a broad, reflexive, and critical framing that emphasizes the always ambiguous character of making, reversing operations that aren't always in themselves truly emancipatory or progressive, and providing mirror-reflections for design, art, and other undisciplined creation, when it is framed as 'making'.

We juxtapose four very different but resonant contexts, shorter explorations related to research currently under way at Critical Media Lab Basel.[1] We address these through different scales,

1 In a workshop devised for Transmediale 2016, a team comprised of members of the Critical Media Lab Basel and collaborators problematized making in terms of five anxieties relating to *community,*

layers, and levels of materiality, beginning with additive design. This is complemented by discussions of the micro-level of our built, designed, and made environments through work on the materiality of sand and collaboratively made open source softwares and digital environments. Reflections on the epistemological dynamics of making and thinking-making follow. What kind of tradeoffs are made between the agility and transferability of practices, gained through systemic abstraction and generalization, and the material and bodily engagements and efficacies of individualized making? Idiosyncratic, individual explorations highlight how making (and unmaking) are not *one thing* but specific orientations that arise in practice, in materiality.

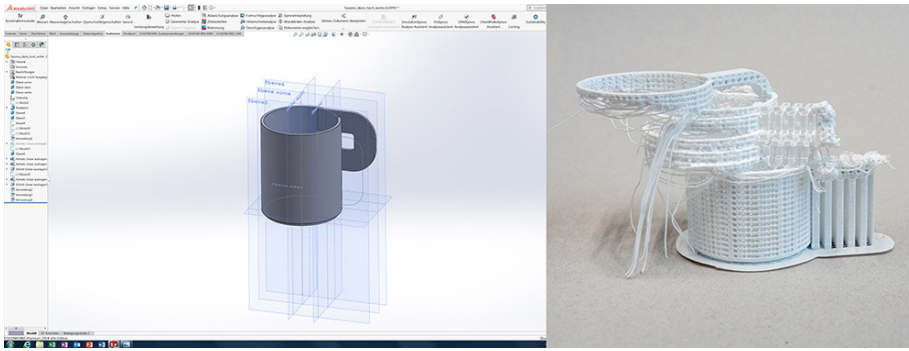

Fig. 1. Merle Ibach, virtual display of cup design and its 3D printed result, 2019.

Additive Design

3D printing is seen as an alternative to industrial manufacturing. It is a technique and technology charged with designerly as well as political promise. The potential for participation in, and democratization of, manufacturing processes, as well as a return of offshored production back to local communities and the unboxing of global supply-chains are amongst these promises.[2] Through innovation-driven experiments, technophilic supporters – from the amateurism of 'maker space' culture to engineering in the building sector, biotechnology, or aerospace industries – have projected practical, economic, and idealistic legitimacy onto 3D printing. Yet, the most common use of thermoplastic print technologies arises in prototyping practices, primarily in the Do-It-Yourself sector, an area which is neither industry oriented nor purely craft-based,[3] and develops little of the projected promise of maker-marketing characterizations. Even as 3D printing is poised to transform some design and manufacturing processes, perhaps even

responsibility, effectiveness, authenticity, and *kit-ification*. Questions raised included: is your experience of making sincere, legitimate, and genuine? How does making increase or reduce proximities, collectivities, autonomies, sufficiencies, and dependencies? How can we think 'outside the box' when everything comes in a box? Does making (need to) make a difference? Does making give us abilities to respond politically, ecologically, or economically?

2 Jesse Adams Stein, 'The Political Imaginaries of 3D Printing: Prompting Mainstream Awareness of Design and Making', *Design and Culture*, 9:1 (2017): p. 20.

