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Carrying Computerization
Interfaces, Operations, Depresentations

Indispensable and Invisible[1]

Interaction is dismissed. In the end of 2016 the cover of the *Interactions* magazine, published by the Association for Computing Machinery since 1994, crossed out the last word in human computer interaction and replaced it with *integration*. The "era of human-computer interaction", the cover story stated, "is giving way to the era of human-computer integration – integration in the broad sense of a partnership or symbiotic relationship in which humans and software act with autonomy, giving rise to patterns of behavior that must be considered holistically" (fig. 1).[2] After a summary how "the nature of our interaction has continuously evolved" from "switches, cards, and tape to typing, mice, and styluses, adding speech and gesture"[3] and a forecast on "brainwave interaction"[4] (recalling Vannevar Bush's thoughts on "a couple of electrodes on the skull"[5]), the most interesting question was raised:

We can see these changes, but the most dramatic change affecting human-computer interaction was invisible: what the computer does when we are not interacting with it.[6]

This correlation between integration, (autonomous) activity and hiddenness was accompanied by another marketing-related connection between computers and invisibility, published at the same time. The international video campaign "Feel connected all over Europe" of the German telecommunications company Deutsche Telekom presented the singer Andrea Bocelli praising what is called laconically the network: "It gives me freedom. Reliably wherever I am. It transcends boundaries. It's indispensable and invisible."[7] Bocelli's statements are decorated and elaborated by images of him walking, riding, and boating in several iconic places in Europe (fig. 2). The fact that Andrea Bocelli is blind and that this promotional video about network technology and digitization shows no form of computer technology or infrastructure at all, is important for the message with which

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1 Some parts of this paper have been published in the journal *Cinéma & Cie* (Vol. XVII). I would like to thank the participants and organizers of the workshop "Screen Operations. Conditions of Screen-based Interaction" at Humboldt University Berlin, 2016, for discussions and comments.

2 Umer Farooq, Jonathan Grudin, Human-Computer Integration, in: *Interactions* 23.6 (2016), pp. 27–32, p. 27.
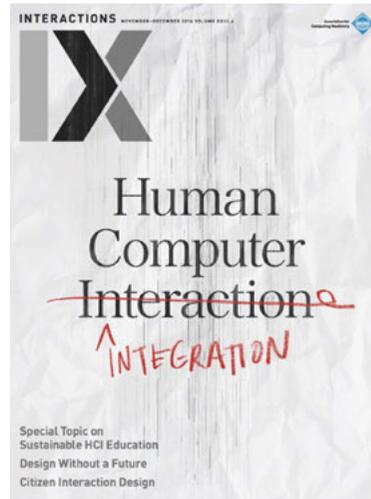
3 Ibid., p. 28.

4 Ibid.

5 Vannevar Bush, As We May Think, in: *The Atlantic Monthly* 176 (1945, https://theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881 (accessed September 20, 2017).

6 Farooq, Grudin 2016 (as fn. 2), p. 28.

7 Serviceplan Group, Telekom Connecting Europe – TV commercial 2016, https://youtube.com/watch?v=6No-bDXIdEE (accessed September 20, 2017).

1   Cover of Interactions, 23/6 (2016). Association for Computing Machinery.

2   Still from Telekom commercial *Feel connected all over Europe*

the video concludes: "The network – it's the present and the future. You can't see it. But you can feel it."[8]

Both contributions to the (inexisting) presence of computers are expressions of an important consilience: On the one hand, the current discussions and developments of concepts like *Ambient Intelligence*, *Internet of Things*, and *Smart Environments* promote the powerful and consequential omnipresence of computers, which is, on the other hand, understood and promoted as indiscernible, unobservable, embedded, and (nonetheless or therefore) effective.[9] A mag-

ical match – (omni-)present and hidden at the same time. From early plans of *Ubiquitous Computing* up to current concepts of "calm" and imbedded technologies the linkage between ubiquity, efficiency, and invisibility is important, especially in concepts and presentations of developers.[10]

One of the most famous examples of the living contradiction of invisibility and readiness-to-hand was given by Steve Jobs' farewell performance as CEO of Apple in San

8   Ibid.
9   "It is still a matter of some debate whether and how interaction designs for or ubicomp culture are to tend towards the transparent and calm invisibility of an infrastructure for interactivity or towards a more personalized, attention-getting, even exciting unfolding, and mediatory laying bare of

potential paths for technocultural interrelations and interactivities." Ulrik Ekman, Individuations, in: Ulrik Ekman, Jay David Bolter, Lily Diaz, Maria Engberg, Morten Søndergaard (eds.), *Ubiquitous Computing, Complexity, and Culture*, New York: Routledge, 2016, pp. 77–90, p. 83.
10   Natascha Adamowsky, Vom Internet zum Internet der Dinge. Die neue Episteme und wir, in: Florian Sprenger, Christoph Engemann (eds.), *Internet der Dinge. Über smarte Objekte, intelligente Umgebungen und die technische Durchdringung der Welt*, Bielefeld: transcript, 2015, pp. 231–265, p. 245.

