Culture Unbound
Journal of Current Cultural Research

Playing with Personal Media: On an Epistemology of Ignorance

By Timo Kaerlein

Abstract

Mobile devices are ubiquitous and increasingly an integral part of everyday media usage. One remarkable development in the field of personal media (smartphones, tablet computers, etc.) is the trivialization of their interfaces and appearance, especially when compared to the complexity of the underlying software and hardware. The iPhone and its successors trump with usability, they offer simple and seemingly direct access to many functions. Software can be handled with basic hand gestures or voice control, no expert knowledge is required to use the devices. Rather, current apps and operating systems are designed for a playful approach that favours unbiased exploration.

The article investigates forms of the trivial in both device materiality and interface design from a media studies perspective. Pertinent philosophical positions on human-technology relationships by Günther Anders and Hans Blumenberg are discussed to explore the ramifications of a highly productive epistemology of ignorance. A focus is placed upon the process of blackboxing, a technique of invisibilization common to media technologies wherein the social and material prerequisites of a given artefact are hidden from users. The black box also serves as a model of thought to offer a way of analysing unknown complex systems as proposed in cybernetics, and it has more recently been picked up and refashioned in significant ways in actor-network theory.

Playing with personal media is situated between the poles of user infantilization and the freedom of exploring new practices. Triviality in interface design is ambiguous in that it denies insight into more fundamental processes but at the same time creates a space for playful variation not requiring professional knowledge. The article aims to negotiate between positions of elitist criticism and affirmative technophilia, which are widespread in the discourse on mobile devices.

Keywords: Mobile media, epistemology of ignorance, Apple, Friedrich Kittler, Günther Anders, black box, cybernetics, interface theory.

Introduction

Friedrich Kittler was a passionate proponent of the command-line interface. In his opinion, user-friendly operating systems such as graphical user interfaces with their desktop metaphors (and even software in general) are patronizing insofar as they deny access to fundamental processes taking place on the hardware level. Kittler's essays "Protected mode" (1991) and "Es gibt keine Software" ('There is no software', 1993) contain a formidable rant about the monopolistic software tycoons of the 1980s and 90s, Microsoft foremost among them. As Geoffrey Winthrop-Young has pointed out, Kittler's critique can be read as the expression of a Protestant fixation on the written word, i.e. on machine-readable code, a *sola scriptura* of the electronic age (cf. Winthrop-Young 2005: 146).

Kittler's arguments are mirrored in the contemporary critique of the interfaces of personal media devices like smartphones and similar Internet-capable, mobile computing technologies.[1] Apple – not Microsoft – is one of the main players in this field today, following a somewhat Catholic approach in creating handheld auratic idols to be caressed continuously and involving more senses than just the visual. The religious analogies contrasting the supposed focus of Catholicism on appearances, rich sensuality, and fetishistic adoration to the Protestant retreat towards spiritual essence and plain text may serve as an introduction to the problem treated in this article. They will not be pursued further as such. The question rather is about how to approach everyday technological objects like personal media, objects that are not sufficiently described by referring exclusively to their local materiality, but instead are part of an infrastructure. As the 'Internet in your pocket' – Apple's advertising slogan for the first generation of iPhones – personal media are representing a network of invisible forces or power relations, *pars pro toto*. This standing in of a local object for a complex web of relations has been identified as the fundamental structure of fetishism (cf. Böhme 2006: 190 and Morley 2007: 293-309 for a description of personal media as "magical technologies" (ibid.: 293) or the "totems of today's 'technotribes'" (ibid.: 297)).

This article will investigate seemingly trivial technological objects that due to their ubiquity are mostly taken for granted. Personal media – in the sense explicated above – are increasingly becoming an integral part of everyday media usage. Whereas their interfaces are undergoing a process of trivialization with colorful icons, touchscreens and simplified apps instead of fully customizable programs, concerns are raised about production circumstances, tracking capabilities, the walled garden business models employed to run third-party software on the devices, and so on. Layers of complexity are attached to personal media that are not readily represented in their appearance. This becomes all the more a pressing issue as contrary to many domestic technologies, personal media are intimately connected to the human body and usually taken everywhere, worn constantly and always-on. The trivial poses a problem here as phenomena that are seemingly

self-explanatory don't call for explanation and thus obscure the nested levels of blackboxing – technical, economic, environmental, political – that are necessary for their constitution. Thus they lend themselves to cultural critique from various angles. At the same time, triviality is defined by affordances: Trivial technologies are inclusive and open for all precisely because they don't raise barriers of cognition, skill or involvement.

Personal media are widely seen as stripped-down versions of general-purpose computers that prevent the user not only from accessing core functions, but even from independently installing software and manipulating general settings. Consequentially they are marketed to a general audience, often without prior experience in computing. They feature so-called *Natural User Interfaces* (NUI) that supposedly don't need any initial learning phase (cf. Wigdor & Wixon 2011). Cory Doctorow, blogger and copyright activist, writes about the iPad under the heading "Infantalizing hardware":

> Then there's the device itself: clearly there's a lot of thoughtfulness and smarts that went into the design. But there's also a palpable contempt for the owner. I believe — really believe — in the stirring words of the Maker Manifesto: if you can't open it, you don't own it (Doctorow 2010).[2]

Doctorow bemoans the experience of having to deal with a technology that comes in the shape of a hermetic black box. In his view, personal media offer a nondescript surface which grants superficial operativity but simultaneously hides its inner workings and its history, i.e. the values, norms and prescriptions that have been involved in the product design and development and become a fixture evading critique. The artifact doesn't tell anything about itself and incapacitates the user because it doesn't allow any invasive interference.

In the following, Kittler's and Doctorow's view will first be enhanced by referring to a pessimistic position expressed in the philosophy of technology – formulated by Günther Anders, who is hereby proposed to be read as an interface theorist (cf. Kaerlein 2012). The argument will then be relativized by referring to Hans Blumenberg's position that science and technology in general call for a conscious waiver of sense (*Sinnverzicht*). Next, the cybernetic epistemology of the black box will be revisited, which has been taken up and modified in actor-network theory. This will not solve the controversy but instead historicize it. It will be argued that playing with personal media as a dominant form of interaction builds on a productive epistemology of ignorance that simultaneously limits critical discourse as well as opens up spaces of play, contingency and potentiality.[3] Several examples will be provided to demonstrate both the invisible entanglements of personal media in material networks and infrastructures as well as the emergence of mobile playscapes, i.e. practices of creative exploration that build on a position of ignorance on the part of the user. The approach taken here is more systematic than empirical, more epistemological than ethnographic, hazarding the consequences

of theoretical reduction in favor of clearly outlining a particular discourse on human-technology relationships.

