9. Inventing Pasts and Futures

Speculative Design and Media Archaeology

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Abstract

This chapter aims to put imaginary media research and speculative design in conversation; what does it mean to think of media archaeological and imaginary media projects in the context of speculative design? This earlier missing discussing of the two parallel fields sets out to investigate critical methods in speculative practices across media and design with a special angle to imaginary pasts. Both speculative design and imaginary media research are interested in how alternative worlds might be created and how both temporal, social, and technological tabulations situate coordinates of past-future in alternative ways. The chapter addresses different art and design projects, cross-fertilising the two traditions of media and design theory and practice, and aims to elaborate ways how media archaeology could contribute to speculative design and hence contemporary issues in critical design.

Keywords: Imaginary media, speculative design, design fiction, art practice, practice-based research

Introduction: Imaginary Media as Impossible Yet Necessary Techniques

To be able to start with the non-existent, sometimes even the absurd, is a skill in itself. It can be a methodological way of approaching reality not as ready-made and finished, but as produced and open to further variations, potential, and a temporality that includes the possibility of something else. Like with all methods, the skill of thinking the non-existent needs practicing. It also needs institutional contexts that are able to support such an odd task that seems devoid of actual truth-value and easily dismissed as not incorporating the epistemological seriousness required of the academic subjects.

Despite the difficulty of giving a good one-liner definition that could cover all aspects of different traditions of media archaeology, it is safe to say that it has been able to create an identity as a field interested in the *speculative*. This has meant many things from mobilisation of media history executed by way of surprising connections across art, design, technology, and architecture to acknowledging the unacknowledged, a sort of a search and rescue-operation for devices, stories, narratives, uses, and misuses left out of the earlier registry. Archaeology has been sometimes used as a general term for the way in which we investigate the conditions of existence of media culture, and the media technical conditions of existence of cultural practices – two things that are closely connected, with the two aspects in co-determining relations: media technology and cultural practices. And it also bends our notions of history and time itself. As Thomas Elsaesser (2016, p. 201) puts it, it is a symptom of a very different sort of a relation to the past: ‘on the one hand, it suggests a freeing up of historical inevitability in favour of a database logic, and on the other hand, it turns the past into a self-service counter for all manner of appropriations’.

Already, early on, imaginary media was one part of the media archaeological body of research. It had the clear aim of reminding scholars and artists that media technological reality was not to be restricted to what actually is. It was not to be contained by the histories of technological achievement but meant to relate to the broader cultural and artistic history,

which technology can be imagined, and where it returns as imaginary attachments to values, affects, aspirations and dreams. Eric Kluitenberg (2011) articulates that such shifts seem at times almost seamless, a theme rather prescient in the marketing discourses of digital culture. We feel constantly affectively attached to dream devices of corporations, carefully framed by their sales pitches as part of a wider infrastructure of desire. While such an attachment is odd enough, broadly speaking the discourses of imaginary connections constitute also our cultural topoi (Huhtamo, 2011a), which then become the environment for recursive dreaming that characterizes consumer culture and production of reality.

But how insufficient and narrow it would be to restrict oneself to what is actual. A variantology of imaginary media, as Kluitenberg puts it (2011, p. 57) can address theological discourses, aliens and the dead, to things untrue and yet so impactful for any account of cultural history. Such imaginations are ways to rethink the usual coordinates of time and space – the time of not merely a past-that-was, but a past-that-could-have been; a future imagined as one recurring fantasy of rejigging the time we are in now. These are the places that are not only distant but sometimes impossible. How liberating this feels instead of buying into the ready-made dreams. No wonder such strategies can be connected to a wider political imaginary that includes geographical, racialized and gendered others. Artists such as Zoe Beloff have set scenes for alternative media histories through the silent mediums – female protagonists, written into the stories. Furthermore, Kluitenberg points to afrofuturism as another interesting political imaginary. As the director John Akomfrah puts it in an interview with Kluitenberg, afrofuturism and other imaginary media practices are not mental refuge. They produce and sustain new cultural practices and spaces in which black science fiction carves its collective existence but also facilitates relations with, for example, gay and women's movement including in the science fiction of Octavia Butler and Samuel Delaney. What is being approached is a black techno-cultural imagination where also music plays a key role in how pasts, presents, and futures co-determine each other in new ways: 'Black science-fiction culture, especially music, figures the past in the present by matching the quest for 'outer'space with new journals into the inner "technological tape" space of black sound itself via the digital utopias of jungle and techno.' (Kluitenberg and Akomfrah 2006, p. 293). Even if also imaginary media is at times defined as 'untimely'[1] (Zielinski, 2006, p. 30; Kluitenberg, 2011, pp. 56–57), it functions as an interesting situated practice that is aware of geographies and can challenge the Eurocentric focus of some of the speculative design discourse and practice (see Parikka, 2018). Hence, the more interesting of such fabulations function as situated imaginarios that play with the Deleuzian theme of Erewhon (of Samuel Butler's imaginary places with connotations of Nowhere) transformed into NowHere. In some recent work, afrofuturism has also been connected to issues of cultural heritage as a project between speculative futures and records of the past (see Nowviskie, 2016).[2]

So what does it mean to think of media archaeological and imaginary media projects in the context of speculative design? The question itself acts as a conceptual probe that searches for specific practices in both media and design. Furthermore, it is also a probe that scans the disciplinary relations of two sets of discourses about the past and the future. As two parallel fields with not much contact in the past, speculative design and imaginary media research are interested in how alternative worlds might be created and how temporal, social, and technological fabulations situate coordinates of past-future in alternative ways. I will discuss different art and design projects, cross-fertilizing the two traditions of media and design theory and practice, and aim to elaborate how media archaeology could contribute to speculative design and to some contemporary issues in critical design. There are some earlier ideas that have suggested how this might work. For example, Bruce Sterling's idea of 'paleo-futures' as 'the reserve of historical ideas, visions and projections of the future – a historical futurity of that prospective' (Hales, 2013, p. 7) is one example of the shared suitably complex time-scales of overlapping design and media archaeological imaginations, but this chapter teases out further contexts for this methodology.

Speculative Pasts

The term *speculative* has enjoyed quite the popularity over the past years. There are different versions of how the speculative is manifested from global financial markets to non-human philosophy (speculative realism), and it seems a very apt word to summarize the cultural situation of metastability we are surrounded by. As Benjamin Bratton (2016) argues, it is not in any way marginal to the core processes of contemporary culture and economics – the speculative *is* the core.