3 Umweltbundesamt (ed.), *Die Zukunft im Blick: 3D-Druck: Trendbericht zur Abschätzung der Umweltwirkungen*, Dessau-Roßlau: Umweltbundesamt, 2018, p. 19. https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/fachbroschuere_3d_barrierefrei_180619.pdf.

fundamentally, the majority of produced artifacts are copies of existing objects. These copies no doubt reflect even more fundamental traditional social configurations, and will do so for the foreseeable and prolonged future. Very popular items of everyday use like vases, cups, simple mechanical parts, connectors, adapters, or decorative artifacts, are locked-in designs that originate under conditions of industrial fabrication, and are therefore unlikely to be manufactured in truly radically new ways. Additive manufacturing is explicitly defined by Jesse A. Stein as: '[...] part of a system of technologies that also encompass digital design (e.g. CAD files), feedstock (materials required to print matter, e.g. plastic spools), and associated digital and physical infrastructure (e.g. the internet, hardware, energy, space)'.[4] Additive manufacturing does not only mean the addition of layers of material onto a carrier plate: design education, designers, design tools, and material resources necessarily complete their qualities in a reciprocal symbiosis. It is a globally networked community, comprising the knowledge and practice of 3D printing, that embed themselves in and inform 3D additive manufactured designs, creating further layers of remixed, transcultural knowledge. Thought of as a *media* technology, 3D printing operations don't merely lead to new or alternative representations, but to fundamentally different design methods and experiences of design and making processes.

Critical Media Lab's Merle Ibach (Junior PhD Researcher) explores additive design processes and their ways of becoming. Merle's practice-based research explores two perspectives of additive manufacturing and 3D printing. On one hand, there are individual aesthetic expectations associated with 'virtual qualities' prior to manufacturing. 'Mathematical pureness' and independence from statistical variation and morphology are given by software paradigms and built-in settings. These are projected and infused when a physical model is made 'inside a computer' and then additively produced in the world. Ibach understands that growing up and living with ergonomic, standardized, mass-produced, industrial products creates tendencies for aesthetic homogeneity. On the other hand, there are aesthetic qualities that emerge within the sociotechnical negotiation of particular tendencies and interests across the spectrum suggested by actors like designers, CAD software, STL-files (a file format for unstructured polygon surfaces), ABS-Filament (the synthetic material, derived from petrochemical mineral oil), and 3D printers themselves. What Isabelle Stengers, a philosopher of science, has called 'reciprocal capture'[5] also describes a dual process of co-invention between a designer, a maker, and their tools. However, while imagined as being deterministic, computational scripts, additive manufacturing, and digital design are reciprocal processes that are never fully duplicated. The complexity of a first prototype, devised by one person alone, is manifested through a host of systemic translations and technological transformations.

'In the computer', within CAD software, wireframe models are constructed that do not directly link form, geometry, and materiality as it will manifest 'outside the computer'. Instead, these links are purely mediated. Exported as a STL-file, the dimension-driven

4 Stein, 'The Political Imaginaries of 3D Printing', p. 7.

5 Isabelle Stengers, *Cosmopolitics I: The Science Wars*, trans. Robert Bononno, Minneapolis: University of Minnesota Press, 2010, p. 36.

geometry of the vector-based model is algorithmically translated into surface polygons. This transformation, amongst other changes, creates flattened, fractured elements from curved and rounded surfaces. Elements can become grossly distorted in relation to the chosen degree of approximation (e.g. size and density of polygons). The STL file format often causes further syntax errors such as the doubling of object facets, gaps between them, or incorrect assignment of their orientations. The file is then translated by a 3D-printer software, into *g-code*. By slicing the model into layers, g-code contains data and instructions with parameters like speed, XYZ-coordinates, and material feeder movement, that later direct the stepper motors that move the print head. Through a nozzle as small as 0.25 millimeters, heated up plastic filament is applied to the build plate. In the process – imagined as a trajectory from imaginary representation toward physical manifestation – an in-computer model is filtered into simple geometrical shapes, reduced to polygon surfaces, sliced into layers, cut into short commands, and then finally reconstituted by hot, fluid plastic with a shrinkage rate of around 1%.

During preliminary design processes, relations are formed and values negotiated whose persistence are just as transient as they are 'rapid'. Whether printing a rare, mechanical connection, a complex, lightweight structure, a residential house, or an artificial coral reef, 3D printing embodies a promise – that at the end of every idealized design process there could, or should, be a 'Print' button. Even if every application, in practice, actually depends on another technology, all these applications are united in their basic operations. Controlled by software, a printer applies material, layer by layer, onto a substrate, and things appear. Particularly in prototyping operations, which is the iterative designing of possible 'solutions', thermoplastic print technologies accelerate the development process from first draft to a final (often commercial) product. *Media* materiality, as John Durham Peters points out, provides more than just organizational structures.[6] It shifts the paradigms of making, from ideation to design onward. Software is also continuously updated, so its experience underlies a constant relearning and refining. Virtual design environments are workspaces of endless iterations, of unhampered addition, removal, multiplication, and scaling. Due to automated production, design through additive manufacturing seems to us only determined by formal, aesthetic questions.

