The "digital subjects" of twenty-first-century education: On datafication, educational technology and subject formation

Felicitas Macgilchrist

Georg Eckert Institute for International Textbook Research, Braunschweig, Germany.

Institute for Educational Science, University of Goettingen, Goettingen, Germany.

Email: macgilchrist@leibniz-gei.de. Twitter: @discoursology.

How are young people constituted as subjects in schools today, as digital technology becomes increasingly widespread? Buzz words for twenty-first-century education include "creativity", "critique", "collaboration", "communication", or sets of core skills that are often linked to the now classic flexible, entrepreneurial selves of neoliberal imaginaries (Miller & Rose, 2008; Sennett, 1998). This chapter overviews recent critical scholarship on education and technology in the twenty-first-century, highlighting three aspects: practices, datafication and subject formation. It then explores subjectivation in more detail, looking closely at one worked example to map the kinds of future students imagined in current policy. Mainstream policies for education in a digital world foreground three digital subject figures: The User, the Critic, and the Maker. Each of these, in some ways, re-establishes dominant power relations and relations of inequality in today's schools. On the margins of the policy discourse are, however, further subject figures which interrupt dominant imaginaries: The Expert, the Ecosoph, and the Social Designer. The chapter suggests that these marginal subject figures illustrate diffraction patterns in today's world in which we can think otherwise about what constitutes a livable, legitimate life.

1 Twenty-First-Century Education

Much discussion – euphoric and dystopian – about the kind of education necessary in the "twenty-first century" revolves around digital technologies. Whether the focus is on digital media, educational technology, big data, learning analytics, predictive analytics, artificial intelligence, educational data mining, adaptive technology, or further concepts and practices, a core interest for cultural studies in education is that "debates about the digital are the mirrors through which contemporary society observes, problematizes and reflects itself" (Süssenguth, 2015: 8).

1.1 Critical Digital Practices

One priority in discussions on the digital in education is how to *enact critical practices*, whether this refers to teachers practicing critical digital pedagogy, school leaders establishing critical digital data infrastructures, or students engaging in critical digital literacy, media literacy and radical digital citizenship. What is missing from mainstream debates about 21st century learning and digital education, say the advocates of these critical practices, is a foregrounding

of the human relations in education and a related set of complementary 'skills' for engaging actively with global political, social or ethical issues.

Taking a broad approach to critical practices in digital education, conversations around digital citizenship have discussed openness and participation, online activism, digital identities, and how to move beyond personal responsibility to a model of digital citizenship that orients to justice, cooperation and equity (see Caines, 2017). Advocates for a radical digital citizenship aim to make critical socio-technical relations visible and to develop emancipatory technological practices which foreground struggles for social justice and equality (Emejulu & McGregor, 2016).

Other work focuses more specifically on students' critical engagement with technology. Drawing on critical literacy (Janks, 2002; Shor & Pari, 2000), multiple literacies (Ito et al., 2013; New London Group, 1996), culturally relevant pedagogies (Ladson-Billings, 2009) and computational thinking (Wing, 2006), for instance, has led to an approach to critical computational thinking for civic engagement (Lee & Soep, 2016). Similarly, a model of critical digital design combines critical literacy with design-based approaches to enable both critical consumption of available media products and young people's own affective and creative production (Pangrazio, 2016).

Critical digital pedagogy draws on critical pedagogy's emphasis on problem-posing education (Freire, 1970) and on "recognizing one another's presence" in the classroom (hooks, 1994: 8), on reflective dialogue which begins not with students, teachers or technological tools, but with learning, agency and community (Strommel, 2014). Critical digital pedagogy reminds educators to reflect on the values coded into digital tools, the affordances of technology, and the potential effects of how we choose to talk about and use educational technology (see e.g. Bali, 2017; Doxtdator, 2017; Watters, 2017). Overall, these exchanges aim to support educators, students and scholars to think critically about their (our) own digital practices and engagement beyond a narrowly defined (neoliberal) set of 21st century skills.