Vilém Flusser's thoughts on a philosophy of photography (Flusser 1983/1994) include several arguments that anticipate the discussion traced here. In fact, Flusser's description of the camera apparatus as a symbol-processing machine can still contribute to the understanding of today's portable computers such as personal media. The camera is more toy than tool as it contains a set of rules that the photographer either actualizes or controverts by engaging in experimental behavior (cf. ibid.: 25). In both cases, it remains a black box that contains far more possibilities than any photographer could ever make use of (cf. ibid.: 26), so that he or she usually focuses on inputs and outputs exclusively without worrying about the operation in detail. "It is a complex plaything, so complex that those who play with it cannot see through it" (ibid.: 29, translation by the author). The notion of play in Flusser's account is characteristically ambivalent – it is both an expression of the human condition vis-à-vis the apparatus (more *homo ludens* than *homo faber*), but also a possible way to undermine programmed intentions and the comprehensive automation that Flusser sees working as a general principle of post-industrial society. Insofar as Flusser himself has hypothesized that the "universe of photography" can serve as a model case for "post-industrial life per se" (ibid.: 68, translation by the author), his writing can be seen as an early attempt at describing a cybernetic epistemology of ignorance and finding means to criticize it – which is the goal of this contribution as well.

The Outdatedness of Appearance

Regarding the present generation of personal media, it can be observed that the reproach of trivialization certainly contains some truth. The iPhone was released in 2007 and is still the most iconic smartphone in public awareness – leading even respected scholars to somewhat exaggerated endeavors like calling for an "iPhone theory of mobile communication" (Goggin 2012: 17). It prominently features a flat, black touchscreen display and one main button below it. That is essentially the full physical interface if we omit for a moment some further controls hidden on the top and spines of the device. This minimalism is continued in the design of the operating system with its touchable icons and the app infrastructure, which is basically a closed system of accredited programs that often claim not to require any initial expertise on the part of the user.

Matthias Müller-Prove has offered an entertaining, but also thought-provoking account of the history of computer interfaces (cf. Müller-Prove 2011). He contrasts the transition from command-line over graphical to the present 'natural' or tangible user interfaces with the developmental stages of a child's mental capacities, following the combined models of Jean Piaget and Jerome S. Bruner. While a child increasingly develops an iconic and a symbolic mentality, learning to differ-

entiate and to operate visual and formal cues, user interfaces seem to follow an opposite trajectory. The command line is a highly formalized environment, demanding analytic skills and relying heavily on users' active knowledge. The graphical user interface with its windows, icons, menus, and desktop metaphor simplifies this setting, but at the same time restricts access to more fundamental levels of a system architecture. The current 'natural' user interfaces add a whole array of physical dimensions like multi-touch capabilities, accelerometers, gesture and voice control and different sensors to the devices. In that way, they are designed for seamlessness, often following a paradigm of reality-based interaction (cf. Jacob et al. 2008). As the various advertising narratives never fail to emphasize, every child can use such an interface, which is basically reactive to various kinds of input that can be combined without having to translate them first to a formal machine language. It has to be noted that this trivialization of human-computer interaction from a user's perspective does not imply a trivialization on the level of hardware and software architecture. On the contrary, e.g. a voice interface based on natural language processing (Apple's Siri is the most prominent example), poses a highly complex challenge in implementation. What seems trivial on the outside requires refined engineering knowledge.

The radical German technology critic Günther Anders developed a philosophy of discrepancy in his 1956 book *Die Antiquiertheit des Menschen* ('The outdatedness of man', cf. Liessmann 2002: 54). He speaks of a Promethean gap ('Prometheisches Gefälle') between humans and the technological objects they themselves have set in the world. It signifies the historical moment where humans are no longer able to understand what they can produce as a collective. As "inverted utopians" (Anders 1981/2003: 96), our capacities of production surpass our capacities of understanding, let alone emotionally comprehending the world of technology. This defect in human capabilities is complemented by an according defect on the side of the apparatuses. Anders calls it the outdatedness of appearance and describes it as follows:

> If we, incapable of imagination, are blind, then *the apparatuses are mute*: this means that their *appearance doesn't reveal anything about their character*. […] They feign an appearance that has nothing in common with their essence, they seem to be less than they are. […] This '*negative swank*', this "*being more than it seems*", has never before occurred in history (Anders 1980/2002: 34f., translation by the author).

What Anders had in mind, were first and foremost the innocent-looking cans of cyclone-b gas that were used in the death-camp of Auschwitz and – of course – the atomic bomb and nuclear reactors whose appearances don't relate remotely to their potential effects (cf. Anders 1980/2002: 34f.). But it can be argued that his diagnosis equally applies to the computer and even more so, to miniaturized personal devices like smartphones. The computer is hypothetically such a powerful machine, that it can simulate any other conceivable discrete-state machine (as per Turing's definition). Any interface, in allowing the user to operate a computer,

therefore systematically understates what the machine is capable of doing.[4] Additionally, it is part of a history of rationalization, centralized bureaucracy, and military uses in simulation and calculation that make it a central element of what has been conceived of as an intimidating technocratic apparatus at least since the 1960s. The critical discourse includes titles such as Jacques Ellul's *The Technological Society* (1954/1964), Herbert Marcuse's *One-Dimensional Man* (1964) and Lewis Mumford's *The Myth of the Machine* (1967), among others.

Traditional tools – from the flintstone to apparatuses based on mechanical principles – have usually been designed to incorporate in their appearance their context and instructions for use. In the course of industrialization, machines have become the dominant technological form. With them comes the tendency to encase working parts inside nonspecific covers and blinds, withdrawing them from direct supervision. The outer look of contemporary computer hardware is almost meaningless, even if the casing is removed, because processing and storage take place on a different scale than human perception. Software does not readily reveal the limitless possibilities of a computer, but channels it according to users' needs and cognitive capabilities. Computers can thus be seen as the most elusive machines to date, dealing in the realm of the symbolic and not in observable mechanics.