In the context of design education and practice, speculative design emerges primarily at the Royal College of Art, and Fiona Raby and Anthony Dunne's practice in critical design in the age of digital culture. It is not merely a term or practice tied to one institution, the RCA, but has started to resonate with other institutions (not least through the new Speculative Design undergraduate major at UCSD, led by Benjamin Bratton). As a technique or a method, it has already always been in close proximity with a range of related themes such as design fiction. Referring to the usual preference to discuss real world problems – or more specifically things – design discourse and practice attaches and reproduces certain ontological preferences, as Dunne and Raby (2013) argue. They propose speculative design as an intervention in this field. This intervention becomes both an idea of how to engage with design education and also how to understand the function of reality production as exactly a *production* of what we consider as real and actual, which then also implies what is potential as an open ended variation of what *could* be:

> This form of design thrives on imagination and aims to open up new perspectives on what are sometimes called wicked problems, to create spaces for discussion and debate about alternative ways of being, and to inspire and encourage people's imaginations to flow freely. Design speculations can act as a catalyst for collectively redefining our relationship to reality. (Dunne and Raby, 2013, p. 2)

Some of the foundational ideas in speculative design attach it to a multidisciplinary field of investigations, including cinema and other media. The design methodology becomes linked to discursive methods too: 'fictional worlds, cautionary tales, what-if scenarios, thought experiments, counter-factuals, reductio ad absurdum experiments, prefigurative futures, and so on' (*Ibid*., p. 3). It is important to realize that the ideas relate to a bundle of terms and affiliated work that shares some similar values related to prototyping, speculation, and new critical stances that at least seem to try to avoid the commercial market as the only focus of design; examples include critical making, reflective design, near futures-design fiction, adversial design and even critical engineering (as represented by Julian Oliver, Gordan Savičic, and Danja Vasiliev's work) (Hertz, 2016, p. 8). In any case, it is fair to point out the multiple ways in which speculative design is meant to work as a way to reinvigorate certain aspects of practice and design education as well as to think of alternative social macro-perspectives, to follow ideas suggested by Ramia Mazé (quoted in Mitrovic, 2015, p. 11. See also Bratton, 2016.)

A lot of the work focuses on design fiction and powers of the narrative to create such alternative worlds. As Lindley (2015) has argued, design fiction works at least through three different approaches;

1. Intentional design fictions – artefacts that are created as a design fiction.
2. Incidental design fictions – artefacts that can be interpreted as a design fiction.
3. Vapor fictions - usually marketing materials that resemble design fictions.

But *fiction* is quickly reminded to also include physical objects: design fictions are real material media objects that 'are deeply implicated in the ecology of the media situation, that they cannot be untangled from that milieu' (Hales, 2013, p. 7). Fiction is understood as material vehicles expressed through prototyping 'speculative design props' that are 'physical

synecdoches' and 'designed to prompt speculation in the viewer about the world these objects belong to' (Dunne and Raby, 2013, p. 92). One can also call this diegetic prototyping (Kirby, 2010). What is constantly emphasized is that this is not part of the epistemology of modelling, but a different attitude towards the future that works by synecdoche; an object might stand for a wider alternative reality, a speculative environment, a strangeness that gets drawn into our current situations by triggers of relative familiarity. Bruce Sterling writes:

> It's the deliberate use of diegetic prototypes to suspend disbelief about change. That's the best definition we've come up with. The important word there is *diegetic*. It means you're thinking very seriously about potential objects and services and trying to get people to concentrate on those rather than entire worlds or political trends or geopolitical strategies. It's not a kind of fiction. It's a kind of design. It tells worlds rather than stories. (Bosch, 2012)

Hence, it is important to realize what is at stake in the mobilisation of design fiction as a critical gesture. Beside the obvious rather discursive stance, there is still a possibility to think of it as a creation of worlds, as Sterling briefly hints. In terms of design, it relates to how artefacts can act as such diversions from the assumed values of design practice. For example, as Wakkary *et al*. (2015, p. 102) put it: 'In interaction design, counterfactual artefacts can also be seen to gain a perch in this critical inquiry space of consequential propositions rather than matters of functionality or consumption.' It is clearly useful to develop theoretical positions, references and vocabulary that do not only refer to the meaning-creating or discursive structures, but also take into account how we might want to address the entanglement of design strategies and their material practices producing objects.

The recurring reference is to science fiction; design fiction as a core drive of speculative design has a proximity with the poetic powers of science fiction. However, perhaps this is where the reference points could be also extended to a range of material as well as media-specific fields of knowledge, including media archaeology and imaginary media, evidenced in the range of research over the years but also artistic and design work. Bruce Sterling (2009) raises the question of whether one could even speak of a broader 'speculative culture' and in this way he recognizes the valorization of speculation for a range of contemporary practices. Sterling's list of examples includes the scientific experiment, futurist scenario work, observations, storyboards, and storytelling, as well as techniques such as flowcharts and analytical software, brainstorms, and mashups. There's a proximity with a lot of things that resonate with the corporate and business focus on speculation, including the interest in start-up culture. Furthermore, this necessitates to ask whether there are other contexts that are slightly less corporate that could work to restore critical and material issues in speculative design. As Bratton (2016) presents, the historical emergence of speculative emergence could be also situated as part of what he calls the 'material palette' of modern design: mass society based on availability of steel, plastics, the various products emerging from the chemical revolution over the past 100 years or so, etc. So, while in some accounts, speculative design is seen emerging as part of the 1960s architectural discourse (such as Archigram's hypothetical projects) as well as in general the Cold War period synthesis of disciplinary fields expressed in Buckminster Fuller's work, it is also an attachment to the availability and use of new materials that drives the possibilities of design methodologies. In other words, it refers to design in and with materialities that then force to think issues of scale and hence also temporality in particular ways (Bratton, 2016).