1.2 Datafication

A second broad field of inquiry, often drawing on a blend of cultural studies, sociology, software studies, critical data studies and educational policy studies, attends to the increasing role of digital data in shaping the practices and futures of education. Datafication can be understood as the "quantification of all kinds of human behavior and sociality to enable real-time tracking, monitoring and predictive analysis" (Williamson, 2016: 124). Big data, arguably a paradigm or a socio-technical phenomenon rather than a specific object or technology, can be understood as "a way of thinking about knowledge through data and a framework for supporting decision making, rationalizing action, and guiding practice" which, "for better or worse" involves "a belief in the power of finely observed patterns, structures, and models drawn inductively from massive datasets" (Barocas & Nissenbaum, 2014: 46; cf. boyd & Crawford, 2012).

As educational data mining and learning analytics have become established as substantial fields of inquiry with a focus on improving learning by using large datasets, so too has a body of critical scholarship on datafication emerged. This interrogates, for instance, the use of digital data in education governance, as administrators embed digital technologies, and their

standards, codes and algorithms in the day-to-day mundane operation of education, at system level (e.g. international large-scale performance-based assessments, national student databases or regional accountability systems), school level (e.g. attendance, grading, risk assessment, personalized or adaptive learning) and within individual classrooms (Allert, 2017; Anagnastopoulos, Rutledge & Jacobsen, 2013; Bodén, 2015; Selwyn, Henderson & Chao, 2015; Williamson, 2016). Studies argue that digital data infrastructures and the associated data work simplify complex situations into apparently solvable problems (Selwyn, 2016), reduce education to continual personalized training (Thompson & Cook, 2016), affect teachers' professionalization and autonomy (Selwyn, Nemorin & Johnson, 2016), and increase the influence of a diverse range of powerful, yet hidden, data mediators in education (Hartong, 2016).

These cultural studies on the datafication of education also highlight the ethics of technology design, arguing for an "ethical design", in which *learners* learn about themselves, instead of a "colonial design", in which *technology providers* learn about learners by, for instance, generating massive amounts of usage data (Balkan, 2017; see also Eynon, 2013; Mittelstadt et al., 2016). These studies demonstrate how the socio-materiality of digital learning, assessment and teaching recursively reconfigures classroom practices (Breiter & Jarke, 2016; Sørensen, 2009). And they aim to rethink how data infrastructure – understood as "an assemblage of material, semiotic and social flows or practices" (Sellar, 2014: 770) – can be designed. How, for instance, can we open up new ways of relating to the abundance of digital data in the 21st century, ways which counter dominant audit cultures or performance rankings and accountability measures, and instead generate nuanced, critical data which can be used as empowering tools by marginalized groups (Selwyn, 2016)? Or how can we, at the very least, design technology which enables individuals to obfuscate the data traces they produce (Brunton & Nissenbaum, 2015)?

1.3 Subject formation

Lurking at the edges of the scholarship on critical digital practices and datafication are conceptions of the digital subject of 21st century education. I understand "subject" here, drawing on the thinking of Foucault (1982) and Butler (1997), as the specific cultural form which individuals adopt in a given socio-political-historic configuration in order to become a legitimate, desirable and competent being. I use "subject figures" in the following sections to refer to the explicit and implicit constitution of subjects in written texts. The critical scholarship noted above imagines a radical digital citizen, critical computational thinker and critical digital designer; an engaged educator and reflective practitioner who prioritizes social justice and equity; a data worker and data obfuscator. These digital subjects stand in contrast to the dominant discourse of how young people should "be" in the 21st century. To be successful and happy – so the mainstream argument goes – young people need the skills of creativity, collaboration, critique and communication. They also need, e.g., "grit, tenacity and perseverance", which are positioned as "critical factors for success in the 21st century" (Shechtman et al., 2013).

This type of success is thoroughly entangled with the neoliberal, self-optimizing, "entrepreneurial self". For Thompson and Cook (2016), learning personalization, produced through big data and learning analytics, generates an "invested learner"; a subject of investment produced through "Deleuze's control society – in which power is exercised through

simulation, profiling, categorical sorting and 'the anticipation of events' that produces the individual as concerned with the investment to come" (Thompson & Cook, 2016: 741; see also Savat, 2009: 56). Learning personalization ensures, in this sense, the learner's individualized and responsibilized investment in their anticipated future self. For educational technology developers, the student-subject has become an individual "user", whose relation to education is recast in neo-liberal terms of usability, efficiency and consumerism (Ramiel, 2017). Similarly, major educational technology products aim to support character development in schools, by prioritizing socio-emotional learning and character strengths such as grit, zest, optimism, gratitude, social intelligence, curiosity and self-control; these should support growth mindsets and happiness (see Williamson, 2017). The kind of psychologized digital subject promoted and made legible here is one who orients to *individual* ways of finding solutions to personal challenges. They bring these strengths to their résumés and workplaces, enhancing their employability, and more broadly, economic growth. This discourse forecloses to some extent a political digital subject who interrogates structural problems or who organizes in community to address socio-political inequalities (see Parker, 2007).