In the case of the smartphone, the computer is hidden in a small and plain device that has so much become a part of everyday life that it fades from view and evades critical contemplation. Technology often takes on such an agreeable and personalized form today (cf. Liessmann 2002: 191f.) that its users don't bother about any invisible layers of processing, much less about the interconnectedness of devices and sensors that form a complex ecology behind their backs.[5] Instead, people tend to nurture their personal companions, adorn them with all sorts of accessories and increasingly integrate their presence into the body image. The familiar, the trivial, the everyday is often exempt from critical investigation. We often choose not to care about the dubious policies of apps that constantly analyze data traces without our explicit consent for purposes of targeted advertising or surveillance. We welcome the comfort of cloud data storage services while cognitively failing to imagine the sheer scope of the network and losing control of our personal data. Our devices seem harmless because they do not readily reveal their agenda, their scripts, the social and material prerequisites of their production. As they do not allow us to peek inside and restrict our actions to the surface of a mundane interface, they enforce the Promethean gap while at the same time pretending to bridge it due to their handiness.[6]

Waiver of Sense, Not Loss of Insight

Anders' position surely is an extreme one. He revolts against the politics of artifacts, as Langdon Winner would put it (cf. Winner 1980), and demands to "torture

the things until they confess" (Anders 1980/2002: 428, translation by the author) their secret agenda. But it resonates in many of the views articulated by today's critics of technology like Doctorow who does not accept a device that he cannot control completely.

> Freedom in the future will require us to have the capacity to monitor our devices and set meaningful policy on them, to examine and terminate the processes that run on them, to maintain them as honest servants to our will, and not as traitors and spies working for criminals, thugs, and control freaks (Doctorow 2011).

The philosopher Hans Blumenberg observed in 1963 that technologization unavoidably leads to the construction of devices that an observer is simply not able to perceive in all aspects because its mechanisms are hidden in a casing and/or are too complex to comprehend (cf. Blumenberg 1963/2009: 35f.). He argues that this is indeed a necessary condition of any increase in knowledge because human lives are limited – the capacity of their being ('Dasein') is constant, not dynamic (cf. ibid.: 51) – while the theoretical tasks are infinite (cf. ibid.: 41). Therefore, historically achieved successes are being formalized, i.e. reduced to methods that can be applied blindly without having to prove every single statement again. The same applies to technology, which is the material offspring of the process of formalization, and accordingly the empirical test of the validity of scientific claims. While Edmund Husserl maintained that the history of the sciences has led to a gradual deprivation of insight and therefore the loss of an original sense ('Urstiftungssinn'), Blumenberg recognizes the necessity of this process.[7] "The *loss* of sense that Husserl talked about is really a *waiver* of sense that is self-inflicted in the consequence of theoretical claims" (ibid.: 43, translation by the author). In other words, one cannot start from scratch in each attempt to solve a new problem, but a set of functionalized repositories of knowledge practices is inherited that can be put to use without questioning.

Indeed, one could argue that with the emergence of non-trivial machines, knowledge comes to be seen from the viewpoint of practicability in the light of indeterminacies and the incompleteness of observation (cf. Hörl 2010: 54). This means that we can build more than we can understand and epistemic self-restriction is actually a productive paradigm, as is evident in the technoscientific practices of tinkering (cf. Weber 2011). The specific rationality of technoscience embraces contingency, combinatorics, trial and error, self-organization and evolution (cf. ibid.: 94). It is argued that unpredictable outcomes require a loss of control to some extent. Interestingly, in information technology, a component is considered to be *transparent* if it is easy to understand its function without having to bother with its structure in detail (cf. Hilgers 2010). Following this diction, the less it is necessary to cognitively grasp a mechanism, the more transparent it becomes.

I want to argue that a similar logic is working in the trivialization of personal media devices and interfaces. It has been noted that smartphones offer a range of

interaction variants that – as trivial as they may seem – spur creative uses and invite a playful approach. Some examples will be given below. This is made possible precisely because the devices are so secretive when it comes to telling anything about themselves. They do not allow the end user to peek inside – or beyond, i.e. into the further scales of material entanglements that they are part of –, but they do not require it either. Such a playful engagement with personal media and its consequences are made possible by a process of blackboxing that shall be investigated in some more detail next. The blackbox model represents a specific epistemo-politics that is inherited from cybernetics, but is still prevalent in marketing discourses, branding strategies and indeed practices of contemporary personal media.

The Cybernetic Blackbox – A Productive Epistemology of Ignorance

Bruno Latour and others in actor-network theory have used the model of the black box to describe temporary stabilizations in fluid networks. Under the term blackboxing, Latour understands

> the way scientific and technical work is made invisible by its own success. When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become (Latour 1999: 304).

A black box hides its constitution and character as a network and allows other actors to interact with it in a setting of reduced complexity. Personal media can be described as black boxes in several ways. Not only does the term quite accurately represent their literal appearance but it also captures their efficient bundling together of various interests, services and action programs. Blackboxing as a process implies a successful stabilizing effort that on the one hand leads to trivial reproducibility and reliability, while on the other hand allows for even more complexity, as Blumenberg's notion of a gainful waiver of sense suggests. The main function of technology in the black box model is to relieve the user (and, to an extent, also the designer or engineer) from the cognitive burden of having to understand all its internal or external relations. This in turn is a prerequisite for specific non-technical practices and non-instrumental object relationships, which are especially relevant in everyday use, i.e. outside of expert contexts.

If one follows the genealogy of the black box further to its roots in the discourse on cybernetics, an interesting perspective arises. The black box is the central element of an epistemology strongly influenced by behaviorism and its theory is "practically coextensive with that of everyday life" (Ashby 1956: 110), as neuropsychiatrist Ross Ashby argues.

> Thus, a black box gives us a concept that allows us to handle what is, in effect, an unknown world: It is the statement of ignorance, of our ability to overcome and cope with ignorance, and thus is a primative of learning and, hence, of science (Glanville 1982: 1).

Ashby used a prototypical black box – the so-called "Ashby Box" – as a didactic tool to introduce his students at the Biological Computer Laboratory to the intricacies of cybernetic complexity during the 1960s (cf. Müggenburg & Pias 2013: 60f.). Although this device only provided two switches and two lamps – both of which could be in one of two states – the task to analyze the relations between input and output parameters was unsolvable in principle. Because the machine changed its inner state after each switching operation depending on the entire history of its operation, it gained some emergent qualities – its results were absolutely deterministic, but unpredictable (cf. Hörl 2010: 53f.). Ashby himself was obsessed with a similar, more complex device (the so-called Grandfather's Clock, cf. Müggenburg & Pias 2013: 61) that he used as an "inspirational device" (ibid.) because it created ever-changing color patterns. His engagement with this apparatus appears as a precursor to what Karin Knorr Cetina has labeled "object-centered sociality" (Knorr Cetina 1997: 1), understood as an increasingly intimate and comprehensive embedding in object worlds that "constitutes something like the reverse side of the coin of the contemporary experience of individualization" (ibid.). Drawing on Rheinberger's notion of epistemic things and extending the term to encompass computers and other dynamic technological objects, Knorr Cetina argues that such objects are characterized by a temporal logic of unfolding, of revealing ever new qualities that perpetuate an ongoing interest in them (cf. ibid.: 13).[8] Rooted in expert contexts (the libidinal surplus of scientists' engagement with their objects of study), similar processes can be observed in non-expert cultures, specifically "an increased orientation towards objects as sources of the self, of relational intimacy, of shared subjectivity and social integration" (ibid.: 23).