To state perhaps the obvious, what is constantly present in speculative design discourse and prototyping is the temporal perspective of the future. This comes out in many of the definitions and is manifested in statements such as when architect Liam Young defines speculative design as 'a space between design, fiction and future' (Duyar and Andreotti, 2015). It is useful in this context to continued developing how the core ideas of speculative design overlap, incorporate, but also could be complemented with media archaeological and especially imaginary media-themed research and art/ design projects. What if we could then also expand to the spaces between design, fiction and the pasts – alternative, imaginary, recreated,

and impacting on alternative presents too? So, if following Mitrovic (2015, p. 19) we can justifiably say that '[s]peculative practice is related to two basic concepts: speculation on possible futures and the design of an alternative present', it might be as interesting to expand towards a speculation about possible pasts, retroactive futures, and design of alternative presents by different time-based design briefs. This could relate to design in and of deep times (Bratton, 2016), but also design that emerges aware of the media archaeological time of interactions of media-art-science (Zielinski, 2006) and imaginary media (Kluitenberg, 2011) both as a historical targeting of earlier practices of speculation and as ways to mobilize those into consideration of new scales, new temporalities in which design takes a new temporal turn.

Next, I want to turn to discussions of some media archaeological angles to both 'material speculations' (Wakkary *et al*., 2015) and imaginary media.

Speculative Conglomerations

As already briefly mentioned, media archaeological art has dealt with issues that seem intuitively close to some of the methods in speculative design, design fiction, and even what Sterling flags as speculative culture. It has also resonated on a level of a broader attitude: speculative timescales that are brought back to bear upon the otherwise seemingly stable present. There is a political side to this sort of fabulation that has been recognized as part of speculative design's task in a reshuffling of the disciplinary field of design (Mitrovic, 2015). However, the emphasis is different both in terms of the institutional contexts – media archaeology has not penetrated design courses and institutions so strongly as it has done with fine art/media art – and the temporal interest. For media archaeology, inventing an imaginary past, the search for lost ideas and forgotten themes has been more important than the framing of a possible *future* even if it is not necessarily very useful to entirely separate these two.

Some of the work and methodologies in critical design did, however, include a strong relation to media archaeological theories. Paul Demarinis' approach to historical worlds and technologies of media has become a recurring inspiration for experiments with media archaeological material and named aptly as 'thinkering' by Erkki Huhtamo (2011b). In some installations, this included creating immersive environments of past media solutions that in their imaginary quality were well positioned for the speculative take: a good example is the award-winning *The Messenger* (1998) that isa reimagining of the Catalan scientist Don Francisco Salvá i Campillo's (1751–1828) early ideas concerning telegraphic communications systems.

A recent version of engaging with the media archaeological past in a Maker Lab type of a setting is found in places such as the Critical Media Lab (University of Waterloo) and the Maker Lab in the Humanities (MLab) at the University of Victoria (UVic). The latter of the two is led by Jentery Sayers, and it defines the work of design as prototyping 'the past by prototyping absences in the historical record' (Sayers and Chan, 2016). Clearly inspired by critical theories of technology and work that comes close to media archaeology, it is still a site of activity that has a particularly clearly expressed relation to media history but through iterative design processes employing '3-D modeling, fabrication, physical computing' (*Ibid*.) and more. Media history becomes framed through a test-drive that is interested in remaking: a good example is the 'Early Wearables Kit'.[3] But the focus is not merely on technological reconstruction but how such prototyping triggers critical questions about the social contexts in which such early technologies worked. To quote Sayers and Tiffany Chan:

> The technologies we prototype are dated anywhere between the 1850s and 1950s, which give us a sense of media history prior to personal computing but after early feedback control and related mechanics. These prototypes usually inform present-day technologies – wearables, cloud computing, and optical character recognition, for example – by

> giving them a sense of texture and change. How did these technologies become those technologies? Who contributed? Who got credit? Who was ignored? What materials were used, and when? Who or what was deemed innovative or obsolete, and under what assumptions? Did old stuff actually work how people said it did? How might we better understand materials such as early patents, illustrations, advertisements, journals, and even fictions by remaking objects depicted in them? (*Ibid*.)

Garnet Hertz's Concept Lab has also been one of the key reference points where the different traditions of media theory and design have met and been elaborated. This has resulted in media archaeology articulated in relation to design practice – including speculative methods – and design being able to utilize the past, historical sources, archival inspiration and found-objects. Similarly, as Sterling (2006) was already interested early on in the material cultures of dead media – the things fallen out of use as the long backlog of technological culture – Hertz has built on DIY, circuit bending, hardware hacking, and other practices of design in relation to media cultural materials and documents. This has resulted in several projects, some prototypes and some in other ways challenging ideas of functionality and usefulness. But it also included a different sort of a temporal horizon of alternative design models: an implied continuation of critical design methodologies based on the 'bizarre, farfetched and unlikely' (Sterling, 2006, p. 60) aspects of what one could dig from dead media archives.

Consider some of Hertz's ideas in this light. 'Experiments in Galvanism' from 2002 restaged the spectacles of scientific experiments for the public.[4] Another relevant – and undeniably quirkily great example – is the Outrun mod. It is a modification of the 8-bit arcade game turned into an actual physical automobile where the simulation of reality of driving is transformed back into a contemporary version of reality of simulation: 'the windshield of the system features custom software that transforms the real world into an 8-bit video game, enabling the user to have limitless gameplay opportunities while driving'. (Hertz, 2012). Retro-nostalgia of 8-bit 1980s computer culture is remediated but not on new platforms as in retrogaming (Suominen, 2008). Instead, it works as a retro-mediation: driving simulation harks back to the old-fashioned media of cars (even if an electric one) (Hertz, 2012). It is not so much a speculative future but a different sort of a material artefact that becomes the trigger in the experimental work. Sometimes it works even as part of the diegetic fabulation.

Retro cultural practices relate to a mobilization of already existing, abandoned, sometimes broken and in general obsolete sources and materials for design. With Hertz, our collaborative work referred to this as 'zombie media' that is a conceptual tweak to Sterling's dead media: instead of death, we were interested in practices that revive and reanimate obsolete materials and technologies (Hertz and Parikka, 2012). In other ways, this parallels other experimental media archaeological practices that mobilize re-enactments of historical use situations but with an imaginary bent: in the film studies context, at the International Orphan Film Symposium 2014 the performance 'Staging the Amateur Film Dispositif' showed a re-enactment of past media situations. As Andreas Fickers (2015) explains, the performative elaborates not only the apparatuses in the technical sense (8 mm home film, the video camera, etc.) but also speculates in relation to the imaginary worlds of living and experience in which subjectivities take place as part of such dispositifs. This *explorative speculation* as Fickers calls it is not so much about reconstruction in regards to authenticity but a creation of a sensibility to the complex interplay between semantic aspects and the material design cultures of the past, a proximity with technical apparatuses but as hands-on reflexivity.