In the following sections, I explore the kinds of subject imagined in educational policy texts on education in the digital 21st century. As outlined here, most critical scholarship to date has focused on how neoliberal values and priorities are encoded and embedded in educational technologies and mainstream pedagogies, and in the associated policies and policy instruments. Picking up an interest in a "generative criticality" which expressly seeks out moments of "breakdown" in dominant or hegemonic norms, values and practices, my goal was to analyze a policy process in more detail to *also* identify spaces where voices *contesting* an entrepreneurial, individualized, investment logic are thinking otherwise about digital subjects in the 21st century (Gibson-Graham, 2014; Haraway, 2000).

2 Participatory Policy Processes

Several countries developing a national strategy for education in a digital world have involved relevant publics in a participatory policy development process. The Czech Republic, Ireland, Scotland, and Germany, for instance, included consultations with key stakeholders, and incorporated substantial aspects from the feedback in their redrafted documents. Germany serves as a focal case in this chapter to highlight the kinds of subject figures being made prominent across a range of policy oriented documents, and those which are voiced only on the margins of policy debates. Specifically, the analysis asks (i) which subject figures are constituted in the *Strategy for Education in a Digital World* drawn up by Germany's Standing Conference of the Ministers of Education and Cultural Affairs,[1] and (ii) which subject figures are constituted in the responses by some stakeholders but not integrated into the final published Strategy (see Macgilchrist, 2017b for a more detailed analysis of this process, and of the figures described below).

The following draws on key documents written during this process. First, in May 2016, a *Draft* of the strategy was made available online, and circulated among key stakeholders. Second, over the summer of 2016, several *Responses* were drafted and submitted to the Conference

---

[1] Germany has 16 separate and quite autonomous educational systems, one for each federal state. The Conference of Ministers (*Kultusministerkonferenz*, KMK) is a consortium of the 16 ministers responsible for schooling, higher education, research and cultural affairs in the 16 federal states. It aims to formulate policy that can be accepted by all 16 federal states.

of Ministers. This analysis draws on nine *Responses* which were made publicly available, including texts written by a consumer protection organization, a student association and activist groups in media education (see Appendix). In December 2016, the final *Strategy for Education in a Digital World* was published. Where relevant, the chapter will refer to the subject figures constituted in similar strategy documents across Europe.[2] The conclusion reflects on 'what follows' from the range of subject figures identified in these policy documents for the shaping of future citizens, and the institutional support for political and social engagement towards increasing equality and social justice.

2.1 Dominant subject figures

None of the texts consists of only one subject figure; this chapter teases the figures apart to present them individually, despite their entanglement. This section presents three subject figures which are prominent across the *Draft*, *Response* and *Strategy* papers, and which reflect current (global) debates on digital technology in education. These figures help to identify hegemonic assumptions about our digitally networked lives today.

The User

The Conference of Ministers' *Draft Strategy for Education in a Digital World* strongly emphasizes that students need to develop the skills to *use digital tools well*, i.e. to become a competent User. The Draft includes a "competence framework" which stipulates that students should be able to, for instance, "use digital tools to collaborate on bringing together information, data and resources", "use public and private software", "use and apply several technical editing tools", "obtain, save and retrieve information and data", "recognize and formulate algorithmic structures in the digital tools they use", and a further list of functional competences (Draft: 38-40).