Francisco on 6 June 2011. Introducing the service iCloud, Jobs illustrated his idea of an autonomous service, for which "I don't even have to take the devices out of my pocket" or "to be near my Mac or PC".[11] Since

> *all these new devices have communications built into them; they can all talk to the cloud whenever they want. [...] And now everything's in sync with me not even having to think about it. [...] [S]o everything happens automatically and there's nothing new to learn. It just all works. It just works.*[12]

Obviously today's interface culture is shaped very much by various forms of interfacing with computers that cannot be reduced to user interfaces, we address by touching or clicking, gestures or voices. N. Katherine Hayles remark, "[m]obile phones, GPS technology, and RFID (radio frequency identification) tags, along with embedded sensors and actuators, have created environments in which physical and virtual realms merge in fluid and seamless ways",[13] sums up some forms of interfaces building and organizing *seamless* processes of connectivity. But this development, mirrored by the term "Post-Interface"[14] and Mark B. N. Hansen's perspective on "twenty-first-century media" ("no longer a delimited temporal object that we engage with focally through an interface such as a screen, media become an

environment that we experience simply by being and acting in space and time"),[15] should not be misunderstood as a disappearance of human computer interfaces or even of interfaces at all.

Interfaces Carry

Why do interfaces matter? Firstly, because the term refers to different modes and processes of connectivity that ensure the functionality of (all forms of) digital computers in the first place. It is important to remember that the term *interface*, introduced by the physicists James and William Thomson in late 19th century, was originally used to describe the transmission of energy.[16] Their usage of the term "would define and separate areas of unequal energy distribution within a fluid in motion, whether this difference is given in terms of velocity, viscosity, directionality of flow, kinetic form, pressure, density, temperature, or any combination of these".[17] With this in mind, the question of the pursued ubiquity and networked embeddedness of computing, relying basically on transportation of signals and the carrying of electricity, is inevitably a question of interfaces. The term interface helps to describe the "interior telegraphy" of the computer as well as all forms of its networks, its relations to us and its incorporations.[18] Hence, the ongoing development

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11 EverySteveJobsVideo, Steve Jobs introduces iCloud & iOS 5 – WWDC (2011), https://youtube.com/watch?v=gfj7UgCMsqs (accessed September 20, 2017).

12 Ibid.

13 N. Katherine Hayles, Cybernetics, in: W. J. T. Mitchell, Mark B. N. Hansen (eds.), *Critical Terms for Media Studies*, Chicago: University of Chicago Press, 2010, pp. 145–156, p. 148.

14 Michael Andreas, Dawid Kasprowicz, Stefan Rieger, Technik | Intimität. Einleitung in den Schwerpunkt, in: *Zeitschrift für Medienwissenschaft* 15 (2016), pp. 10–17, p. 12.

15 Mark B. N. Hansen, Ubiquitous Sensation. Towards an Atmospheric, Impersonal and Mircotemporal Media, in: Ulrik Ekman (ed.), *Throughout. Art and Culture Emerging With Ubiquitous Computing*, Cambridge: MIT Press, 2013, pp. 63–88, p. 73.

16 See Peter Schaefer, Interface. History of a Concept, 1868–1888, in: David W. Park, Nicholas W. Jankowski, Steve Jones (eds.), *The Long History of New Media. Technology, Historiography, and Contextualizing Newness*, New York: Peter Lang, 2011, pp. 163–175.

17 Branden Hookway, *Interfaces*, Cambridge: MIT Press, 2014, p. 59.

18 Hartmut Winkler, *Prozessieren. Die dritte, vernachlässigte Medienfunktion*, Munich: Fink, 2015, p. 294.

of an increasingly hidden dissemination, interconnection, and implementation of computers cannot be understood without asking about interface processes.[19]

Graphical user interfaces are but one of the multilayered aspects characterizing interfaces in terms of digital computing. These "symbolic handles", as Florian Cramer and Matthew Fuller have called them, "which [...] make software accessible to users" depend on and are connected to other interface aspects and processes, such as hardware connecting humans/bodies to hardware, hardware connecting hardware to hardware, software connecting software to hardware, and software providing software to software connections.[20]

Secondly, our encounter with computers in all its forms by use of programmed and designed user interfaces is not superseded but accompanied by "pervasive" and "ubiquitous" computing that Ulrik Ekman has described as "a sociocultural *and* technical thrust to integrate and/or embed computing pervasively, to have information processing thoroughly integrated with or embedded into everyday objects and activities, including those pertaining to human bodies and their parts".[21] Mark B. N. Hansen's description of the "experiential shift" by "twenty-first-century media" depicts the diversity of interconnected interface politics:

> *Thus, well before we even begin to use our smart phones in active and passive ways, the physical devices we carry with us interface in complex ways with cell*

towers and satellite networks; and preparatory to our using our digital devices or our laptops to communicate or to acquire information, the latter engage in complex connections with wireless routers and network hosts.[22]

While these devices are constantly and so-called calmly interfacing with networks and servers, we also do use *our smart phones in active ways*, which is why we pay for and update them. Even today, graphical user interfaces are so obviously omnipresent that this manifestation of software is still "often mistaken in media studies for 'interface' as a whole".[23] Screen operations belong to the chief activities in large parts the world; work and leisure activities are increasingly involving screen activities, just as three most popular websites worldwide – Google, YouTube and Facebook – bank on our interactions with their offerings on different kind of screens.[24] Despite this, media studies analyses of common user interfaces are still not common.[25] This must change if we are to better understand of our relationship with (previous, current, and upcoming) forms of computing.