In a different context, this relates to the materially grounded speculative practices (Wakkary *et al*. 2015). Continuing the work of speculative approaches and design fiction, it flags an interest in materially grounded 'actual artefacts', which are already situated or resituated objects in the everyday. It could be seen as a sort of a reality tweak by way of design, where with subtle shifts the material speculation attaches to a present temporal horizon. Building on the literature in speculative

design and design fiction, the writers aim to elaborate counterfactual artefacts as the starting point of a situated material speculation. Besides a short elaboration of 'possible worlds', as it is discussed in analytical philosophy (such as Saul Kripke), there are also other influences: 'Eco viewed a literary text as "a machine for producing possible worlds" and in this sense we view a counterfactual artefact as a "machine" for producing possible worlds.' (*Ibid*., p. 102). Such a generative notion of material speculation engages with not only the cognitive reality of possible vs. actual world – a discussion that should in another context be related to the alternative Deleuzian pairing of virtual and actual – but also to the idea of reality production. Instead of cognitive contemplation, reality is being produced by way of material interventions.

The showcased projects are able to shed some light into how design methods are made use of. Among the various ideas they discuss is the Inaccessible Digital Camera, packed inside a concrete casing into a form of inaccessible, unusable piece of media; it becomes one way of commenting on the various layers of the seemingly soft digital technologies, which however prevent tinkering and opening up the machine in multiple other ways than what are preconfigured for the user. Even the digital service industries are built on various layers of hardware nested inside various layers of legal conventions and code. The project with most media archaeological connotations is the simple Photobox machine: 'The Photobox is a domestic technology embodied in the form of a well-worn antique chest that prints four or five randomly selected photos from the owner's Flickr collection at random intervals each month' (*Ibid*., p. 104). The Photobox sits as traditional technological design – when technologies were to be hidden inside doors and panels – and as a sort of an algorithmically determined slowing down of user patterns. It also is speculative design that establishes relations than merely presenting objects; it articulates social media (Flickr archive), print technology, old-stylized wooden box design at the crossroads of different materials and networks. As such, it is hard to pinpoint it on a map of new or old, future or the past, as it is more of a constellation of multiple overlapping times. Hertz has in another context spoken of *speculative conglomerations* to refer to this sort of a multi-temporal perspective to living media history. It attempts to avoid both the reference to dead media and to future, being a design or art method attached to 'a blend of dead media from the past that are not replicas of an exact time and location, but a speculative conglomeration of lost forms of communication from the history of computing' (Hertz, 2009, p. 127). It involves multiple materialities and multiple temporalities, which in Hertz's analysis stem from his reading of Tom Jennings' *Story Teller*, art installation/experimental narrative about Alan Turing. It can be addressed as as a sort of a media archaeological version of counter-factual objects as 'a hybrid blend of obsolescence where unfamiliar time periods are layered into a functional system that is almost impossible to differentiate from an actual historical artifact from the 1950s' (*Ibid*) The narrativization of Turing is supported by an assemblage of (obsolete) technologies to underline multitemporality of the various devices 'thinkered' together: perforated paper tape, teletype, phoneme-speech, glowing phosphors, and ink-on-paper.

Such counter-factual devices and installations become design strategies for alternative experiential realities that are not attached to just one temporal perspective. In other words, speculations with the past have a sort of a possibility of prescribing also the past – as visible in archival material, obsolete technologies, and forgotten ideas, media that imaginary media research has been interested in – as open ended, not fixed. This is a sort of a media theoretical versioning of William Faulkner's often quoted words 'the past is never dead. It's not even past.' In practices such as the earlier mentioned MLab this comes out probably clearest, while the other examples cited above are also contributions to the continuum across media theory and design.

One can also find other individual projects that resonate with the already mentioned ones. This sort of a seriality between projects is what I argue as defining a speculative design in a media archaeological, imaginary media context. One often mentioned example is Gebhard Sengmüller's *A Parallel Image* installation. The installation is an alternative, partly imaginary, partly once-existing patent of a transmission system. It offers, however, a break from the adopted, normal

transmission systems that work by way of serial transmission (an image broken down into signals serially transmitted to the receiving end) and conceives a parallel image transmission with every image element (or pixel) connected to the receiving end simultaneously. The system of 2500 cables then offers an imagined and built alternative media world to that of Maurice Leblanc's serial transmission that stems from 1880. What if things, circa 1879, had proceeded differently, and the contemporary global sphere had been formed around this rather alternative sort of technical image culture? It fabulates with the history of HCI before computational culture, relating to alternative interfaces, but also the speculative worlds in which such systems might be viable (or, in fact, bracketing viability and preferring the speculative stance). *A Parallel Image* is not the only speculative media system that is part imaginary part real constructed by Sengmüller. His VinylVideo system created an alternative media entertainment discourse around the possibility of recording video on vinyl records. Similarly, some of the other works revolve around different transmission and expression systems that mix lineages of audiovisual media development as well as scales of perception (such as the Very Slow Scan Television-experiment of a bubble wrap CRT screen with a frame rate of one per day).

Diego Trujillo's *This Tape Will Self Destruct* also plays with historical narratives and connotations that fabricate an imaginary device that relate to Cold War narratives. With an honorary mention in the Prix Ars Electronica, the device looks at the intersection of SigInt and HumInt – signal intelligence and human intelligence. Spy narratives conglomerate with a technical device that 'prints self destructing documents'. As Trujillo explains:

> *This Tape Will Self Destruct* explores the intersection between our current techno-political status and Cold War spy fiction. The project consists of an electronic device that prints self destructing documents. The documents are a mixture of images and texts extracted from Cold War fictions paired up with excerpts from current secret documents, resulting in an amalgam that blurs the line between present reality and past fiction. A short amount of time after leaving the machine the documents burst into fire and their content is forever erased as the flames consume the paper. Making the iconic self destructing document real through a functional machine revalidates Cold War fictions in the context of our contemporary values surrounding secrecy. (Trujillo, 2015)