Several Responses to the Draft warned the Conference of Ministers of the dangers of adopting an instrumentalist, reductive understanding of digital skills (KBoM!: 2; GfM: 1,4; GMK: 6)[3]. They made suggestions for a more nuanced, sophisticated User figure. Overall, however, the User-figure was also construed in these Responses. Only the *Society for Media Studies* (GfM) rejects the User figure, describing the use of technology as a "trivial" skill which is becoming increasingly irrelevant as interfaces become more intuitive (GfM: 3). The final published *Strategy for Education in a Digital World* continues to focus very heavily on the User figure. Of the 61 individual competences listed in the final framework, 41 prioritize the *use* of available digital products *in order to use digital products*; 15 prioritize the use of digital technologies *in order to reach other ends* (e.g. "participate in society as a self-determining citizen", "use digital technologies for social wellbeing and inclusion"). The Strategy thus primarily addresses students as Users (Strategy: 15-18). Similarly, two of the four competence fields in the

---

[2] To this end, this chapter draws on policies available online in English or German from 17 states: Austria (School 4.0), Croatia (Digital Agenda), Czech Republic (Strategy for Education Policy of the Czech Republic until 2020), Denmark (Strategy for Digital Welfare), France (The French Digital Plan for Education), Hungary (Program for Promoting Digital Education in Schools), Ireland (Digital Strategy for Schools), Italy (National Plan for Digital Education), Netherlands (Digital Agenda), Norway (Framework for Basic Skills; Digital Agenda), Poland (Digital Poland; Digital School), Slovenia (Digital Slovenia; Strategic Guidelines), Scotland (Enhancing Learning and Teaching through the Use of Digital Technology), Spain (Digital Agenda), Sweden (Digital Agenda), Switzerland (Digital Switzerland), UK (UK Digital Strategy), and Wales (Digital Competence Framework).

[3] See the appendix for the full list of Responses.

Austrian competence model digi.comp describe the use of currently available commercial and non-profit hardware and software. Reading across the policy papers, it seems that those initiatives which orient to European Commission or European Union policies and frameworks (e.g. Denmark, France, Hungary, Germany) prioritize infrastructure and hardware, digital assessments, and basic user skills; whereas those orienting to UNESCO's competency frameworks include more attention to creative, collaborative and critical digital literacy, to digital citizenship, and to addressing societal problems (e.g. Ireland, Sweden).

One scholarly critique of focusing on the User-figure relates to digital practices and what has been called the "digital divide" or digital use divide. Even when this concept is viewed critically (boyd, 2014), it seems clear that some children and young people, often those in privileged positions in the opportunity structures of society, are developing sophisticated skills *outside* schools. They are learning to create digital tools, deconstruct data infrastructures, and actively shape socio-political change, i.e. they are engaging in critical digital citizenship. Other children and young people are limited to learning about technology in schools which only teach them a basic competence in how to use existing, often commercially available, hardware and software products. A second critique interrogates the shift from constructing the subject as a "student" to constructing them as a "user". When commercial edtech firms configure their imagined users, they configure a set of priorities into their technologies which recast the relations between these young people and the education system "in terms of services, consumerism, usability and efficiency (Ramiel, 2017: 2). The goal of the school system shifts from *education* and teaching values to the next generation to *learning* and attracting the attention of young consumers (see also Biesta, 2013; Franck, 1998). The non-profit edtech sector – which plays a significant role in designing curricula and software, but is far less vocal in public discourse than the for-profit sector – seems to configure a different sort of User-figure, in which engagement/attention are more closely entangled with educational/pedagogical priorities (Macgilchrist, 2017a).

The Critic

While the User-figure is a central figure across the policy papers, it is not the only subject-figure. The Draft also foregrounds a Critic subject-figure. Critical thinking has long been central to educational theories and media education. What precisely "critical thinking" means has, however, changed substantially. Where previously, "critique" referred to a questioning of societal inequalities, hegemonic relations or entrenched problems such as racism, today it primarily refers to a technical approach to media texts, e.g. identifying "fake news" (cf. Giroux, 2011). Indeed, in the Draft, the focus is on students being able to "reflect critically on their own media use" (Draft: 14), on the "dangers and risks" of digitalization (Draft: 1), and on "the potential, selection and use" of media (Draft: 4).