19 "But alongside and interwoven with computational and networked digital media, more than one 'environmental' system of calculation, slipping in and out of direct perception, and the multiple interfaces between them are to be reckoned with." Matthew Fuller, Foreword, in: Ekman 2013 (as fn. 15), pp. xi–xxvi, p. xx.

20 Florian Cramer, Matthew Fuller, Interface, in: Matthew Fuller (ed.), *Software Studies. A Lexicon*, Cambridge: MIT Press, 2008, pp. 149–152, p. 149.

21 Ulrik Ekman, Introduction, in: Ekman 2013 (as fn. 15), pp. 1–59, p. 22.

22 Mark B. N. Hansen, *Feed Forward. On the Future of Twenty-First-Century-Media*, Chicago: University of Chicago Press, 2015, p. 62.

23 Cramer, Fuller 2008 (as fn. 20), p. 149.

24 Alexa web analytics, http://alexa.com/topsites (accessed September 20, 2017).

25 For exceptions, see Matthew Fuller, It looks like you're writing a letter. Microsoft Word, in: Matthew Fuller (ed.), *Behind the Blip. Essays on the Culture of Software*, New York: Autonomedia, 2003, pp. 11–37; Christian Ulrik Andersen, Søren Pold (eds.), *Interface Criticism. Aesthetics Beyond Buttons*, Aarhus: Aarhus University Press, 2011; Margarete Pratschke, Interacting with Images. Toward a History of the Digital Image: The Case of Graphical User Interfaces, in: Horst Bredekamp, Vera Dünkel, Birgit Schneider (eds.), *The Technical Image. A History of Styles in Scientific Imagery*, Chicago: University of Chicago Press, 2015, pp. 48–57; Teresa Martínez Figuerola, Jorge Luis Marzo (eds.), *Interface Politics*, Barcelona: BAU, 2016; Florian Hadler, Joachim Haupt (eds.), *Interface Critique*, Berlin: Kadmos, 2016; Jan Distelmeyer, *Machtzeichen. Anordnungen des Computers*, Berlin: Bertz + Fischer, 2017.

These analyses are necessary because interfaces define today's reality in manifold ways. Understood as the complex of various processes of connectivity and conduction, interfaces do carry – on all levels of its acceptation – the worldwide computerization, in which graphical user interfaces still build the real but underestimated blockbusters of today's visual politics.

Graphical user interfaces inform us (to some extent) of the real and the imaginary, the well-prepared and consequential relations between humans and computers as applied in computers. They mediate interrelations between humans and computers. Studying its interface politics allows for the computer to be realized as a particular "power machine",[26] which enables us to examine a key component of computers and computerized media/things/beings: programmability.

The fact that graphical user interfaces work so differently from, for instance, cinematic or televisual appearances and do inevitably rely on other interface processes between all sorts of hard- and software makes the task of interface analysis and critique so urgent. The example I would like to comment on here is the YouTube interface – those immensely popular conditions with which we upload, search, identify, organize, tag, encounter, and negotiate the occurrence of video material on this second most popular website worldwide. To turn towards these special screen operations, it is important to consider their operative images as depresentations.

Operative Images and Depresentation

The interdependence of aesthetics and dispositifs demands attention be paid to the special status of these images and signs that – to quote a Windows 10 commercial from 2015 – "help you do your thing".[27] Of course, these so-called *computer icons* could likewise be symbolic, depending on the specific interface design. Regardless of the potentially iconic or symbolic character of these images and signs, all clickable or touchable appearances correspond to Peirce's idea of indices.[28] These images and signs must have a physical relation to the somehow presented processes of computing, to the interior telegraphy of the computer. They "show something about things, on account of their being physically connected with them"[29]; otherwise they simply would not work.[30]

Hence, images and videos on YouTube could combine different indexical qualities. Dealing with the YouTube interface by clicking/touching on a video thumbnail offered on the screen or by clicking/touching on a running video to stop or to enlarge it, is an expression of a certain semiotic shift. Because indexicality of these images and videos is no longer only generated by a potential trace to a pre-filmic reality but also by the trace to the interior telegraphy of the networked computer that makes its existence and usage possible. Since we are invited and enabled to interact with these

26 Distelmeyer 2017 (as fn. 25), pp. 82–92.

27 Windows, Windows 10 Highlights Reel, https://youtube.com/watch?v=j-3ZLphVaxkg (accessed September 20, 2017).
28 See Marianne van den Boomen, *Transcoding the Digital. How Metaphors Matter in New Media*, Amsterdam: Institute of Network Cultures, 2014, pp. 37–41.
29 Charles S. Peirce, What is a sign, in: The Peirce Edition Project (ed.), *The Essential Peirce. Selected Philosophical Writings* Volume 2 (1893–1913), Bloomington: Indiana University Press, 1998, pp. 4–10, p. 5.
30 To specify this indexicality, it is helpful to remember the difference between what Peirce called a genuine index and a degenerated index, because graphical user interfaces combine both forms of Peirce's indexicality.
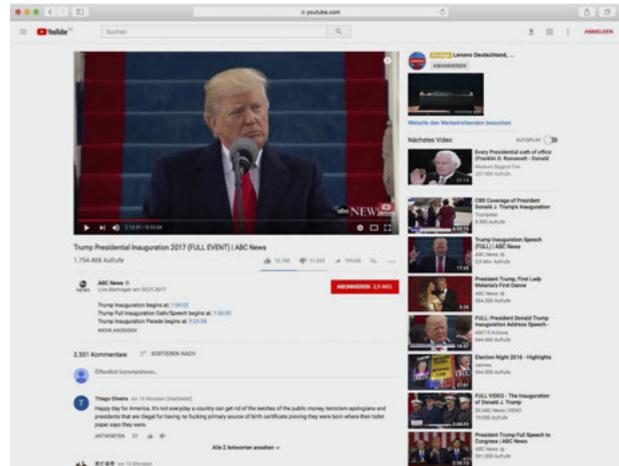
3 Screenshot of the ABC video Trump *Presidential Inauguration* on YouTube.