One can see where it fits in both in relation to media archaeology (an investigation of real and imaginary narratives and devices of the technical media of the Cold War with a dose of Thomas Pynchon-styled rhetoric) and to speculative design. It operates as a work of physical fiction (Dunne and Raby, 2013, p. 89). The material nature of such fiction was of course underlined in many of the examples in design fiction but undertheorized in terms of what sort of fiction and textuality is at play. One might wonder whether this sort of speculative stance also attaches to material specificities in the manner of not just alternative cognitive worlds of meaning but mixed semiotics and a-signification. Hence, just to briefly address this other sort of thinking about the nature of signs in such a design fiction that is materially specific one can turn to Félix Guattari. By detaching the work of signs from signification and instead approaching them as material signs that have effects in the world, we start to understand how signs change matter by way of assembling and undoing, to paraphrase Genosko (2009, p. 94). This view concerning language is not merely about a fabulation of possible worlds as a set of already existing possibilities – but one that is interested in which ways material signs, objects, etc. can operate as part of a world that is not predetermined; it is instead, performed and in operation as mutating matter. Signs have an impact with a material force that is not returnable to merely operations of signification (*Ibid*., pp. 94–95). To understand the full impact of this version of alternative linguistics would need much more elaboration in the context of this chapter, but the main takeaway is to understand how instead of thinking the speculative materialities merely as illustrating a piece of narrative design fiction we can underline that there is a material force in such design strategies and their milieus of objects that surpasses the representational content. They are vectors to an alternative, already situated and yet imaginary possibility

that work through a combination of methods of fiction and methods committed to material impact. This impact, then, can also link with change and transformation: reality producing and inducing fictions.

Dramaturgies of Difference

Moving back and forth between media archaeological art and speculative/ critical design projects, one also has to be rather acutely aware of the range of criticism that have been raised. In terms of speculative design, the issues of (cognitive) fabulation and work of fiction have been accused of being constrained by attachment to the White Cube format of the gallery and museum-exhibition styled visual curating of objects with design trying to imitate the institutional prestige of fine art. Such design practices come close to the expanded possibilities of expression that art methods have enjoyed over the twentieth century, and yet also are constrained by similar reasons and spatial settings that are seen as socially and geographically exclusive. In some cases, this has led to the questioning of the viability of such projects as critique: whether 'novels, films, games, and theme parks are better platforms for critical and speculative design than galleries and museums will ever likely be' (Laranjo, 2015; see Russell, 2015). However, many of the projects have actually employed the widespread use of media like film/ audiovisual as the mode of expression in order to reach wider audiences.

A more detailed criticism can be found in Cameron Tonkinwise's review of Dunne and Raby's work. The critique raises the need to consider the wider institutional context in which speculative design is being mobilized. Tonkinwise (2014) argues there are several shortcomings in the projects and the methodology. He continues to outline that these include the implicit modernist spirit of technological objects as design leadership, aimed for an audience for which the pieces are created as stylish and admirable and which then might trigger certain cognitive and affective feelings. But he also argues that there is a radical lack of diversity in the geographical contexts and ethical constituency of how the speculation is situated. For speculative design to claim to address an existing lack of imaginaries implies that only specific kinds of situated practices were in the first place accredited as interesting enough to be 'speculative'. This might then relate to for example a different set of coordinates for what counts as the temporality of the speculative and for example how different regions and practices e.g. in the Global South presents have a different sense of the future/present/ past. The design practices of speculation remain too easily a mere market diversification that is still rather presentist in its assumed audience than committed to specified politically significant goals. In such a case, politics risks becoming merely a liberal horizon of choice between different options. As Tonkinwise suggests, perhaps there is an unrecognized danger that despite the criticality, some of this sort of methodology actually mirrors the normalized design discourse as well as its Eurocentric underpinnings when it comes to what sort of design methodologies are employed and what sort of imaginaries are being produced. (On speculative design and feminism, see also Martins, 2014). I will return later to the alternative temporalities and alternative modernities that might facilitate developing ideas in Speculative Design and broaden the scope towards a wider set of geographies and situated imaginations.

As some have warned, also speculative historical practices such as media archaeology have to address the tendency that it would succumb to being 'mere rediscovery of the forgotten, the establishment of oddball paleontologies, of idiosyncractic genealogies, uncertain lineages, the excavation of antique technologies or images, the account of erratic technical developments' (Druckrey, 2006, p. ix) and so on. To continue this argument, some artistic practices are important to keep in mind as ways of articulating the continuation of the textual form of theory by way of other means of expression (Fickers, 2015). I argue that some work in gender studies and feminist theory, and also post-colonial studies can point out interesting tentative resonances that could address some existing issues that are not, of course, restricted only

to speculative design. It is also an interesting way to tackle the mantra that media archaeology is not political or that it is overly focused on technologies, which is sometimes a claim left underdeveloped or articulated in passing without much critical in-depth debate as well as ignoring existing important work in gender and other political contexts.

Zoe Beloff's audiovisual practices engage in early and pre-cinematic era often with a rather emphasized gender perspective. As examples of design fiction by way of audio-visual and media archaeological art practice, her projects and installations engage in alternative worlds but, as she emphasizes, are not merely interesting as forms of media historical fiction but aware of the material media conditions of the scene.

> [T]he apparatus is always a part of the storytelling process – part of the experience of understanding media – whether people are aware of it or not. I had the idea that, to conjure up the past, it was not enough just to work with historical imagery or archival footage; one must think also about projection apparatuses of an earlier era. (Beloff and Parikka, 2011)

Especially in some of her work, such as *Charming Augustine*, the gendered conditions of a 'medium' become central. The piece addresses practices of medial treatment of hysteria, and the female patients as objects of photographs. Here, the female body becomes an essential part of the media situation, not merely the male photographers Paul Régnard and Albert Londe. In Beloff's world that summons past imaginaries of media:

> Too often it is simply the technologists who go down in the history books not those who created the desire for the apparatus, the reason for its existence. In this sense Elizabeth d'Esperance and Augustine were also important to the invention of the moving image. It was women like them who opened up a space of desire, of possibility that the moving image apparatus could come into existence (*Ibid*).

Here, conditions of media are not merely technological but work through the social networks in which gendered subjectivities, institutional contexts, medical practices, media techniques, discourses of madness and more interact. The apparatus plays part in this assemblage alongside other social forces. One can see some similarities with other work that address the past worlds – part real, part imaginary and speculative – through media archaeological methods such as Aura Satz's audiovisual art. *Joan the Woman - With a Voice* (2013) takes scenes from Cecile B. deMille's silent feature 'Joan the Woman' (1916) and uses them in the light box installation. As a reminder of the labour of colour in early film, Satz narrates that this media historical trait is not merely about technological capacities that was then automated – originally '[t]he repetitive, menial and dexterous task of adding colour frame by frame was mostly relegated to female labour, and some film factories such as the Pathe laboratory in Vincennes employed hundreds of women for colour printing' (Satz, 2013). Not so much imaginary media, but through artistic methods illuminating a forgotten side of media history, it allows a different sort of awareness of reality production to emerge: hand tinted worlds of colour with issues of gendered labour framed as more central than the narrative of technological progress and enhanced verisimilitude. Fabulation 'backwards' in time instead of towards the future is efficient as well in illuminating politically important themes relating to what often gets side-tracked as one variable in speculative work.