Several Responses reacted strongly to this, recommending that critical thinking be specified in more detail, be expanded, and be made mandatory (vzbv: 4, KboM!: 2; DGfE: 3, GMK: 6, GfM: 2, WMDE: 8). For instance, students should be able to critique not only the contents of media but also the platforms, the devices, and the algorithms for utilizing digital data that undergird today's media technologies. Overall, however, the Responses focus on critical thinking as media critique. A clear goal for most contributors to the policy process in Germany – and across Europe – is to encourage students to think critically about digital media (contents, software, hardware, practices, data extraction). An abstract use of the phrase "critical thinking"

as a generic "key skill" for the 21ˢᵗ century which remains an empty signifier, not specified in any detail, is prominent in other national policy documents (e.g. Ireland, Slovenia). The Welsh *Digital Competence Framework* from 2016 includes one of the more specific Critic subject-figures, which should be able to "critically evaluate their place within the digital world, so that they are prepared to encounter the positive and negative aspects of being a digital citizen" (p. 5). The published Strategy in Germany picks up many of the Response's suggestions about sharpening and strengthening the role of media critique, and also includes references to a generic 'critical thinking' skill.

It is, however, the broader yet also very specific goal of thinking critically about society or the world (injustice or inequality) which is prioritized in writings on critical digital literacy, critical digital citizenship and datafication. Critical appraisal of data practices, for instance, would not be limited, as it is in the Strategy, to encouraging educational technology firms to protect student data, or encouraging students to be aware of how they can (individually) access data security settings. As noted above, more critical approaches recommend the collaborative renegotiation of legitimate data practices, and invite students to reflect critically on how digital technologies are implicated in knowledge capitalism, aesthetic capitalism or cognitive labor; how digital practices foster individual competitiveness; how data analytics lead to new forms of surveillance, exclusion and obfuscation; or which ecological consequences follow from our consumption of technology.

The Maker

A third dominant subject-figure is the Maker. Creativity is central to this figure. In these sections, the Draft addresses students as subjects who can create and share media themselves. Digital media enable "new imaginative, creative processes" (Draft: 2), "new creative processes and thereby new media realities" (Strategy: 8). The goal is a "transformation of classic roles of children and young people: away from passive users to active producers of media content" (Draft: 30). Since the linearity of production, distribution and use of media" has been disrupted, "now every person and thus also students and teachers can develop and share media" (Strategy: 30).

Again, the Responses welcome the attention to a Maker figure, and propose changes to the Draft to make the Maker figure more specific or elaborate. They reflect on possibilities within a maker culture for students to make YouTube videos, games or other interactive projects, to practice entrepreneurial creativity, to work in FabLabs and Makerspaces with robotics or digital art, and to create YouTube tutorials and games (KBoM!: 6, GMK: 10; DGfE: 2). And again, the revised Strategy picks up many of these suggestions, formulating an expanded Maker figure who engages in a broader range of activities than in the Draft version. Makerspaces and the role of digital technologies in creative work appear frequently across European policy documents (e.g. Austria, Czech Republic, Ireland, Poland, Norway, Scotland, Slovenia, Sweden, Switzerland, UK, Wales).

A major scholarly critique of the Maker figure centers around the ambivalent politics of the imperative to be creative which has emerged over the past 30 years. Where creativity in the 19th century was the prerogative of individual creative geniuses, and creativity in the 60s was a radical left-wing project, today creativity is expected of us all (McRobbie, 2015; Reckwitz, 2014). One critique of this is the explicit linking of creativity with entrepreneurship, in which the economy and profitability drive creativity (Raunig & Wuggenig, 2016), and creativity

becomes the marker of aesthetic capitalism (Böhme 2016). A second critique attends more broadly to maker culture: if creativity today is tied to an exciting, dynamic, individualized 'Californian ideology' (Barbrook & Cameron, 1995) of making rather than repairing things, the caring professions, like social work, education, nursing, etc. as well as unpaid care work, fall by the wayside (Doxtdator, 2017), as does the need to collectively work towards reducing inequality (Sadowski & Manson, 2014).

2.2 Marginal subject figures

The User, the Critic and the Maker are clearly visible in the German policy process, and in policy documents across Europe. Alongside these dominant figures, further subject figures appeared on the margins of the debate. Drawing on Haraway (1997; see also Barad, 2007), these figures can be read as figures of "diffraction". Rather than "reflecting" current assumptions about digitally networked lives, these figures create diffraction patters, illustrating how the world can look otherwise.