What do these examples from the history of cybernetics show? As the observer initially does not possess any knowledge about the functionality of a black box, he or she is forced to randomly modify the input to see how it affects the output. In other words, he or she is invited to *play around*, to engage in an exploratory behavior, as no method whatsoever will lead to faster results if one assumes the absolute opacity of the black box. The epistemology of the black box and that of play and random experimentation in affective object relationships are intricately connected. Ashby presents the scenario of a black box "which might be something, say, that has just fallen from a Flying Saucer" (Ashby 1956: 87). An experimenter treats it with several different inputs and protocols the observed outputs. Following the description of this procedure, Ashby feels it necessary to include a paragraph addressed to the reader missing a methodical approach:

> It will be noticed that nothing has been said about the skill of the experimenter in manipulating the input. The omission was deliberate, for no skill is called for! We are assuming, remember, that nothing is known about the Box, and when this is so the method of making merely random variations (e.g. guided by throws of a die) on the input-switches is as defensible as any other method, for no facts yet exist that could be appealed to as justification for preferring any particular method (ibid.: 89).

The Dutch anthropologist, biologist and psychologist Frederik J. J. Buytendijk – who counts as one of the main protagonists of cybernetic anthropology (cf. Rieger 2003: 189) – has stated as early as 1933 that play is essentially a dynamic reciprocating motion: "Every act of play starts with a movement whose consequences are not entirely predictable, which carries in it a surprising element." (Buytendijk 1933: 116, translation by the author). This means for the "object of play": "[It] does not have the character of an intellectually defined object, it is not a What, but a How, that is constituted in the circular process of allurement and its answer, of moving and being moved, be it that the player does not know of this becoming" (ibid.: 132, translation by the author). Buytendijk's modeling anticipates the cybernetic principles of feedback loops and control systems that equally require an input that is subsequently modified in reaction to the observable state of the system. Ignorance is the reverse side of the coin of this epistemology as nothing is nor needs to be known about the content of the black box or play-other.

What Ashby and Buytendijk before him are describing is essentially the situation that many so-called end-users, and to a lesser extent even software designers and hardware engineers, are initially confronted with when dealing with personal media and their applications. The artifact appears as a plain, black surface with no discernible features, apps are just an icon on the screen that launch a separate interface. The first contact will usually be one of random experimentation, i.e. touching the device, shaking it, using more than one finger at the same time, pinching, wiping, tapping, etc. The marketing of personal media and their NUI draws heavily on the image of the innocent and naïve user who intuitively learns to handle a device without prior knowledge – just as a child would explore an unknown environment.[9] When an interaction is supposed to be 'natural' and thus self-explanatory, it is designed to fit in with users' everyday environments and (mostly learned) routines of behavior. This attitude is profoundly anti-hermeneutic as it simply doesn't seem important to understand what lies behind or under the observed phenomena – what counts is what you can do with it. Recent interface innovations in the areas of touchscreen displays, voice control and gesture recognition thus actually increase the distance between human and computer on the level of logical operations while simultaneously presenting a new experiential 'immediacy' of interaction.

The liberation from cognitive ballast apparent in current human-computer interfaces, specifically in the area of personal media, yields highly productive outcomes. Reduced to a position of ignorance, the user is denied any systematic or analytic possibility of understanding (there is no easy way to access a command

line on an iPhone, let alone to trace the production path of the device itself). The user's position indeed resembles a child-like impartiality with all its drawbacks, but it would be a fallacy to ignore the creative potentials this specific stance entails. The act of blackboxing, i.e. of withdrawing insight, paradoxically animates users to experiment freely and explore aesthetic or playful practices. A becoming-child of the user can reasonably be condemned as infantilization, but it might also indicate an epistemology of ignorance and thus a generative mechanism.[10] The black box does not so much interest as a *cipher* to be decoded, but rather as a *function* which is defined by its inputs and outputs alone (cf. Galloway 2011: 273). Kittler himself has admitted that desirable – at least to him – "*synergies between man and machine*" do not necessarily entail the opening of casings but definitely a "playing with all buttons" (Kittler 1989: 111f., translation by the author). In Hartmut Winkler's reading, this points to a changing and still somewhat diffuse standpoint of critical theory: "not to take an outside perspective towards the machines, but instead to think with the hands and to fathom the black boxes in practical manipulation" (Winkler 2003: 223, translation by the author).[11]

The concept of epistemologies of ignorance can be helpful to understand the way in which the systematic invisibilization and/or trivialization of certain components and features of personal media acts both as an enabler of practices as well as a precaution against undesirable interventions. While an epistemology of ignorance might in fact be the working principle of consumerist capitalism in general, in the area of interfaces it seems to apply especially well.[12] An integrated system of practices, beliefs and technologies depends for its stability on widespread, and at times self-inflicted, ignorance concerning some of its qualities; in fact, it can only function according to the extent that ignorance is sufficiently embodied in its participants. In the context of the media literacy debate, for example, the argument is common that children and teenagers are much more skilled inhabitants of the contemporary media ecology (so-called 'digital natives'), so that the older generations may learn from them how to handle interfaces and to be productive with digital media. This is only true to the extent that a significant degree of ignorance is taken into account regarding the ways media are embedded in wider social and ecological frames and technical infrastructures. In this respect, theoretical work is sought for that is able to nurture the potentials of a hands-on, practical – but, to an extent, ignorant – approach towards digital technology, but on the other hand can resume the work of deconstruction by pointing to the sites where problematic processes of blackboxing continue to occur.

Invisible Media Ecologies and Mobile Playscapes – Examples

In this section, several phenomena are discussed that make evident how both Anders' analysis (antiquatedness of appearance) and Blumenberg's (gainful waiver of sense) can be applied to the description of personal media, i.e. Internet-capable,

digital communication technologies. Of course, both authors drew on different technological objects to make their observations, but the connected portable microcomputer is suited especially well to this kind of analysis. Personal media are

1) marked by a deep discrepancy between appearance and capacities – the perceptible form and apparently trivial interfaces do not allow any conclusions about programming, production circumstances, conflicting agencies bundled into the device, etc.;

2) very easy to use because many layers of complexity have been removed from the interface, which makes them relevant in everyday use and allows people without expert knowledge to achieve considerable successes.