In artist Peter Blegvad's three-part division, media appear as remembered, observed and imagined (Kluitenberg, 2011, p. 55); the past and present of media as actual things is complemented by the persistence of what can be imagined as media. One can start to see how many media archaeological art projects are designing the objects, which *could have been* as well as such aspects of media realities, which have not been acknowledged as part of the discursive or physical spaces. Hence, issues of gender are articulated into the picture not merely as imaginaries but necessary corrections to established historical narratives. They are also one expression of a political method of 'thinking as intervention' (Brecht, quoted in

Zielinski, 2006a, p. 259) into the supposedly real but working through the impact of also the potential worlds. We can perhaps also talk of design as intervention. Somewhere in the interstitial spaces between the remembered, the present and the imaginary these shadow realities re-appear by way of ghosts unseen in the first place. Indeed, this is not so much the category of impossible media, or conceptual or even timely media (Zielinski, 2006b, p. 30), but an alternative reality of media culture's actors, objects, processes, discourses, and aesthetic-political themes. It resonates with the theme of variantology that is partly driving some part of the conceptualization of imaginary media: to resist the drive of normalisation and engage in 'cultivating dramaturgies of difference' (Zielinski, 2006a, p. 259) as a way to question issues of progress.

Gender issues have not featured strongly in the existing work in variantology but it has given good clues as to where theory is situated as embodied knowledge and as geography. Zielinski recognizes the primacy of narratives of invention in 'Berlin, London, New York, and Paris' (*Ibid*., p. 261), but also flags all that has been geographically excluded. Or perhaps this could be even called geopolitics of media history-cum-media archaeology: to articulate both when are media, but also where are media. The current centrality of many regions in Asia – such as Japan and China – are among the discursive vehicles through which to 'advocate a two-fold shift of geographic attention: from the North to the South and from the West to the East' (*Ibid*.). Such new cartographies are according to Zielinski more accurate descriptions of the travels of innovations and devices. They are also correctives to the usual linear stories of media history. Without developing the link to post-colonial theory it does however flag the possibilities of thinking the Global South in the context of speculative practices and media archaeology. This includes both the ignored real histories as well as imaginary possibilities that can impact the dominant narratives of innovation as well as issues of gender in the non-Western context too.

In other words, the speculative geographies are linked to what I already briefly flagged at the beginning. The situated imaginaries that emerge since the 1970s in the form of Afrofuturism describe different sorts of variations of future and past that do not merely reproduce the social relations of normalized technoutopias. Of course, they are not entirely devoid of the usual references which however take a different shape, sometimes in playful ways too. Transport and departure takes place through trope of the spaceship, perhaps most famously articulated by Sun Ra. But it is also the context where, as Akomfrah articulates, science fiction meets a reflection on the trans-Atlantic as the seascape of racial, colonial violence that is the historical reference of the enduring presence of the past as persistence of the experienced injustice:

> A series of thinkers starting with Samuel Delaney have in different ways teased out a suggestive connection between extraterritoriality and the new world slave sublime, the kind of alienation that science-fiction writers try to explore through various genre devices – transporting someone from the past into the future, thrusting someone into an alien culture, on another planet, where he has to confront alien ways of being. All of these devices reiterate the conditions of being black in the New World […]. (Kluitenberg and Akomfrah, 2006, p. 290)

But this context then clearly articulates a wider space of cultural practices that combine real issues in social movement with the discovery of important texts, historical layers, and theoretical references. As Akomfrah narrates, it becomes a space for 'an inventory of black techno-arcania' (*Ibid*.). The variantological ideas that are allowed space in some media archaeological publications have also links to the possibilities of such an excavation of historical, politically important tropes (Kluitenberg, 2011). In either case, it also relates to a different sort of an institutional situation than much of speculative design (see also Martins, 2014). My point is not so much to accuse speculative design of elitism (*Ibid*.) while staying aware of limitations and shortcomings that need to be addressed, as well as expand the temporal horizon of practice. Next, I want to continue on this topic by way of some media archaeologically-inspired experiments that bring relevant points in educational contexts to the fore.

Speculative (Media Archaeology) Design as Briefs

In addition to theoretical discussions, the implications for design and art education are interesting. The MLab, and some other labs that are not thoroughly discussed in this chapter, presented an institutional site for speculative prototyping that engages with media history; it can be seen as a sort of a spatialisation of media archaeological work in design contexts. Besides what has already been discussed, I want to refer to one particular brief at Winchester School of Art, my home institution. As part of Fine Art's undergraduate Sculpture and Print pathways, the second- and third-year students under the supervision of Ian Dawson and Louisa Minkin were to create a collective piece of work, a reconstruction of the 1860s Francois Willeme photosculpture-machine. Willeme's original piece has been briefly mentioned in some histories of photography as a curiosity from the 1860s Paris and patented in 1864 in the US (Patent: US43822 A): a photographic studio and apparatus that works by multiple parallel cameras set from different angles to produce a 3-D image of the model that then was worked into a sculpture with the help of a pantograph and a cutter. The 24 images set at a 15-degree angle in that specific photographic space are the data capture feeding the visual information for the print/sculpting phase. It can be seen as a financially unsuccessful attempt at 'reconstructing spatial information' (Schröter, 2014, p.109) through multiplanar images, and as a pre-digital attempt at virtual optics (*Ibid*., p.108) and rapid prototyping as a design technique.