According to a report of the German Federal Environmental Agency, the overproduction and defective production of 'more or less value-free items' tends towards the creation of increased environmental pollution for humans and the environment.[7] A good deal of particulate matter is produced during additive manufacturing. Other issues include the toxicity of the materials that are used for the filaments and their lack of recyclability. Even the biodegradable plastic polylactide (PLA) that is often used as alternative to petroleum-based plastics like ABS can only be composted through special industrial procedures. Furthermore, the printers have high power consumption in proportion to their modest outcome of individual pieces. So far, 3D printing in total has a marginal impact

6 John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media*, Chicago: University of Chicago Press, 2016.

7 Umweltbundesamt (ed.), *Die Zukunft im Blick: 3D-Druck*, p. 35.

on the environment when compared to industrial manufacturing.[8] But extrapolating its effects onto a larger scale points to additive manufacturing as a potential harbinger of a parallel ecological disaster.

3D printing is both a technology and a socio-ecological concept. Through the principles of 3D printing, distinctions between designer, manufacturer, distributor, and consumer become reconfigured and realigned.[9] The implicit regime programmed into additive manufacturing eradicates the materiality of an object during its design process. 'Making' here – marketers suppose – somehow loses its weight, its perfidy, its resistance. The material aspects of 3D printing are left in the background, shifting attention away from the material resources and chains of technical know-how and instrumentation required. In this imaginary of 'making', things can be fabricated from any sort of material, any sort of synthetic structure. The design ecosystem, simultaneously dematerialized and rematerialized, provokes changes and transfigurations to global ecosystems.

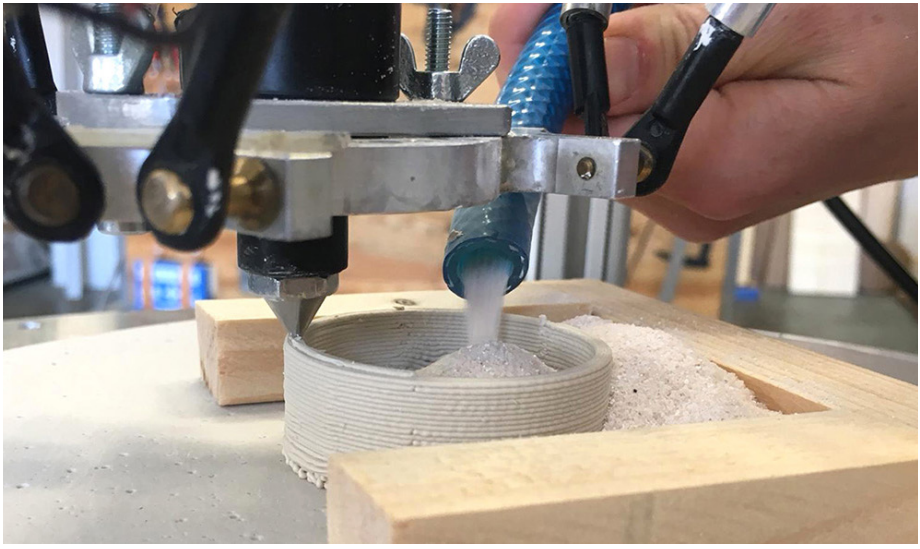

Fig. 2. Merle Ibach, ceramic 3D printer with improvised support structure of logs and sand, 2019.