images, they refer to another realm – to the processuality of my networked computer (fig. 3).

The video *Trump Presidential Inauguration 2017* and its thumbnail image is photographically indexical because of its "physical relation between the object photographed and the image finally created".[31] The additional indexical qualities of the video – which we have learned to stop and continue by clicking/touching on it, as well as of the thumbnail, which we click/touch to select and start the video in the first place – are relying on the programmability of computers. This programmatic indexicality is reliable, because these images and signs "materially refer to an act of executing machine code"[32]: "They refer to existential, physical chains

of causation, to machine processes to be executed in order to yield a specific result."[33]

Graphical user interfaces visualize what the computer offers to do in a particular way without, showing what is actually happening *inside* the machines. "Software, or perhaps more precisely OS," as Wendy Chun has stated, "offer us an imaginary relationship to our hardware: they do not represent the motherboard or other electronic devices but rather desktops, files, and recycling bins."[34] Unsurprisingly the YouTube interface does not represent any of the hardware of the servers or network processes necessary to realize my search request.

Nevertheless at the same time this hardware based relationship offered by software – depresented by symbolic or iconic signs – offers more than just an *imaginary relationship* to the working hardware of the computer, for example, in the form of the motherboard. These clickable or touchable signs are simultaneously linked electronically to the inner processes of the machine, to its interior telegraphy, whose flow of electronic signals connects, among others, the motherboard to the indexical signs of the graphical user interface. In terms of YouTube the click/touch on the offered thumbnail of the video *FULL VIDEO – The Inauguration of Donald J. Trump* instructs the interior telegraphy of my computer to use the exterior and protocol-driven telegraphy of the World Wide Web to stream the requested data. An imaginary and at the same time real and physical relationship enables us to click/touch these images, to start the prom-

31 Tom Gunning, What's the Point of an Index? Or, Faking Photographs, in: *Nordicom Review* 25.1–2 (2004), pp. 39–49, p. 40.
32 van den Boomen 2014 (as fn. 28), p. 40.

33 Ibid.
34 Wendy Hui Kyong Chun, *Control and Freedom. Power and Paranoia in the Age of Fiber Optics*, Cambridge: MIT Press, 2006, p. 20.

ised and hidden algorithmic processes, which is why Frieder Nake calls them "algorithmic images".[35]

The contradictory character of these images and signs has led Marianne van den Boomen to introduce the very fruitful term of depresentation. They show what we can do without showing the "procedural complexity" and the multitude of requirements and consequences attached: "[T]he icons on our desktops do their work by representing an ontologized entity, while depresenting the processual and material complexity involved. This is the way icons manage computer complexity, this is the task we as users (in tacit conjunction with designers) have delegated to them."[36]

To address the special quality of these "symbolic handles",[37] I have discussed them as "operative images", adopting a concept coined by Harun Farocki to describe the production of images by machines for machines.[38] This term – translating "operative Bilder" Farocki has called them "operative images" as well as "operational pictures" and "operational images" – is driven by the interest in processes not represented by these operative images but rather of which operative images are part of themselves.[39] "These are images", Farocki explained, "that do not represent an object, but rather are part of an operation."[40]

Volker Pantenburg has emphasized that operative images "aren't intended to be released separately, and strictly speaking don't need to appear as images at all but emerge as the intermediate product of a wider technical process".[41] Farocki described them as differentiated by purpose: "In my first work on this subject, Eye/Machine (2001), I called such pictures, made neither to entertain nor to inform, 'operative images'."[42] This last point is crucial and marks a productive difference between Farocki's concept and my application of it.[43] Whereas the operative images of a graphical computer interface may not be made for edification, information or instruction in the classical sense ("*Erbauung oder Belehrung*"[44]), they do (and must) instruct users on what can be done. What they instruct and are part of through depresentation is a kind of knowledge about computers, about their usage, and about us – it forms an "implicit memory".[45]

The interdependency with technical execution ("*technischen Vollzug*"[46]) differentiates this form of operativity from others, as for instance the operative imagery, operative writing, and diagrammatic operations of Sybille Krämer's approach to diagrammatology.[47] Operative images as depre-

35 Frieder Nake, The Semiotics Engine. Notes on the History of Algorithmic Images in Europe, in: *Art Journal* 68.1 (2009), pp. 76–89.

36 van den Boomen 2014 (as fn. 28), p. 36.