Two examples shall be provided for the systematic divergence between the general capacities of material production and the cognitive and emotional comprehension of the artifacts resulting from it. Issues of e-waste – most notably due to planned obsolescence, which, for Anders, is an indication of "ruthlessness" (Anders 1980/2002: 40) towards the serial product that is "born to die" (ibid.: 38, both translations T. K.) as the industry demands a minimization of the intervals of consumption – and precarious labor conditions (cf. Taffel 2012) systematically evade attention insofar as they form the backbone of the personal media infrastructure without having a proper representation inside the system. Instead, the discourse of virtuality and immaterialization surrounding the early explorations of cyberspace and virtual reality in the 1990s is carried on today in pieces of hardware that seem to work "as if by magic" (Cannon & Barker 2012: 73). The suggestive immediacy and weightlessness of accessing content by the touch of a fingertip finds its cruel counterpart in an economy of exploitation that leads to Foxconn workers in Shenzhen to literally lose their fingertips in the process of electronics manufacturing (cf. Qiu 2012). As Christian Dries has pointed out, "our mobile companions are not only made of metal and plastic, but also of blood and turn out to be monsters in a moral sense" (Dries 2009: 96, translation by the author). This invisibilization of infrastructures of production and disposal certainly is not specific to personal media but it contrasts rather sharply with their suggestive handiness and trivial appearance.

On another level, the seemingly trivial everyday devices are more than they seem to be, when one takes into account their incorporation into a technical network infrastructure. Every smartphone is a potential tracker, a circumstance which has initiated some debate about a renaming of the devices to raise awareness for this fact (cf. Maass & Rajagopalan 2012). Data traffic with cloud services, and even mundane mobile gaming offers opportunities for location-specific targeted advertising and corporate or state surveillance via GPS. Long-term self-experiments have pointed to the ubiquity of profiling and the emergence of a "data self" (Loebel 2013: 159) that consists of everyday routines and habits that are typically not readily available to an individual consciousness – but can be made visible by automatic tracking and analysis. Again, a wide gulf seems to separate

device appearance and behind-the-scenes processuality. A trivial ontological attitude – which would attempt to describe the world as it is given to an independent outside observer (cf. Hörl 2010: 59f.) – ironically finds its limits facing seemingly trivial objects of observation.

On the other hand, we can find many examples for an unfolding of mobile playscapes with personal media, i.e. practices of play and exploration that are dependent on blackboxing complexity. These practices rely on an intentional superficiality of engagement and to an extent on a deliberate not-wanting-to-know about technical specifics, to a much greater degree than even in the case of the graphical user interface. The *Instagram* photo editing app for example allows users to simply add filter effects to pictures taken with the cameras of their devices. It is essentially a stripped-down *Photoshop* with pre-selected options and an easy-to-use interface. Professional photographers are horrified by its banality (cf. Bevan 2012, who calls Instagram filters the "antithesis of creativity"), while amateurs like it for basically the same reason. The arguments here often center on the traditional craftsmanship of good photography, on the authenticity of 'real' vintage photos against stylized nostalgia filters, and the value of photography as an art form. In the meantime, millions of amateur photographers are experimenting with new ways to aestheticize their everyday experience by finding unusual angles, editing shots and sharing them on the Internet. *Wired* editor Clive Thompson calls it "The Instagram Effect" (Thompson 2011). He summarizes: "I find it a lovely moment. Today's tech is often blamed for producing a generation of people who stare at screens. But sometimes it opens up a new window on the world" (ibid.).[13]

Additionally and again on a very different level, the possibility to play around, the "production of a cellular playscape", as Michal Daliot-Bul puts it in her case study of "Japan's mobile technoculture" (Daliot-Bul 2007), is marking a "cultural shift" (ibid.: 968) towards a consumption-oriented, hedonistic and aestheticized lifestyle. "In the keitai [Japanese term for mobile phone] cultural environment, playfulness has come to be the civilizing matrix of multimedia consumption that develops in play-form" (ibid.: 966).[14] A specific trajectory of this shift lies in a construction of personal media as intimate companions and playmates in everyday life (cf. ibid.: 955). This is evident in the various appropriative strategies applied mainly but not exclusively in youth cultures:

> With a variety of hand straps; cute, attachable mini-dolls and cartoon characters; funny, illuminating antennae; carrying bags; 3D stickers to cover up the mouthpiece; full-body stickers; screen holograms; and handmade painting on customer demand, mobile phones became a fashion item of complex and excessive signs play (ibid.: 957).

By playing with personal media, an altered human-technology relation ensues: The devices and their affordances are interpreted more in categories of sociality and affectivity and less in functional terms (i.e. as tools for specific purposes). The *transparency* (in the sense introduced above) of the technical components

increases this effect, as it raises cognitive barriers that stimulate alternative schemata of interpretation.[15] Again, practices of appropriation are not exclusive to personal media – the example from Japan uses regular mobile phones. However, miniaturized computers in their character as black boxes both offer themselves to creative domestications as well as resist them to some extent. They are open to various uses, not restricted to a single function, which also means that the range of possible uses always transcends an individual user's scope.

That personal media in the sense used here have to be understood in the genealogy of personal computers provides a further explanation for their increasing integration into practices of play and lifestyle. John M. Roberts and Brian Sutton-Smith have argued that the dominant technologies of a given historical epoch are regularly taken up in its preferred play-forms (cf. Roberts & Sutton-Smith 1962). Especially technical solutions that have been developed out of a calculus of labor efficiency are often simultaneously used as toys. Roberts and Sutton-Smith call their approach *conflict enculturation theory* and state that during play symbolic solutions are sought for socially relevant conflicts. For example, in times of automation, gambling machines begin to get very popular among the working class. Similarly, computers are reappropriated as personal affective technologies for leisure activities by today's office workers and the so-called 'Creative Class' (cf. Florida 2002). The fact that computers came to be seen as *personal* technologies at all can in fact be traced back to countercultural efforts in the 1960s and 70s that formed precisely as a protest against the military-industrial complex and the supposedly dehumanizing effects of anonymous computing machines. Decisive in this respect were the non-hierarchic networking and collaborative practices around the *Whole Earth Catalog* that, as Fred Turner has shown, have paved the way for the Internet, virtual communities, social networks and – somewhat ironically – neoliberal ideals of self-management and flexible labor (cf. Turner 2006).

Conclusion

This contribution has aimed at outlining the contours and genealogy of a debate around contemporary personal media that is often ideologically entrenched. On the one hand, the position of elitist critique is not primarily concerned with practical uses and gratifications, but operates according to an imperative of remorseless debunking.[16] On the other hand, discourses of affirmative technophilia (as stereotypically represented in the writings of *Wired* magazine) are not interested in the actual and potential ramifications of personal media practices and materialities but prefer to stress their accessibility along with their economic promise. It was proposed to understand personal media as part of a productive epistemology of ignorance, i.e. to acknowledge that they draw much of their appeal from what one does *not* know about them. This is not to say that to avoid potential complicities, one should refrain from using such devices altogether as radical abstainers or lud-

dites might demand. Rather, the foremost task in theoretically describing personal media and their impact not only on users' lives but also on the whole system of exchanges and interactions in which they are embedded can only be to acknowledge their potentials while pointing to their entanglements at various sites of agency.