Sand

Our second field of exploration is based on the practice-based study of the loose granular silicate material, sand. This work, conducted by Critical Media Lab's Junior PhD Researcher Michaela Büsse, takes a grain of sand as an inter-scalar vehicle for reflection and critical practice. Sand, as a substance, combines geological time with human time, ecology with economy with politics. Sand is both witness and object to 300 years of history, and it is of course not a uniform, real, or imagined materiality. Defined only by its grain size, desert sand is different

8 Umweltbundesamt (ed.), *Die Zukunft im Blick: 3D-Druck*, p. 35.
9 Stein, 'The Political Imaginaries of 3D Printing', p. 8.

from sand found in rivers or on beaches. Grain shape is rendered by environmental forces such as water and wind, and compositions can be a varied amalgam of shells, plants, and rocks. Sand contains disparate mineral compositions, consisting of quartz, magnetite, and other oxides, and is in high demand for engineering purposes. Because of its rich mineral composition, volcanic sand is of high economic value as well, particularly in places like Singapore and China, where the respective industries are concentrated. Sand is *becoming*: becoming land, becoming industrial zones, becoming electronic goods, as a medium and material of design and making. Japan, Singapore and Dubai use sand (also rocks, soil and cement) as infill to increase the territory of their nations.

In Tokyo Bay, one of the biggest land reclamation areas sprawls out over 480 hectares. On the Dubai coast, construction sites have added more than 100 kilometers of coastline and over 600 hectares of landmass. Singapore's territories have expanded from 58000 hectares to 71000 hectares, a growth in land of just over 22%. As opposed to diking – land reclamation by enclosure and water removal, practiced in the Netherlands since the 15th century – land reclamation by infill is additive manufacturing on a large scale. Ships get loaded with sand that is shot with high pressure through a jet, displacing and expanding seafloor into landmass. As floating 3D printers, they apply layer by layer of sand and instantly create new coastlines and tracts of land. 'Human activity has effectively created a new layer on the surface of the planet, made up of old bricks, cement, and rusting metal. Geologists and archaeologists have started calling this layer the archaeosphere'.[10]

Unmaking an archaeosphere, through these micro-trajectories, points to its materiality. From formation through to erosion and extraction, the material flow of sand unfolds itself. Its becoming is mediated through geological and human forces alike. Sand acts as a fluid medium. It is always flowing, until something prevents it from doing so. At that moment it crystallizes out as land, as buildings, as microchips – depending on the form that its composition takes and the role that modern infrastructures play. In its different formations, sand is constitutive of human life: the land we live on, the houses we dwell in, the digital infrastructures we rely on. The difference between a sand grain originating from the desert or the sea can only be observed through a microscope. Whereas erosion and segregation in rivers lead to irregular movement and thus an irregular shape, sand steadily moved by wind features a round shape. This round sand is considered useless for further industrial processing. Material value here is measured by economic value. Such measurements do not take into account the price of losing one's home, a habitat, or an ecosystem. Mining frequently causes ground subsidence, which in turn causes flooding, which eventually causes the disappearance of entire areas of land.

What becomes apparent when walking through the sand mines in Luzon and ending up in a white lab[11] in Singapore are the asymmetries and limitations inherent in all making. The unmaking of design, whether a microchip, a brick, a building, or an island – all

10 Emmett Fitzgerald, 'Making Up Ground', *99% Invisible*, 13 September 2016, https://99percentinvisible.org/episode/making-up-ground/.

11 A white lab is a sterile laboratory-like environment where microelectronics are processed.

human-made infrastructures – reveals what design covers up. The hidden infrastructures of extraction that keep sand in flow are brought to the foreground. Once they are made into a microchip, sand is forever short-circuited from its return to the riverbed. In enacting its potential for electronic processing, sand's original territory of an island is erased, soon disappearing altogether.

Fig. 3. Michaela Büsse, mining site for volcanic sand, close to Clark, Luzon, the Philippines, 2018.

Grafoscopio

Collaborative coding practices are an unmaking, a specific instance of descriptive yet productive deconstruction. For the purposes of analytical reconstitution, a group at the Critical Media Lab Basel seeks to open an investigation, one made possible by a coded script that accesses and evaluates data in the context of a software toolset for research. Potential applications include data journalism and the Digital Humanities. In contrast to the first exploration on additive design and 3D printing, where material aspects and the sociotechnical are hidden, here software is designed to reveal and unmake the digital environment it is built within and relies upon. This software toolset, called *Grafoscopio* (GS), is being developed at the Colombian hackerspace HackBo, which is located in the city of Bogotá. The space was founded in the year 2010 as a membership-based collective to foster engagement with a variety of technocultural matters such as DIY hardware projects, tinkering with Arduino, open source software projects, science and math, as well as internet activism. GS is conceived and coordinated by design researcher Offray Vladimir Luna Cárdenas and is:

> a moldable tool for interactive documentation and data visualization, that is being used in citizen, garage & open science, reproducible research, (h)ac(k)tivism, open & community innovation, domain specific visualization and data journalism, and has a lot of other potential uses. [...] Grafoscopio integrates simple and

> self-contained 'pocket infrastructures' that can be executed on/off-line from a USB thumb drive, a Raspberry Pi-like computer, a modest server, or any hardware in between and beyond.[12]

Grafoscopio is at once a note-taking application, a publishing suite, and an interactive tool for data exploration and visualization. It runs within the Pharo Smalltalk environment, an integrated operating system, development environment, and programming language. Similar to Oracle's Java, it can be executed on any hardware and in any operating system. Pharo Smalltalk is itself a community-based open source project and a contemporary incarnation of the historic programming language Smalltalk-80, developed in 1980 by Alan Kay, Dan Ingalls, and Adele Goldberg. GS derives its versatility mainly from its technological functionality. Like its more prominent relative, the Jupyter Notebook, it is possible to write and execute code within documents edited in GS. By providing this functionality, the hands of users such as journalists or academics are extended towards epistemic practices and techniques of unmaking. The software's functionality and basic Pharo Smalltalk coding skills can be learned through tutorials within the environment itself. However, the main way to get involved with GS is Data Week, a workshop format cultivating the development and use of GS.

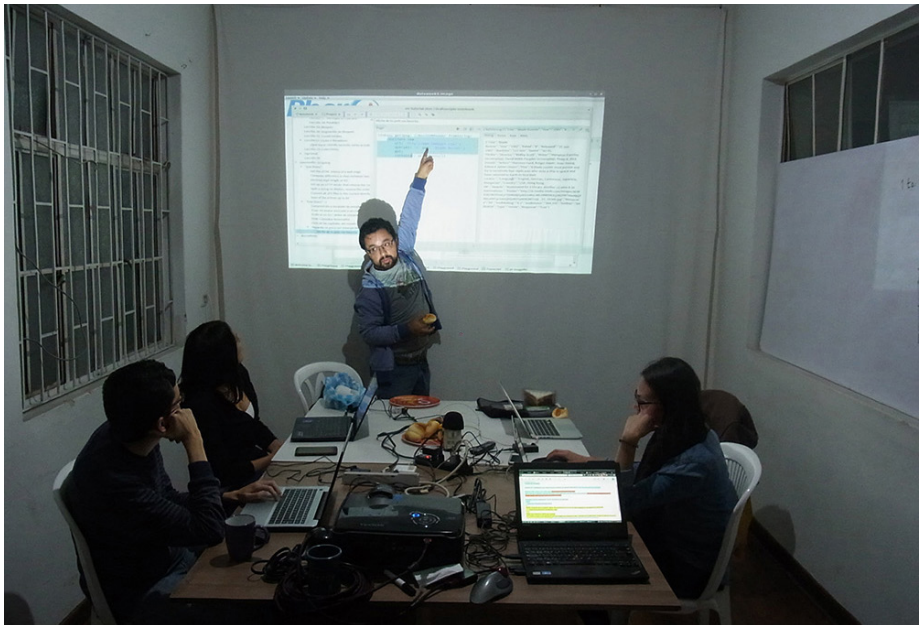

Fig. 4 Felix Gerloff, Luna Cárdenas and participants at Data Week 5, 2016.

While Luna Cárdenas is the main driver behind GS and has done the bulk of its programming himself, he regularly hosts Data Weeks at HackBo to introduce people to the environment and develop it further. Data Week sessions take up civic concerns in the context of Open

12 Offray Vladimir Luna Cárdenas, 'Grafoscopio: A Moldable Tool for Literate Computing and Reproducible Research', *The Journal of Open Source Software* 2 (October, 2017): p. 251.

Data and internet activism, that is, orientations toward legislative action and governmental campaigns on digital or environmental issues. Participants include software engineers as well as journalists and academics. One example of a basic critical exercise deployed within this format is the Data Selfie. Participants learn to call up data from Twitter profiles of themselves as well as politicians through the Twitter API and render so called Data Selfies – visualizing the quantitative relations between the tweets, retweets, and replies a profile has accumulated.