We can also approach contemporary practices of 3-D imaging as later remediations of the idea and this speculative proposition was picked up in the student project through a collaboration with the University's digital humanities scholars in Archaeology and their expertise in 3-D modelling (see Beale *et al*., 2013). The project produced the contained space where the cameras were operated by participants. The model sat in the middle of the constructed 'room' and the multiple images were later reworked into a sculpture. What is most interesting is the challenge how to integrate media archaeological thinking into a speculative, yet historically grounded project that also needs to work as an educational brief. Was the most interesting idea whether the apparatus 'worked'? The functionality of combination of the studio and fabrication was limited. The end results of 3-D sculptures were clearly more akin to prototypes, but they performed a speculation with past material that had been left outside the mainstream development of photography. Perhaps it was exactly this sort of combination of design fiction together with material art practices (in the context of sculpture and print) that held the most promise as an experiment in educational practices (that then also toured to Central Saint Martins in London as a featured student/art project). I am also keen to stress its potential as an alternative temporality for speculative projects where the archival material and the media archaeological methodology were some reference points together with the new and emerging technologies of 3-D modelling and printing. The material practice, re-enactment performed the work in a way that was not merely about a historical reconstruction. It also provided a way to imagine how differently 3-D technologies look like from the past perspective. And indeed, it was also one way of featuring experimental media archaeology (Fickers, 2015): staging experimental situations by way of artistic methods and in resonance with design fiction, describing an alternative world where photosculpture had become the mainstream way of producing portraiture (perhaps pre-empting current practices of 3-D printing selfies!).

Another approach to mobilizing speculative design in the context of media archaeology is part of a brief we jointly designed with my collaborator, designer and writer Ayhan Aytes.[5] The brief was tested at the 3rd Istanbul Design Biennale in November 2016 with designers, artists, and students. The workshop attendants were tasked to offer initial design blueprints or scenarios for speculative devices/fiction worlds resting on the assumption that 'the Arab-Islamic Renaissance of 800-1300' of technological automata and other inventions triggered an earlier wave of technological modernity. This geopolitical shift in the usual story of emergence of modern scientific societies from Europe to the Middle East was to function as a reminder of the roots of some technological innovations and also to spark a context of design

fiction: a *what if* speculative design brief that picks up on ideas that branded steampunk in the 1990s to an 'islampunk' of Baghdad, and the Middle-East: from the design fiction worlds of Victorian era as the start of the computer culture as William Gibson and Bruce Sterling pitched in 1990 (in the midst of the massively invested discussions about emerging Digital and Network Culture) to about a thousand years earlier and in a different socio-religious context.

The brief benefited from the ZKM exhibition Allah's Automata, which exhibited and discussed 'Artefacts of the Arab-Islamic Renaissance (800-1200)' in Karlsruhe in 2015 and the spring of 2016. With Aytes as a special advisor on the project that was led by Peter Weibel and Siegfried Zielinski, we had an insider view to the construction of the exhibition that featured Al-Jazari's work, *Banū Mūsā* brothers' ' *Treatise on Music'* and programmable music automaton, and other examples. It included a replica of the famous Elephant Clock with its various references: not only Arabia (the falcons) but also China (dragons), India (the elephant itself), Persia (the carpet), Greece (the construction of the mechanics and movement), Mesopotamia (the scribe sitting on top), Egypt (Phoenix), and, of course, Alexandria (with the hydraulic mechanism). (Zielinski, 2015, p. 15; see in general Zielinski and Weibel, 2015). Visual and design cultures were condensed in the example of the Elephant clock, which also featured a key technology in the sense we usually ascribed to European modernities and the Christian habits of the everyday: time-keeping and clocks as public ways of communicating organized life of periodic rhythms, and in some cases, even communication with God (as Kluitenberg 2011 articulates in relation to the medieval mystic Heinrich Suso, and something that also features in Allah's Automata – the audiovisual worlds of minareths as unifying time and sound based environments).

Allah's Automata was primarily based on the importance of the translational work that define the centrality of Muslim cultures as part of the history of technology. It offered a sort of a media-archaeological entry into the conditions of existence of European renaissance by looking at Arab, Persian, Indian, and Chinese contexts, although focusing mostly on the Abassid Empire and its 'thirst for knowledge and scholarship' (Weibel, 2015, p. 7). The understanding of technology was expanded to include the systematization of fields of knowledge, including astronomy as well as chemistry, and to be included as part of considerations of technology – what could be more natural for our age as well than to focus for example on the bioengineering challenges as utopian moments of design briefs of a very fundamental kind?

The exhibition painted an image of an audiovisual universe that was technologically advanced. Hence, in this alternative geography of media, Constantinople/Istanbul, Baghdad, Kurdistan, and many other places start to play a new, deterritorializing role that is pitched as the challenge to a design imagination of a media archaeological kind. This project was clearly inspired by variantology (Zielinski, 2006a; Zielinski and Furlus, 2010); the enthusiasm that is expressed in variantological research writes important corrections and additions to the assumptions of the primacy of the Greek-European lineage of technology and science; the manuscripts and designs for automata by *Banū Mūsā* are part of this narrative of rare artefacts from the mentioned Arab-Islamic Renaissance, with the Book of Ingenious Devices from ca. 850 being one of the precious objects mentioned. The conditions of existence of the core European technological culture were in this case argued to be preceded historically and geographically by something else – by the Muslim cultures hundreds of years earlier, a theme discussed in historical scholarship earlier: 'The hardware is virtually identical to the revolving cylinders with pins that were used 500 years later in the European glockenspiel of the late Middle Ages, even later in the mechanical organs of the Renaissance, and for writing automata and automatic music instruments in the Age of Enlightenment' (Zielinski and Furlus, 2010, p. 10).

Besides this historical work included in Allah's Automata, which inspired our smaller exhibition element at the Istanbul Design Biennale 2016, the references became a resource for the speculative design engagement that included this empirical angle to artefacts and manuscripts. But it was also meant to perform subtle sorts of tweaks of the geopolitical definitions of advanced technologies. Through speculative practices of imaginary times of past and futures we wanted to ask: can we shift the understanding of sites of technology and their cultural markers from the usual stories of the US and

Europe to these other locations, including in relation to the much-debated discussion relating to Muslim cultures in the current context of security fears and deliberately mobilized islamophobia used as a tool of xenophobic politics? How are we able to pitch alternative frames for the infrastructures of technology that define the contemporary geopolitical condition including urban development in current geopolitically central metropolises such as, for example, Istanbul where the religiously conservative government and policies meet with massive corporate investment into technological constructions with questionable environmental consequences?

In other words, we wanted to interface historical discourse and archival research with design practices that touch contemporary political issues. Such have to do with the particular ways in which history is mobilized in current social contexts such as in Turkey through fabulations of Ottoman histories to justify policy decisions and the geopolitical manoeuvring of the current AKP-government. And it has to do with the wider global geopolitical situation post-9/11 with the increase in anti-Muslim sentiment, the Middle Eastern crisis with wars in Iraq and Syria, and the refugee movements through Turkey to European Union as one crucial line of renegotiation of several political issues from border (control) to religious identities including debates about the veil. In other words, aware of the rather different focus of many speculative design projects, we wanted to develop a brief that even in subtle ways carries with it this rather urgent and sensitive set of political conditions in a media archaeological context.