Established research like the digital materialism approach (cf. Manovich 2001) and software studies (cf. Fuller 2008) offer building blocks to a critical theory that does not eschew the confrontation with devices in everyday – trivial – contexts of use. More recently, investigations into a general ecology of media and technology have pointed to the necessity of a radically environmental thinking to understand the current technological condition (cf. Hörl 2011). Jussi Parikka, for example, has contributed to the debates around new materialism by extending the scope of media materiality to include rocks, chemicals and the like (cf. Parikka 2012): "Indeed, materiality is not just machines; nor is it just solids, and things, or even objects. Materiality leaks in many directions, as electronic waste demonstrates, or the effects of electromagnetic pollution. It is transformational, ecological, and multiscalar" (ibid.: 86). As artifacts, personal media are part of several frames of reference, some of which are obvious to human observers, some not, but all are part of the same (material) reality. Thus, the study of digital media might profit from taking into account the existence of an epistemology of ignorance at work at the heart of its subject matter that privileges certain forms of materiality and excludes others as irrelevant. By referring to Anders' radically interpretative approach, I want to suggest that a "hermeneutics of technology" (Winkler 2003: 224, translation by the author) becomes a complementary – if somewhat defiant – option to study digital media. Such an approach would have to systematically transcend perceptual evidences – not by theoretical speculation but by acknowledging the existence of agencies outside the human frame of reference. The question remains where the critique is headed. Whereas Flusser was still optimistic about the possibilities of illuminating the black box (cf. Flusser 1983/1994: 15), from today's perspective on "scalar entanglement" (Taffel 2013), it is very likely that we're dealing with black boxes all the way down – so that opening one will always lead to multiple others.

Timo Kaerlein is a doctoral researcher in the DFG-funded Research Training Group 'Automatisms' at the University of Paderborn (Germany). His research interests include media theory, digital culture, personal/mobile media, cultural theory of play, science and technology studies. The current work focuses on automatisms in interface design and practices of appropriation of personal media. E-mail: t.kaerlein@gmx.de.

Notes

[1] Personal media are here understood as Internet-capable, portable microcomputers in various shapes (often attuned to their wearers' bodies) that currently happen to converge with mobile telephones – leading to the development of so-called 'smart' phones. There is no indication that this encounter of computing and personal telecommunications technologies is the last step of an ongoing development. Projects undertaken in wearable computing (Google Glass, Smartwatch, etc.) seem to point to a future of an ever closer integration of human body and computing devices.

[2] The so-called maker's bill of rights can be found at http://makezine.com/04/ownyourown/ [Accessed 19 February 2013] (originally published in Make Magazine in 2006). The regressive potential of the current generation of personal media has repeatedly been described in expert and press discourses on media interfaces, particularly "Apple's most recent interfaces and ad campaigns have cultivated an attitude of childlike wonder on the part of its consumer base, in part by shrewdly maintaining an atmosphere of mystery and magic surrounding the product and its inner workings" (Cannon & Barker 2012: 73).

[3] The term "epistemology of ignorance" is also used in critical race studies, but adapted here for the context of media technologies, as will be made clear later. Charles Mills, who coined the term in 1997, summarizes it as such: "Thus in effect, on matters related to race, the Racial Contract prescribes for its signatories an inverted epistemology, an epistemology of ignorance, a particular pattern of localized and global cognitive dysfunctions (which are psychologically and socially functional), producing the ironic outcome that whites will in general be unable to understand the world they themselves have made" (Mills 1997: 18).

[4] *Interface* does not only denote the "symbolic handles, which […] make software accessible to users" but also the points of juncture between software, data and hardware and even between different hardware components of a system or network. Thus, "[c]omputer programs can be seen as tactical constraints of the total possible uses of hardware" (Cramer & Fuller 2008: 149).

[5] The term (media) ecology is used here in the sense introduced by Matthew Fuller and Jussi Parikka, among others. "Ecology comprises the study of patterns of interconnection, interaction, and transferences of energy between agents involved in complex networks featuring living and non-living nodes, exploring how different parts of the global household relate to one another" (Taffel 2013). Usage of the term is thus not limited to living ecosystems, but it comprises multiple entangled scales of materiality, stretching across content, software, and hardware in the case of media ecologies.

[6] The term 'handiness' or 'readiness-to-hand' is used by Martin Heidegger to denote the way in which objects that belong to the human lifeworld are usually approached – with a view to their use and effectiveness and without much thinking about the object in its quality of being a thing in its own. Incidentally, the word 'Handy' is used in the German language as a colloquial term for mobile phones.

[7] Husserl's example is geometry, which stems from an idealization of bodily measures, but consequentially becomes a pure method, "a purely technical handling of the inherited tool" (Blumenberg 1963/2009: 31, translation by the author).

[8] Knorr Cetina explicitly differentiates objects of knowledge from the closed boxes of ready-to-hand tools and consumer products (cf. Knorr Cetina 1997: 12). In my view, the distinction is not so sharp as blackboxing is often the prerequisite of new potentialities that arise out of a reduction of complexity of constituent parts.

[9] This imagery has forerunners in graphical user interfaces for the personal computer. One major selling point of these metaphorical environments was their inclusion of audiences lacking technical knowledge about computers. Personal media ubiquitize this tendency and enhance it by new interaction modalities.

[10] Furthermore, especially the mobile (smart) phone as the prime example of personal media has been described as a transitional object in the terms of Winnicott's psychoanalytic object relations theory (cf. Winnicott 1971 and Ribak 2009). This more or less metaphorical adoption points to the possible function of personal media in parent-teen interrelationships, but also to their connection with creativity, play and the creation of protected spaces of experimentation. Whereas transitional objects thus play an important role in socialization, the reference also underlines their immense regressive potential.

[11] Winkler's reflection resonates with Galloway's question about which allegory of critique might be adequate if opening or decoding the black box does not seem to be a viable option anymore (cf. Galloway 2011: 274). Galloway does not arrive at a convincing answer, but speculates that it might be about (re-)programming the black boxes, i.e. taking them as a given and manipulating them on the surface.