37 Cramer, Fuller 2008 (as fn. 20), p. 149.

38 See Distelmeyer 2017 (as fn. 25), pp. 92–98.

39 Harun Farocki, Quereinfluss/Weiche Montage, in: Christine Rüffert et. al. (eds.), *Zeitsprünge. Wie Filme Geschichte(n) erzählen*, Berlin: Bertz + Fischer, 2004a, pp. 57–61, p. 61; Harun Farocki, Phantom Images, in: *Public. Art, Culture, Ideas* 29 (2004b), pp. 12–22; http://harunfarocki.de/installations/2000s/2003/eye-machine-iii.html (accessed September 20, 2017).

40 Farocki 2004b (as fn. 39), p. 17.

41 Volker Pantenburg, *Farocki/Godard. Film as Theory*, Amsterdam: Amsterdam University Press, 2015, p. 210.

42 Farocki 2004b (as fn. 39), p. 17.

43 For other approaches to the term, see Werner Kogge, Lev Manovich. Society of the Screen, in: Alice Lagaay, David Lauer (eds.), *Medientheorien. Eine philosophische Einführung*, Frankfurt/M.: Campus, 2004, pp. 297–315; Ingrid Hoelzl, *The Operative Image. An Approximation*, http://mediacommons.futureofthebook.org/tne/pieces/operative-image-approximation (accessed September 20, 2017).

44 Farocki 2004a (as fn. 39), p. 61.

45 Jan Distelmeyer, An/Leiten. Implikationen und Zwecke der Computerisierung, in: *Navigationen. Zeitschrift für Medien und Kulturwissenschaften* 17.2 (2017), pp. 37–53.

46 Farocki 2004a (as fn. 39), p. 61.

47 See Sybille Krämer, Operative Bildlichkeit. Von der Grammatologie zu einer 'Diagrammatologie'? Reflexionen über erkennendes Sehen, in: Martina Heßler, Dieter Mersch (eds.), *Logik des Bildlichen. Zur Kritik der ikonischen*

sentations of computer performance are parts and thresholds of (at least) four types of mutually connected operations – that is, interface operations within the meaning of the multilayered interface facets:

1. Operations as the various interrelations between hardware and software ensuring that these general-purpose machines and universal symbolic machines fulfill their tasks.
2. Operations as the interrelations of several computers, leading to further co-action of hardware and software by protocol-driven networks.
3. Operations as the connections and communications between computers and non-computer forms of interconnected materiality – such as human bodies or technical artifacts – that lead to the issues of surveillance and cybernetization of beings and (an internet of) things under programmed control.
4. Operations as *us* dealing with *them* – operations as the handling of and dealing with computers, hence: operations understood as technical, physical, and cognitive processes, including questions of the relationship between software and ideology raised by Wendy Chun,[48] Alexander Galloway,[49] and Cynthia and Richard Selfe.[50]

I would like to highlight just two aspects of the last type: The first aspect is related to the special indexicality of these operative images, which leads back to the question of how analyzing graphical user interfaces could help address the dicey character of computerization. Addressing this indexicality inevitably confronts us with consequences of programmability, which I understand as perhaps the most thought-provoking characteristic of computers and computerized media, things and beings. Graphical user interfaces always propose ideas and depresentations of more than just the computer; instead, "[i]nterfaces and operating systems produce 'users' – one and all."[51] And since all of our computer use has to be envisaged and enabled by programming, computer interfaces always empower users to regulate while at the same time forcing them to be regulated.[52] Hence, the interface mise-en-scène – the available structure of operative images and depresentations – shapes the aesthetic appearance of the computer as an *aesthetics of regulation* (Ästhetik *der Verfügung*).[53]

This aesthetics is marked by a particular power structure – a logic of regulation: Actively regulating users are being regulated in a system, in which they have to play under the default rules with the provided tools and prerequisites.

Vernunft, Bielefeld: transcript, 2009, pp. 94–123; Sybille Krämer, Christina Ljungberg (eds.), *Thinking with Diagrams. The Semiotic Basis of Human Cognition*, Boston/Berlin: Mouton de Gruyter, 2016.

48 Wendy Hui Kyong Chun, *Programmed Visions. Software and Memory*, Cambridge: MIT Press, 2013.
49 Alexander Galloway, *The Interface Effect*, Cambridge: MIT Press, 2012.
50 Cynthia L. Selfe, Richard J. Selfe, The Politics of the Interface. Power and Its Exercise in Electronic Contact Zones, in: *National Council of Teachers of English* 45.4 (1994), pp. 480–504.

51 Chun 2013 (as fn. 48), pp. 67–68.
52 I would like to stress the point that the common distinction between *users* and *programmers* is highly problematic – especially when it comes to interfaces. As Wendy Chun has pointed out, "programmers are users" since "they create programs using editors, which are themselves software programs": "The distinction between programmers and users is gradually eroding, not only because users are becoming programmers (in a real sense programmers no longer program a computer; they code), but also because, with high-level languages, programmers are becoming more like simple users. The difference between users and programmers is an effect of software." Wendy Hui Kyong Chun, On Software. Or the Persistence of Visual Knowledge, in: *Grey Room* 18 (2004), pp. 26–51, p. 38.
53 See Distelmeyer 2017 (as fn. 25), pp. 65–126.