The Expert

One particularly marginal subject-figure is the figure of the student-expert. Only in one document were students themselves addressed as experts. The *German National Association for Student Affairs* recommends that "[university] students with disabilities, as experts on this issue, be drawn into the process as early as possible" to decide how new technologies can support an inclusive higher education (DS: 2). In this Response, university students speak for themselves, addressing the expertise of students as valuable in the process of developing plans, process and strategies.

In none of the German documents (Draft, Responses, Strategy) were *school* students addressed as experts. The Conference of Ministers describes its consultation process as including "the expertise of scholars, business leaders, consumer protection, organizations and unions". But not the expertise of students. Scotland and Ireland also engaged directly with children and young people in their consultations. Ireland's *Digital Strategy for Schools* from 2015 notes that "Young people have a mature perspective on how technology can be of benefit for living, learning and working in the future." (p. 54). Overall, however, the student Expert is rare in political decision-making across Europe.

Where the figure of the Expert is becoming more prominent is among educational technology firms. While textbook publishers have traditionally seen *teachers* as their core customers, in agile software development, *learners* are often seen as the core customers (Macgilchrist, 2017a). Whether this expertise is seen as something other than simply a sophisticated User, and whether it touches on more radically democratic understandings of equality and intellectual expertise (e.g. Rancière, 1991), remains to be seen.

The Ecosoph

Although there is arguably a broad awareness of the environmental consequences of our heavy consumption of new technologies (Gabrys, 2013; Parikka, 2015; Rossiter, 2016), it remains a marginal position in public discourse. On occasion, students are addressed as what I will call an "Ecosoph", someone who is aware of the interconnections among humans, society, technology, the economy and the environment (e.g. Guattari, 2000). In the competence framework proposed by the Conference of Ministers, for instance, the Draft

proposes that students should: "Protect nature and the environment: Know [*kennen*] the ecological effects of digital technologies" (Draft: 39). Aside from one note on sustainable consumption (VZBV: 7), the ecological dimension was not addressed in the publicly available Responses. The Strategy has been revised to stipulate that students should "Protect nature and the environment: Consider [*berücksichtigen*] the ecological effects of digital technologies" (Strategy: 17). Across Europe, although numerous countries plan to harness ICTs for sustainable development, only the Czech Republic explicitly proposes that "environmental awareness" should play a role in educational goals related to digital transformations (CZ: 32) and Slovenia reports on an ICT-related project to learn about ecology (Slovenia: 20).

Arguably, the requirement to "consider the ecological effects" in the final Strategy in Germany is the strongest formulation, articulating a shift from a 'knowing subject figure' (in the Draft, Czech Republic and Slovenia) to an 'acting subject figure'. If all young people did not just "know about" but seriously "considered" the "toxic conditions of production and their effects on worker's health and the environment" (Rossiter, 2011), that would have a radical impact on their consumer behavior.

The Social Designer

The final subject figure is the "social designer". Only in one Response, from the *Informatics Society* (GI), are students repeatedly addressed as people who can change society. "The digital transformation of our entire society, culture and economy is primarily designed by people who are qualified in information science" (GI: 2). The *Informatics Society*'s express goal is to "teach students about the operating principles of a 'digital world', and to open possibilities for them to actively co-design it" (GI: 5). This Response locates students not only within media systems, but within the world at large: They should learn not only how to design media products, but also how to design the social, cultural and economic world.

This was not adopted by the Conference of Ministers' revised Strategy, whose frame for change is summarized in the introduction: "What competences do children, young people and young adults need to satisfy the demands of the digital world?" The policy addresses young people as reactive subjects who are expected to satisfy the demands of, or meet the challenges of, a world which is already digital. The notion that they can co-design and shape this world is not expressed in the Strategy. Similarly, most policies across Europe focus on *reacting* to challenges posed by digital transformations; what we can design is limited to digital products and new strategies for teaching and learning. Wales and the Czech Republic, however, address (young) people as active social designers. The Welsh *Digital Competence Framework* from 2016 includes a strand on "Citizenship", which focuses "on learners developing the skills needed to contribute positively to the digital world around them" (p. 5). The *Strategy for Education Policy of the Czech Republic until 2020* notes in 2013 that: "The 21st century is distinguished by rapid changes in the social, economic, technological and cultural conditions of human existence. Instead of passive acceptance of these changes, it is desirable that people take up the reins and actively shape their lives and public affairs" (p. 23). The intriguing point in the Czech formulation is that it goes beyond the "solutionism" (Morozov, 2013) of the German Informatics Society's Response, i.e. the implication that the future is shaped primarily through IT and the design of digital technologies. In the Czech Strategy the goal is broader: that the public takes up the reins of changing the conditions of human existence.