During these Data Weeks, the collaborative coding and making of a digital infrastructure enabled its users to practice an extended form of unmaking – deconstructing or analyzing as well as re-presenting, for instance, political rhetoric and stances. Data Selfies of some politicians, for example, revealed evidence of the unidirectionality of their communication on social media. This practice or set of practices characteristically combined the opening up of technological platforms, the cultivation of basic coding skills, the promotion of a rather quantitative data analysis approach (including visualization with a critical civic concern), the connection to political discourse, and community building. Collaborative coding, then, might also be a form of unmaking of knowledge hierarchies. Collectively, participants learn to break down the technological barriers of access to infrastructure and information, removing the hurdles faced by those not professionally trained in a technological field. Ultimately, such a modulation of practices by hacking might be an unmaking of these professional practices themselves, one that, in turn, reconfigures what it means to conduct journalistic or academic investigations.

Acknowledging the necessary context-specificity of unmaking, GS figures as a moldable tool that can be altered and adapted by its users. While it doesn't deploy glitches or subvert the logic of programming languages, like some of the examples of 'queer computing' in Jacob Gaboury's critical unmaking paper, this specific version of unmaking might nonetheless fulfill the requirements he formulates for such a practice: 'It would appear that queer computation cannot simply offer an antinormative critique of digital media. Instead, it must offer a reframing of the goals, drives, and interests of these media as technologies in which queerness is necessarily situated'.[13] Developing and deploying GS as a critical, subversive tool in social and political contexts contributes to establishing a somewhat antinormative approach to digital media and endows its users with the abilities to further understand and possibly unmake their basic protocols and formats.

Unmaking Making

Making has strong connotations of expansion and exploration, as well as reflection. Philosopher and urban planner Donald Schön's monograph *The Reflective Practitioner* is a text of high relevance for makers and their cultures.[14] Schön questions how action and reflection could ever be separated. Thinking and making constitute contiguously iterative loops of perception and proprioception, activation and reactivation, immersion and reflection. For

13 Jacob Gaboury, 'Critical Unmaking. Toward a Queer Computation', in Jentery Sayers (ed.) *The Routledge Companion to Media Studies and Digital Humanities*, New York: Routledge 2018, p. 486.

14 Donald Schön, *The Reflective Practitioner: How Professionals Think In Action*, London: Temple Smith, 1983.

all our talk of 'theory and practice', we have little practical evidence or substantial reason to separate these things. More specifically, to understand the relationship between applicability and context dependency in making, it is necessary to look at the various levels of abstraction that are activated, and at the constellations which emerge in thinking and making processes.

The main function of abstraction is to extract, but also to distance something from concrete experience and context. Abstraction is a strategy to enable easier manipulation, faster referencing, and finally general applicability in the sense of synthesizing theories that are applicable to a wider range to situations.[15] Making, on the other hand, is an utterly bodily and affective activity, a close engagement with very concrete materials and environments. Making is an arguably less abstract affair than, for example, thinking in mental imagery or allegory.

In dance, rehearsing choreography without carrying out every movement is more abstract than a final dance performance in front of an audience. Movements are carried out at a level of high abstraction when a dancer is sitting in the subway, on the way to a rehearsal, or going through the choreography with eyes closed. Even here, tiny micro-movements of the body are (re)enacted, a disposition to carry out future movement. The bodily reenactment of the choreography is carried out on different levels of mental-physical abstraction, and the resemblance between these is maintained throughout scale. The dancer might think of these physico-mental run-throughs as instances of the same choreography, as David Kirsch writes.[16]

According to theories of embodied cognition, the minimal or dispositional reenactment of past experiences are like the exercises of a dancer. We recall what we know – this is thinking with concepts. Alva Noë understands conceptual deliberation as abstract reenactment, a reproduction of past experience drawing upon a constellation of mental images, words, artifacts, and bodily movement.[17] Reenactments can be triggered internally as well as externally, and can manifest themselves in the production of things internally or externally. The empiricist philosopher Henry H. Price illustrates the principle of how these activations happen:

> [...] the 'activating' of any mental disposition is a matter of degree. Between the two extremes – complete latency and complete actualization – there are many intermediate degrees of sub-activation. When the word 'cat' occurs, or a cat-like image, a whole series of concepts linked in one way or another with the concept cat may be in some degree brought to mind. It is true of me at all times that I am capable of recognizing mice, bowls of milk, fur, tigers, mammals, hearth-rugs, at any rate [...]. At all times I have memories of what all these diverse entities are like (in the dispositional sense of the word 'memory'). But if the word 'cat' occurs to my mind – or a cat-image or a physical cat-replica – then something comes to be true of me which is not

15 See how Bruno Latour traces the subsequent stages of extracting/abstracting and theory making from a field trip in the rain forest to publication of a theory in: Bruno Latour, 'Circulating Reference', in Bruno Latour, *Pandora's Hope: Essays On The Reality Of Science Studies*, Cambridge, MA: Harvard University Press, 2000, pp. 24-79.

16 David Kirsch, 'Thinking with The Body', *Proceedings of The Annual Meeting of the Cognitive Science Society* (2010): pp. 2864-2869.

17 Alva Noë, *Action in Perception*, Cambridge, MA: MIT Press, 2004.

> true at all times. All these diverse memory-dispositions are to some degree excited or sub-activated. I am put into a state of readiness to recognize mice, bowls of milk, tigers, etc., if I should happen to perceive them; and also in a state of readiness to talk of such entities or produce images of them. I am ready to do these things, even though I do not actually do any of them.[18]

Price goes on to explain how producing and iterating on drawings and clay models varies in sketchiness or elaborateness, depending on how much knowledge we possess about that thing, or how much we are able to formulate the relevant details during this process. Notably, what we reenact during creative processes may vary in temporal and spatial scale. Parts of objects can be reenacted as well as whole objects (which are parts of other objects themselves).

Fig 5: Viktor Bedö, SNSF-project "Thinking Toys for Commoning", collaborative unmaking-making of the bottom-up organization of house-keeping by members of a housing co-operative by combining things and tools (materiality) with words, figures and lines (abstraction), 2018.

In processes which emphasize making – rather than thinking – the maker is working with less abstract, cognitively *heavier* things, more embedded in a context and the circumstances of the process. The maker of a 3D-printed model of an island needs to have more detail than the creation of a mental image or a pencil drawing. The maker also has to be concerned with the qualities of the 3D printer's filament, the qualities of the tools, and the infrastructures being used. When making an island by pumping sand into the sea, more consideration must be given to the environmental context, the

18 Henry H. Price, *Thinking and Experience*, London: Hutchinson's University Library, 1953, pp. 137-138.

architecture and activities that will populate the island. As the materiality of the things increases, the time and effort we need to invest to manipulate these things will change drastically. Concomitantly, possibilities for embodied interaction increase, as meaningful interaction within a context and a surroundings, in the form of a richness of detail. As materiality increases, we lose abstraction, mobility, and general applicability.

A Non-conclusive Conclusion

These examples provide us with a fractal, splintered picture of making, unmaking, and related thinking and practices. New insights and designs emerge as weak links and faint activations in the making process. This is where the maker feels that something is not right with the picture or something might be missing. Our fingers itch to change a line, our eyes squint in an effort to refocus, things are rearranged to ease the tension. Past experiences of the maker guide our focus to various features of the material, the possibilities of the tools, and the affordances of the maker-in-space. New constellations like additive design trigger mental images or inspire sketches on paper – aspects co-activate each other by constantly rearranging the actual constellation of things. Here, implicit embodied knowledge, at the peripheries of our attentions, is pulled in and find its satisfactory place, setups in which makers find coherence between what they know about the world and what they anticipate. Tools, materials involved in the making process, and the space in which the making takes place – all these may differ in scale, but their power to activate and promote elements of these constellations are the same. Each project or project phase, framed as making or unmaking, locates itself somewhere on a continuum between contextualized and abstract, functionalization and curiosity, done for use or done out of 'pure' interest. In this, we resist the general characterization of these acts as 'making' or 'unmaking' and instead understand the heterogeneity of both as instantiated in each and every project or moment of engagement with and through materiality.

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