But this is not a one-way street: Precisely because every computer operation relies on programs, all programmed functions, regulations, barriers, and presets are principally alterable and expandable by users or hackers. This processuality identifies dealing with computers as a power struggle with which its political issues may begin. It confronts us with controllability resulting from programmability.

The second aspect of operations in terms of human handling of computers is related to knowledge, informing our actions. Criticized by various media scholars, the mythical term *digital* has been an extremely powerful buzzword and sales argument at least since the early 1990s.[54] To mark *the digital* as a myth and to keep in mind the problems of coping with mythical terms as shown by Roland Barthes, I arranged myself some years ago with another not yet mythical term: the neologism *digitalicity*.[55]

In Western-European and US-American discourse since the early 1990s digitalicity is shaped to a special degree by promises (and fears) of interactivity, flexibility, control, freedom, and empowerment. Celebrated as a victory of digital media's acclaimed elasticity as opposed to rigid, inflexible, passive, and hierarchy-based predecessors, the same programmatic linkage between flexibility and control is now – at the latest since the Snowden disclosures and the debates about dominating corporations and algorithmic regulation – also an object of criticism.[56] As just one example I would like to quote maybe the most influential protagonist of digitalicity from the 1990s, Nicolas Negroponte:

[M]ore than anything, my optimism comes from the empowering nature of being digital. The access, the mobility, and the ability to effect change are what will make the future so different from the present.[57]

Understanding digitalicity as one important discursive aspect of computerization and – not least – the hopes of and investments in the "fourth industrial revolution" as for instance shown in the European Commission's "path to digitise European industry"[58] – the question arises, how a given interface mise-en-scène corresponds to the promises and fears that have shaped digitalicity. With this question I would like to turn to YouTube as an example.

YouTube Operations

If you enter the URL www.youtube.com or follow a corresponding link, bookmark, or presetting, the front page of YouTube presents a deployment of selectable operative images, depresenting potentially upcoming video events (fig. 4).[59] Even if you have no personal account to log in, the personalizing *you* of YouTube is taken seriously right from the start: Thanks to recorded, evaluated, and conjugated former visits and dealings with YouTube, every front page should be a customized performance. This personalization is the outcome or yield of *my* work within the YouTube

54 See Hartmut Winkler, *Docuverse. Zur Medientheorie der Computer*, Munich: Fink, 1997; Lev Manovich, *The Language of New Media*, Cambridge: MIT Press, 2001; Chun 2006 (as fn. 34).
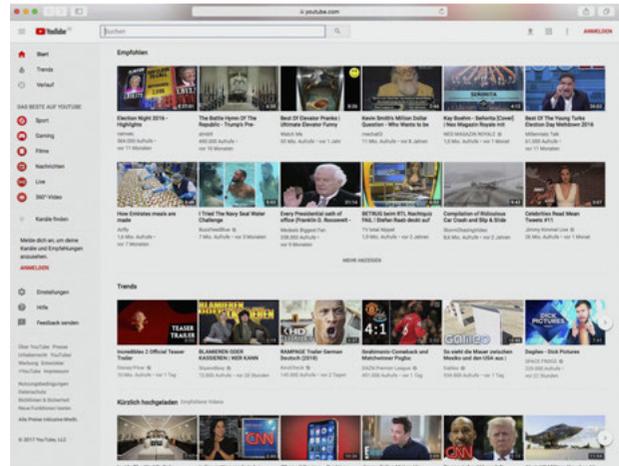
55 See Jan Distelmeyer, *Das flexible Kino. Ästhetik und Dispositiv der DVD & Blu-ray*, Berlin: Bertz + Fischer, 2012.

56 See Distelmeyer 2017 (as fn. 25), pp. 98–126.

57 Nicolas Negroponte, *Being Digital*, New York: Alfred A. Knopf, 1995, p. 230.

58 European Commission Directorate General for Communications Networks, Content & Technology, *The Fourth Industrial Revolution*, https://ec.europa.eu/digital-single-market/en/fourth-industrial-revolution (accessed September 20, 2017).

59 I am describing the YouTube interface performed by a browser; the interface designed for the YouTube app is a different formation.

Considering the familiarity with this widespread freedom as prepared choice-control, other widespread aesthetics of regulation could easily be overlooked. Especially computer games challenge and play with this dominant overview order. Examples can be found in different sorts of games, most obvious maybe and long-lasting in first-person shooters like the popular Tom Clancy's Rainbow Six Siege (Ubisoft, 2015), in which the crucial point is not to know but to explore what actually is offered and waiting around the corner. Nevertheless this exploring mode of aesthetics is quite often supplemented by another order of selectivity, showing available weapons, equipment, maps, and the like.

Hence, an order of selectivity, invoking our wealth of choice by menus and similar arrangements, is not in the least determined by technology. Instead this order of selectivity is a cultural construction and just one, yet dominant mode of aesthetics of regulation. It presents the computer as an empowering decision devise and shapes YouTube to a special degree (fig. 5).

The aforementioned flexibility of the video appearance in the YouTube frame is increased by the offer to transform the running video appearance in terms of language, subtitles and resolution, which can be adjusted using the operative image of a gearwheel on the bottom right of the video frame. Furthermore since 2012 each YouTube video is presented in a paradigmatic way: When the cursor moves the progress bar, the video blurs and a collection of somehow representative single frames pop up as a preview, offering a navigation aid through the whole video by means of this frame collection.