[12] Here, one can begin to speculate if the formal properties of a blackboxed commodity in general equally invite a process of mystification as well as an urge to unmask and profane the object. (At least) two stances seem systematically possible, sometimes even simultaneously: 1. the construction of symbolic meanings complementing its trivial appearance – Marx famously calls this the "[f]etishism of commodities" (Marx 1867/1887: 46), and 2. the desire to radically deconstruct those phantasms and reduce the object to its undisputed materiality. I thank Dominik Maeder for the suggestion. It has to be noted though that Marx' approach is somewhat at odds with Anders' position, when the former suggests that some symbolic idealization is inevitably attached to the products of human labor and thus makes them seem more than they are as judged from their use value. They attain the hybrid character of "social things whose qualities are at the same time perceptible and imperceptible by the senses" (ibid.: 47). When Anders argues that the technical apparatuses "seem to be less than they are" (Anders 1980/2002: 34f.), he is thus focusing on the insufficient perceptibility of societal value relations. The process of fetishistic elevation and the outdatedness of appearance can be read as two sides of the same story (which can be exemplified in the Apple kind of techno-fetishism where a rather minimalist design is combined with cultic idealization).

[13] His impartiality is somewhat compromised by the special feature on iPhone lenses a few pages later that are praised as a "must-have for Instagram addicts" (ibid.).

[14] The argument here goes back to Huizinga's classic, if idealized account of play as a vector of cultural developments (cf. Huizinga 1938).

[15] This is especially evident in the interaction with robotic toys and similar "relational artifacts" where, as Sherry Turkle has argued, virtual companionship offers the rewards of an intimate relationship without the demands of actual friendship. Cf. Turkle 2011.

[16] Winthrop-Young attests Kittler an attitude of debunking, i.e. of relentlessly reducing philosophical debate to the factual matter of technology (cf. Winthrop-Young 2005: 68-70).

References

Anders, Günther (1956/2010): *Die Antiquiertheit des Menschen 1: Über die Seele im Zeitalter der zweiten industriellen Revolution*, 3rd ed., München: Beck.

------ (1980/2002): *Die Antiquiertheit des Menschen 2: Über die Zerstörung des Lebens im Zeitalter der dritten industriellen Revolution*, 3rd ed., München: Beck.

------ (1981/2003): *Die atomare Drohung: Radikale Überlegungen zum atomaren Zeitalter*, 7th ed., München: Beck.

Ashby, W. Ross (1956): *An Introduction to Cybernetics*, London: Chapman & Hall.

Bevan, Kate (2013): "Instagram is Debasing Real Photography", *theguardian*, 19 July 2012: http://www.guardian.co.uk/technology/2012/jul/19/instagram-debasing-real-photography (accessed 01 July 2013).

Blumenberg, Hans (1963/2009): "Lebenswelt und Technisierung unter Aspekten der Phänomenologie", *Wirklichkeiten in denen wir leben: Aufsätze und eine Rede*, Stuttgart: Reclam, 7–54.

Buytendijk, Frederik J. J. (1933): *Wesen und Sinn des Spiels. Das Spielen des Menschen und der Tiere als Erscheinungsform der Lebenstriebe*, Berlin: Wolff.

Böhme, Hartmut (2006): *Fetischismus und Kultur: Eine andere Theorie der Moderne*. Reinbek bei Hamburg: Rowohlt.

Cannon, Kristopher L. & Jennifer M. Barker (2012): "Hard Candy", Pelle Snickars & Patrick Vonderau (eds.): *Moving data: The iPhone and the Future of Media*, New York: Columbia University Press, 73–88.

Cramer, Florian & Matthew Fuller (2008):"Interface", Matthew Fuller (ed.): *Software Studies: A Lexicon*, Cambridge, MA & London: MIT Press, 149-53.

Daliot-Bul, Michal (2007): "Japan's Mobile Technoculture: The Production of a Cellular Playscape and its Cultural Implications", *Media, Culture & Society*, 29:6, 954-71.

Doctorow, Cory (2010): "Why I Won't Buy an iPad (And Think You Shouldn't, Either)", *Gizmodo*, 4 February 2010: http://gizmodo.com/5508130/why-i-wont-buy-an-ipad-and-think-you-shouldnt-either (accessed 19 February 2013).

------ (2011): "The Coming War on General Computation", *28C3*, Berlin, Germany 27-30 December: https://github.com/jwise/28c3-doctorow/blob/master/transcript.md (accessed 19 February 2013).

Dries, Christian (2009): *Günther Anders*, Paderborn: Fink.

Ellul, Jacques (1954/1964): *The Technological Society*, New York: Vintage Books.

Florida, Richard (2002): *The Rise of the Creative Class: And How it's Transforming Work, Leisure, Community and Everyday Life*, New York: Perseus Book Group.

Flusser, Vilém (1983/1994): *Für eine Philosophie der Fotografie*, 7th edition, Göttingen: European Photography.

Fuller, Matthew (ed.) (2008): *Software Studies: A Lexicon*, Cambridge, MA & London: MIT Press.

Galloway, Alexander R. (2011): "Black Box, Schwarzer Block", Erich Hörl (ed.): *Die technologische Bedingung: Beiträge zur Beschreibung der technischen Welt*, Berlin: Suhrkamp, 267-280.

Glanville, Ranulph (1982): "Inside Every White Box There Are Two Black Boxes Trying To Get Out", *Behavioral Science*, 27: 1-11.

Goggin, Gerard (2012): "The iPhone and Communication", Larissa Hjorth, Jean Burgess & Ingrid Richardson (eds): *Studying Mobile Media: Cultural Technologies, Mobile Communication, and the iPhone*, New York: Routledge, 11–27.

Hilgers, Philipp von (2010): "Ursprünge der Black Box", Ana Ofak & Philipp von Hilgers (eds): *Rekursionen: Von Faltungen des Wissens*, München: Fink, 135-53.

Hörl, Erich (2010): "Abendländische Rekursionen. Luhmann und die Faszinationsgeschichte der nichttrivialen Maschine", Ana Ofak & Philipp von Hilgers (eds.): *Rekursionen: Von Faltungen des Wissens*, München: Fink, 51–75.

------ (ed.) (2011): *Die technologische Bedingung: Beiträge zur Beschreibung der technischen Welt*, Berlin: Suhrkamp.

Huizinga, Johan (1940): *Homo ludens: Versuch einer Bestimmung des Spielelementes der Kultur*, 3rd ed., Amsterdam: Pantheon.

Jacob, Robert J.K., Audrey Girouard, Leanne M. Hirshfield, Michael S. Horn, Orit Shaer, Erin Treacy Solovey & Jamie Zigelbaum (2008): "Reality-Based Interaction: A Framework for Post-WIMP Interfaces", Margaret Burnett (ed.): *The 26th Annual CHI Conference on Human Factors in Computing Systems, CHI 2008: Conference proceedings ; April 5-10, 2008 in Florence, Italy*, New York: ACM.