Conclusions

Garnet Hertz summed up many of the potentials in media archaeological art and design practices some time ago. It is a well-known quote but worth reprinting again as it can now be read in the context of this discussion of speculative design and imaginary media too:

> The history of obsolete information technology is fruitful ground for unearthing innovative projects that floundered due to a mismatch between technology and socioeconomic contexts. Because social and economic variables continually shift through time, forgotten histories and archaeologies of media provide a wealth of useful ideas for contemporary development. In other words, the history of technological obsolescence is cheap R&D that offers fascinating seeds of development for those willing to dig through it. (Hertz, 2009)

Work with historical materials – both related to discourses of the imaginary and to issues previously ignored, forgotten – can drive interesting ways to think about design and art practices. Archives and historical examples, both familiar and more obscure ones, can provide radically new ways to think not only objects, but also relations that are not, exclusively, history in the narrative sense of the term. The specific future-oriented nature of speculative design can in this sense be expanded to a broader set of imaginaries and temporalities that are not attached to ‘future’ only. This is not to downplay the importance of such ideas, but to offer a broader perspective as to how any speculation can be rerouted through past-futures and how the past can become a way of pitching alternative worlds. Paleo-futures and dead media discourse was one attempt at this direction, as Hales (2013, p. 7) summarizes well: ‘Sterling’s entanglement of fiction with the technological culture of the retrospective, with the retromanic and the imagined, provide an interesting point of convergence with design fictions and archaeologies of imaginary media. If we can say that the actually-futuristic are partly real, then the paleo-futuristic are partly imagined.’such descriptions, but also the actual projects over the years, should offer good impetus to move away from even the linear past-present-future timescales to something else. Media archaeology has always been very good at pitching alternative temporal frameworks as integral to its various methodologies, from recurring topoi (Huhtamo) to time-criticality and microtemporalities (Ernst) to deep times

(Zielinski). When Benjamin Bratton (2016) voices that speculative design occupies a good position to redesign the twentieth-century design culture, he is speaking of a radical brief to rethink not only objects, but also the scope of material relations involved from subjectivities to planetary systems. Indeed, speculative design functions also as such a metanarrative that might facilitate a self-reflexive moment although not merely for the sake of self-reflexivity but for developing it as a critical methodology that needs to sustain its complexity and be aware of its blind spots. This is not merely a task of futurity in the narrow sense, but can clearly adopt a complexity of time at its core: pasts and presents, alternative realities and imaginary pasts, non-human times of planetary duration or bacteria millions years old; a repository of dead media alive again.

On a broader note, I am interested in how media archaeological methods, themes and discourses can be employed in practice-based research and education. This implies that media archaeology has a lot of promise for art and design education, and, in this case, much to contribute to speculative design and design fiction. In other ways, perhaps this modest suggestion featured in this chapter is also useful for speculative design? Critics have flagged the shortcomings of some of the practices: it has remained attached to a Modernist appreciation of practice; it is elitist; it is committed to a rather narrow idea of future; it fails to ascribe to a stronger sense of politics. Whether or not all of the critique is justified, especially considering how differently speculative design is employed in so many institutional contexts, even hackerspaces (see Eriksson, 2011), the critiques are important issues to deal with and take into account in future iterations. The issues brought to the fore by feminist theory and post-colonialism are important ways to open up the situated nature of the imaginaries. As such, they can also be brought to new contexts in which the media-enabled imaginaries function. In either case, the guiding questions have to relate to the politics of the imaginaries produced and also how they reproduce or might help to improve the practices of education in which they function. In my perspective, for both practice-based fields and in the spirit of transdiscplinarity the question becomes: how does one engage in such design fictions and speculations that are impactful of a situated change, recognizing the crucial planetary issues and are fabulating in ways that don't merely repeat the same but produce variations? This refers to a variantology, which is not merely for the sake of sheer amazement, but a geopolitically tuned awareness of where theoretical and practice-based work functions.

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technical media culture. In addition, Parikka has published such books as *What is Media Archaeology* (Polity, 2012) and edited various books, most recently *Writing and Unwriting (Media) Art History* (MIT Press, 2015, with Joasia Krysa) on the Finnish media art pioneer Erkki Kurenniemi. Parikka's website/blog is at http://jussiparikka.net.

1 Zielinski (2006, p. 30) list the various ways in which imaginary media works in the context of historical examples: '*Untimely media/apparatus/machines*. Media devised and designed either much too late or much too early, realised in technical and media practice either centuries before or centuries after being invented'. '*Conceptual media/apparatus /machines*. Artefacts that were only ever sketched as models or drafted as concrete ideas on paper, but never actually built'. '*Impossible media/apparatus/machines*. Imaginary media in the true sense, by which I mean hermetic or hermeneutic machines, that is machines that signify something, but where the initial design or sketch makes they cannot actually be built and whose implied meanings nonetheless have an impact on the factual world of media'.

2 In general, methodologies of speculative design have been discussed also in our AHRC-funded research project Internet of Cultural Things (2016), where we worked with the British Library and an artist in residence (Richard Wright) to creatively assess what it means to consider cultural institutions as data institutions and in the context of discussions such as Internet of Things and big data as the future-horizons of cultural heritage. Wright designed the Elastic System (2016) as a sort of a media archaeological alternative interface through which to visually browse some of British Library's collections, which are not otherwise accessible to the general public. The art project borrows its name from the librarian Thomas Watts's elastic system of storage from 1838 and mobilized as an intervention into current debates related to data and digital libraries.

3 See online here: (Accessed 2 June 2017) https://github.com/uvicmakerlab/earlyWearablesKit

4 Luigi Galvani's eighteenth-century experiments with animal electricity were remediated as part of network culture where the trigger was not merely a public showing how electricity animates an animal body but how 'small implantable web servers' can 'trigger physical activity in the bodies of worm and frog specimens, updating galvanism's electricity with network activity' (Hertz, 2002) and webcast directly from the lab to the social media audience.

5 Aytes (2020) is also preparing a book manuscript on *A History of Intelligent Automata from the Middle East to China*. This book is contracted with Amsterdam University Press, in the Recursions-series.