Hereby the video is not playing but displayed as an area, as a visible set of not yet operative images. This YouTube approach to the order of selectivity touches upon fundamental questions of moving images elucidated by an even more
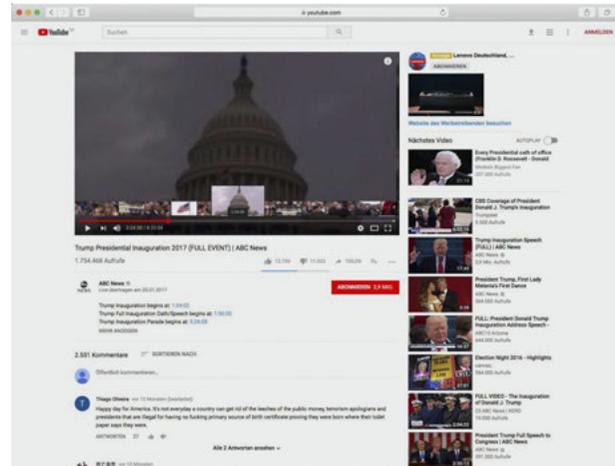
5　YouTube, navigation with progress bar.

obvious and radical programming that changed the look of YouTube already shortly after it has been sold to Google at the end of 2006. In the early days of YouTube, right after a video had been played, it still filled the whole video frame with one somehow representative image, ready to start anew. Since 2007 a finished video is replaced by a thumbnail collection of selectable videos: a new grid order of choice in exactly the frame supposedly reserved for moving images (fig. 6). This programmatic displacement becomes peculiar picturesque when the video is watched in full screen mode. Regarding this familiar mise-en-scéne – this grid of selectivity – Geert Lovink's résumé about YouTube from 2008 could be loaded with a new intention: "We no longer watch films or TV; we watch databases."[64]

64　Geert Lovink, The Art of Watching Databases. Introduction to the Video Vortex Reader, in: Geert Lovink, Sabine Niederer (eds.), *Video Vortex Reader.*
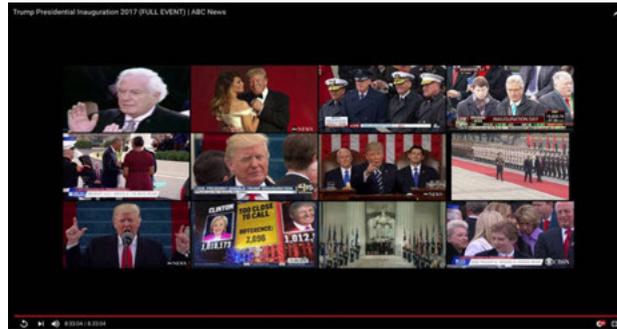
6   YouTube, grid collection of recommended videos.

7   YouTube, autoplay feature.

Instead of the video appearance – that is, the chosen succession and process of moving images and sounds as a syntagmatic gesture – now the exact opposite is taking over: the invitation to select among replaceable images as a paradigmatic gesture, which consists of operative images. Thus YouTube's magic – the additional transformation of moving images into operative images – is demonstrated once more insistently. The programmatic indexicality of these images moves to the front.

Bearing in mind the second type of interface operations, this programmatic indexicality of the collected videos is based not only on the fact that they "all refer causally and physically to a set of software instructions to be executed" but also because of the operative trace to the processing of recorded and algorithmically evaluated data labor, with which these appearances are causally and physically linked.[65] The grid collection of recommended videos – that

is, the idea and promise of this reference – is referring to the recorded viewing and search history. Because these operative images are therefore both depresenting and acting, i. e. part of an agency and an agenda, these aesthetical questions are also and unavoidably political.

With this in mind, a displacement and respectively a diversification of film/video aesthetics by aesthetics of regulation could be witnessed here. The logic of the filmic syntagm gets involved in the paradigmatic logic of digitality and its performed freedom as choice-control. To this, I would like to add, another potential relationship: the connection of this exhibited flexibility, a crucial promise of digitality, with the sociocultural ideal and pressure of flexibility in today's formations of flexible and communicative capitalism. Jodi Dean and Franco Berardi describe "a key contradiction of communicative capitalism" – if you "want to survive you have to be competitive and if you want to

Responses to YouTube, Amsterdam: Institute of Network Cultures, 2008, pp. 9–13, p. 9.

65   Marianne van den Boomen, Interfacing by Material Metaphors. How Your Mailbox May Fool You, in: Marianne van den Boomen et al. (eds.), *Digital*

Material. Tracing New Media in Everyday Life and Technology, Amsterdam: Amsterdam University Press, 2009, pp. 253–264, p. 257.

be competitive you must be connected, receive and process continuously an immense and growing mass of data".[66]

The preliminarity and replaceability of the selected video can be interpreted as visualization and maybe familiarization of what Dean calls "the competitive intensity of neoliberal capitalism".[67] This aesthetic fate of chosen videos may be understood as a reminder of the competitive pressure, analyzed by Boltanksi and Chiapello,[68] and as an echo of Gilles Deleuze's *Societies of Control*[69]: Even these or them, which may have been chosen once among the many, always have to face a new competition right after the very selection. Ongoing flexibility and changeability is to learn and to rely on (fig. 7).