3 Concluding words

The first half of this chapter described several topics in current thinking about education and technology. The second half sketched six subject figures that were constituted in the consultation process in Germany in 2016 for a Strategy for Education in a Digital World, and have been central and/or marginal in policies across Europe. Three of these figures reappear throughout recent debates on education and technology: The User, the Critic and the Maker. The documents analyzed here argue over *how* relevant these figures are, and *how* they should be imagined, but they do not question *that* they are relevant to society in the 21st century. Debates over the contours of these figures are the central "mirrors through which contemporary society observes, problematizes and reflects itself" (Süssenguth, 2015: 8). They reflect (and constitute) the hegemonic, commonsensical configuration in which we live today, and they show (and shape) the contours of legitimate and desirable life.

Three other figures interrupt this discourse: The Expert, the Ecosoph and the Social Designer. They show where the metaphor of the mirror breaks down. They do not 'reflect' society. Instead, they 'interfere': These three figures "diffract the rays of technoscience so that we get a more promising interference pattern on the recording films of our lives and bodies" (Haraway, 1997: 16). The metaphor of diffraction, as the deviation in the straight direction of light waves, "is a narrative, graphic, psychological, spiritual, and political technology for making consequential meanings" (Haraway, 1997: 273). It is an optical metaphor for "the effort to make a difference in the world" (Haraway, 1997: 16). Just as interference patterns illustrate the effect of diffraction, so these three subject figures illustrate the effort to interrupt the usual administration and presuppositions of education, and shape more egalitarian, ecological, and participatory ways of living in the digital world.

The subject figures associated with student expertise, global ecosophy and a participatory shaping of society point to issues at the core of critical digital literacy and digital citizenship. To meet the challenges of a digital world, and also to shape this world together, these figures highlight the importance of student-subjects whose expertise flows into decision making processes; who are aware of, and act on, the complexity of socio-material-technical ecology; and who will learn to assume that they can be part of designing the future of their societies. These are precarious political subjects. They do not cover the range of pressing social issues. None, for instance, prioritize social justice in strong terms. The relative lack of attention to data infrastructures in the documents highlights a challenge for educational policy in a digital world: technology is constantly changing; any attempt to formalize 'competence' in a published strategy cannot hope to include the most recent issues. In this case, datafication has not been foregrounded, i.e. the increasing importance of, for instance, critical *data* literacy as a specific set of practices in critically assessing the role of digital data in decision-making processes, in transparency and surveillance, in mediating and shaping social interaction and ways of knowing the world. Nevertheless, the range of subject figures described here – even if only at the margins – shows the contours of future possibilities for making and remaking educational practice and policy in the 21st century.

Appendix: Responses to the Strategy for Education in a Digital World (in the public domain)

KMK-Strategy (08.12.2016): Strategie der Kultusministerkonferenz – „Bildung in der digitalen Welt". Berlin: Eigendruck. Available at: https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2016/Bildung_digitale_Welt_Webversion.pdf

KMK-Draft (27.04.2016): Strategie der Kultusministerkonferenz – „Bildung in der digitalen Welt" (Entwurf). Available at: https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2016/Entwurf_KMK-Strategie_Bildung_in_der_digitalen_Welt.pdf

bitkom: Bundesverband Informationswirtschaft, Telekommunikation und Neue Medien e.V. (15.07.2016): Stellungnahme Strategie der Kultusministerkonferenz „Bildung in der digitalen Welt". Available at: https://www.bitkom.org/noindex/Publikationen/2016/Positionspapiere/Bitkom-Stellungnahme-zu-KMK-Strategie-Bildung-in-der-digitalen-Welt/20160715-Bitkom-Stellungnahme-zu-KMK-Strategie-Bildung-in-der-digitalen-Welt.pdf

DGfE: Deutsche Gesellschaft für Erziehungswissenschaft, Sektion Medienpädagogik (2016): Stellungnahme zum Entwurf einer Strategie der Kultusministerkonferenz „Bildung in der digitalen Welt". Available at: http://www.dgfe.de/fileadmin/OrdnerRedakteure/Sektionen/Sek12_MedPaed/2016_Sektion_Medienp%C3%A4dagogik_der_DGfE_zur_KMK-Strategie.pdf

DS (14.07.2016): Stellungnahme des Deutschen Studentenwerks zum Entwurf der Strategie der Kultusministerkonferenz „Bildung in der digitalen Welt" vom 27.04.2016. Available at: https://www.studentenwerke.de/de/content/stellungnahme-zum-entwurf-der-strategie.