Kaerlein, Timo (2012): "Aporias of the Touchscreen. On the Promises and Failures of a Ubiquitous Technology", *NECSUS European Journal of Media Studies*, Autumn Issue:

http://www.necsus-ejms.org/aporias-of-the-touchscreen-on-the-promises-and-perils-of-a-ubiquitous-technology/ (accessed 19 February 2013).

Kittler, Friedrich (1991): "Protected Mode",*Draculas Vermächtnis: Technische Schriften* (1993), Leipzig: Reclam, 208-24.

------ (1993): "Es gibt keine Software", *Draculas Vermächtnis: Technische Schriften*, Leipzig: Reclam, 225-45.

------ (1989): "Synergie von Mensch und Maschine. Friedrich Kittler im Gespräch mit Florian Rötzer", *Kunstforum International No.* 98, 108-17.

Knorr Cetina, Karin (1997): "Sociality with Objects. Social Relations in Postsocial Knowledge Societies", *Theory, Culture & Society*, 14:4, 1-30.

Latour, Bruno (1999): *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge, MA & London: Harvard University Press.

Liessmann, Konrad Paul (2002): *Günther Anders: Philosophieren im Zeitalter der technologischen Revolutionen*, München: Beck.

Loebel, Jens-Martin (2013): "Privacy is Dead. Eine Fünf-Jahres-Selbstversuch der bewussten Ortsbestimmung mittels GPS", Hannelore Bublitz, Irina Kaldrack, Theo Röhle & Mirna Zeman (eds.): *Automatismen - Selbst-Technologien*, München: Fink, 143-63.

Maass, Peter & Megha Rajagopolan (2012): "That's No Phone. That's My Tracker", *New York Times*, 13 July 2012: http://www.nytimes.com/2012/07/15/sunday-review/thats-not-my-phone-its-my-tracker.html?_r=0 (accessed 19 February 2013).

Manovich, Lev (2001): *The Language of New Media*, Cambridge, MA: MIT Press.

Marcuse, Herbert (1964): *One-Dimensional Man*, Boston: Beacon Press.

Marx, Karl (1867/1887): *Capital: A Critique of Political Economy. Volume 1, Book One: The Process of Production of Capital*. Translated from German by Samuel Moore and Edward Aveling, Moscow: Progress Publishers.

Mills, Charles W. (1997): *The Racial Contract*, Ithaca, NY/London: Cornell University Press.

Morley, David (2007): *Media, Modernity and Technology: The Geography of the New*, London: Routledge.

Müggenburg, Jan & Claus Pias (2013): "Blöde Sklaven oder lebhafte Artefakte? Eine Debatte der 1960er Jahre", Hannelore Bublitz, Irina Kaldrack, Theo Röhle & Mirna Zeman (eds.): *Automatismen - Selbst-Technologien*, München: Fink, 45–69.

Müller-Prove, Matthias (2011): "Zurück in die Kindheit – Infantilisierung im UI Design", *Hyper-Kult XX*, Lüneburg, Germany 7-9 July: http://www.mprove.de/script/11/hyperkult/index.html (accessed 19 February 2013).

Mumford, Lewis (1967)*: The Myth of the Machine: Technics and Human Development*, New York: Harcourt Brace Jovanovich.

Parikka, Jussi (2012): "New Materialism of Dust", Jamie Allen (coord.), "The Matter with the Media", *Artnodes*, 12, 83-88: http://artnodes.uoc.edu/ojs/index.php/artnodes/article/view/n12-parikka/n12-parikka-en (accessed 19 February 2013).

Qiu, Jack Linchuan (2012): "Network Labor. Beyond the Shadow of Foxconn", Larissa Hjorth, Jean Burgess & Ingrid Richardson (eds): *Studying Mobile Media: Cultural Technologies, Mobile Communication, and the iPhone*, New York: Routledge, 173-89.

Ribak, Rivka (2009): "Remote Control, Umbilical Cord and Beyond: The Mobile Phone as a Transitional Object", *British Journal of Developmental Psychology*, 27, 183-96.

Rieger, Stefan (2003): *Kybernetische Anthropologie: Eine Geschichte der Virtualität*, Frankfurt: Suhrkamp.

Roberts, John M. & Brian Sutton-Smith (1962): "Child Training and Game Involvement", *Ethology*, 1:2, 166-185.

Thompson, Clive (2011): "Clive Thompson on the Instagram Effect", *Wired*, December 27 2011: http://www.wired.com/magazine/2011/12/st_thompson_instagram/ (accessed 19 February 2013).

Taffel, Sy (2013): "Escaping Attention: Digital Media Hardware, Materiality and Ecological Cost", *Culture Machine*, 13: http://www.culturemachine.net/index.php/cm/article/view/468/487 (accessed 19 February 2013).

------ (2013): "Scalar Entanglement in Digital Media Ecologies", *NECSUS European Journal of Media Studies*, # 3 Spring_2013: 'Green': http://www.necsus-ejms.org/scalar-entanglement-in-digital-media-ecologies/ (accessed 28 June 2013).

Turkle, Sherry (2011): *Alone Together: Why we Expect More from Technology and Less from Each Other*, New York: Basic Books.

Turner, Fred (2006): *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*, Chicago: University of Chicago Press.

Weber, Jutta (2011): "Die kontrollierte Simulation der Unkontrollierbarkeit. Kontroll- und Wissensformen in der Technowissenschaftskultur", Hannelore Bublitz, Irina Kaldrack, Theo Röhle & Hartmut Winkler (eds): *Unsichtbare Hände: Automatismen in Medien- Technik- und Diskursgeschichte*, Paderborn: Fink, 93–110.

Winthrop-Young, Geoffrey (2005): *Friedrich Kittler zur Einführung*, Hamburg: Junius.

Wigdor, Daniel & Dennis Wixon (2011): *Brave NUI World: Designing Natural User Interfaces for Touch and Gesture*, Amsterdam: Morgan Kaufmann/Elsevier.

Winkler, Hartmut (2003): "Flogging a Dead Horse? Zum Begriff der Ideologie in der Apparatusdebatte bei Bolz und bei Kittler", Robert F. Riesinger (ed.): *Der kinematographische Apparat: Geschichte und Gegenwart einer interdisziplinären Debatte*, Münster: Nodus, 217-35.

Winner, Langdon (1980): "Do Artifacts Have Politics?", *Daedalus*, 109:1, 121-136.

Winnicott, Donald W. (1971): *Playing and Reality*, London: Tavistock Publications.