I would like to conclude with the observation that even this well-established paradigmatic logic of YouTube is subjected to changes. The installation of the "autoplay" mode, switched on by default since 2015, forms a counterpart to the order of selectivity: "The Autoplay feature on YouTube makes it easier to decide what to watch next. After you watch a YouTube video, we'll automatically play another related video based on your viewing history."[70] Thereby YouTube creates a new emphasis of flow that can be discussed from various perspectives: for instance, both in terms of YouTube's acclaimed reputation as *the new television* and in terms of the "data stream", estimated by Lev Manovich

as a cultural form of presenting data in web-based social network services, heightening "the experience of the 'data present'".[71] Another form of flexibility is performed here – an ongoing flow of change that seems to be no longer under our (prepared and advised) control but that is controlled by information processing like a showcase for "algorithmic governmentality".[72]

Monitoring

This deserves a closer look and further steps. My remarks here are intended as starting points for an analysis that takes account of the complex procedures enabling and pursuing the options of uploading, searching, watching/hearing, classifying, valuing, and exposing data in the form of videos, requests, comments, clicks, and all sorts of metadata. In the end all the options depend on processes that ask for a new attention for intertwined interface operations.

How I operate with the YouTube interface is wedded to other interface operations by which a request for a video finds its way from, for instance, my processing smartphone to the responding server located in one of the European Google server farms in Dublin, Eemshaven, Hamina, or St Ghislain, relying on what Florian Sprenger has discussed as "politics of micro-decisions"[73] and producing traffic that is recorded both to customize my next visit on YouTube (and other informed websites) as well as to profit from my

66 Jodi Dean, The Limits of Communication, in: *Guernica*, http://guernicamag.com/features/the-limits-of-communication/ (accessed September 20, 2017).

67 Ibid.

68 See Luc Boltanski, Ève Chiapello, The New Spirit of Capitalism, New York: Verso, 2007.

69 See Gilles Deleuze, Postscript on the Societies of Control, in: *October* 59 (1992), pp. 3–7.

70 YouTube, Autoplay videos, https://support.google.com/youtube/answer/6327615?co=GENIE.Platform%3DAndroid&hl=en (accessed September 20, 2017).

71 Lev Manovich, Data Stream, Database, Timeline, in: *Software Studies Initiative*, http://lab.softwarestudies.com/2012/10/data-stream-database-timeline-new.html (accessed September 20, 2017).

72 Antoinette Rouvroy, Bernard Stiegler, The Digital Regime of Truth. From the Algorithmic Governmentality to a New Rule of Law, in: *La Deleuziana. Online Journal of Philosophy* 3 (2016), pp. 6–27.

73 Florian Sprenger, *Politik der Mikroentscheidungen. Edward Snowden, Netzneutralität und die Architekturen des Internets*, Lüneburg, 2015.

ascending browsing record by customized advertising.[74] These constructed, programmed, instructed, and performed interface operations built the processual character of You-Tube videos that Yuk Hui has described as "digital objects", focusing "on data and metadata, which embody the objects with which we are interacting, and with which machines are simultaneously operating".[75] Interface operations characterize them as "new", that is "dynamic and energetic", forms of "industrial objects".[76]

Precisely because the question raised by *Interactions* – what computers are doing when we are not consciously interacting with them – is of prime importance, the complex of human and automated interface operations needs to be explored. Interface operations include humans in front of monitors as well as, for instance, sensor-based *Ambient Intelligence* monitoring human or any other activities. Interface analyses should therefore be interested in aesthetics and a specific interface mise-en-scène as well as in the heterogeneous mesh of conditions enabling and determining it together with the practices of use and understanding. Their relevance is increasing the more interfaces and operations between beings, things, and computers are built and relied on – and the more these operations are planned and mediated as *indispensable and invisible*, heading towards new forms of depresentation.

Figures

1   Cover of *Interactions* 23/6 (2016).

2   Deutsche Telekom, Telekom Europe TV commercial with Andrea Bocelli, https://youtube.com/watch?v=eZu6oWfrieo (accessed November 20, 2017).

3   ABC News, Trump Presidential Inauguration 2017 (FULL EVENT) | ABC News, https://youtu.be/Nieiu8tmLIM?t=2h13m31s (accessed November 20, 2017).

4   YouTube, https://youtube.com (accessed November 20, 2017).

5   ABC News, Trump Presidential Inauguration 2017 (FULL EVENT) | ABC News, https://youtu.be/Nieiu8tmLIM?t=2h24m30s (accessed November 20, 2017).

6–7   ABC News, Trump Presidential Inauguration 2017 (FULL EVENT) | ABC News, https://youtu.be/Nieiu8tmLIM?t=8h33m4s (accessed November 20, 2017).

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74   In the case of YouTube interface analyses overlap with "platform studies" insofar as "platform" is understood as "a broad enough category to capture a number of distinct phenomena, such as social networking, the shift from desktop to tablet computing, smart phone and 'app'-based interfaces as well as the increasing dominance of centralised cloud-based computing". Joss Hands, Introduction. Politics, Power and 'Platformativity', in: *Culture Machine* 14 (2013), pp. 1–9, p. 1.

75   Yuk Hui, *On the Existence of Digital Objects*, Minneapolis, 2016, p. 48.

76   Ibid., pp. 49–57.