KboM! Keine Bildung ohne Medien! (15.07.2016): Stellungnahme zum Strategiepapier der Kultusministerkonferenz vom 12. Mai 2016 zu „Bildung in der digitalen Welt". Available at: http://www.keine-bildung-ohne-medien.de/wp-content/uploads/2014/06/StellungnahmeKMK-Papier_end.pdf.

GfM: AG Medienkultur und Bildung der Gesellschaft für Medienwissenschaft (GfM) (14.07.2016): Stellungnahme der Arbeitsgemeinschaft 'Medienkultur und Bildung' zum Entwurf der Strategie der Kultusministerkonferenz "Bildung in der digitalen Welt" (Version 1.0 vom 27.04.2016). Available at: http://media.wix.com/ugd/3961dd_70454349ca384bb5adcf80d784d3b5ed.pdf

GI: Fachbereich „Informatik und Ausbildung/Didaktik der Informatik" der Gesellschaft für Informatik e.V. (2016): Stellungnahme zum KMK-Strategiepapier „Bildung in der digitalen Welt". Available at: https://fb-iad.gi.de/fileadmin/stellungnahmen/gi-fbiad-stellungnahme-kmk-strategie-digitale-bildung.pdf

GMK: Gesellschaft für Medienpädagogik und Kommunikationskultur (15.07.2016): Stellungnahme der Gesellschaft für Medienpädagogik und Kommunikationskultur (GMK) zum Strategie-Papier der KMK "Bildung in der digitalen Welt" (vom 27.04.2016). Available at: http://www.gmk-net.de/fileadmin/pdf/GMK-Stellungnahme_zum_KMK-Strategie-Entwurf.pdf

Vzbv (14.07.2016): Lernen fürs Leben in der Digitalen Welt. Stellungnahme des Verbraucherzentrale Bundesverbands zum Entwurf der Strategie der Kultusministerkonferenz „Bildung in der digitalen Welt", Stand 27.4.2016. Available at: http://www.vzbv.de/sites/default/files/stellungnahme_vzbv_kmk_dig_welt.pdf

WMDE (15.07.2016): Stellungnahme zur KMK-Strategie „Bildung in der Digitalen Welt", Stellungnahme von Wikimedia Deutschland e.V. zur Strategie der Kultusministerkonferenz und anlässlich der Fachgespräche am 8. und 9. Juni 2016. Available at: https://upload.wikimedia.org/wikipedia/commons/5/56/Stellungnahme_WMDE_Bildung_in_der_Digitalen_Welt_15.07.2016.pdf

References

Allert, H. (2017). Im Spannungsfeld zwischen Digital Humanities und Subjektorientierung - Herausforderungen in der sozialwissenschaftlichen Forschung. *merz wissenschaft, 6*, 3-6.

Anagnastopoulos, D., Rutledge, S. A., & Jacobsen, R. (Eds.). (2013). *The Infrastructure of Accountability: Data Use and the Transformation of American Education*. Cambridge, MA: Harvard University Press.

Bali, M. (2017, 29 November). Against the 3A's of EdTech: AI, Analytics, and Adaptive Technologies in Education. Retrieved 20 December, 2017, from https://www.chronicle.com/blogs/profhacker/against-the-3as-of-edtech-ai-analytics-and-adaptive-technologies-in-education/64604

Balkan, A. (2017, 25 August). Colonial Design and Ethical Design. Retrieved 25 August, 2017, from https://twitter.com/aral/status/901081232985006080

Barad, K. (2007). *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham: Duke University Press.

Barbrook, R., & Cameron, A. (1995). The Californian Ideology. *Mute*, Retrieved 18 September, 2017, from http://www.metamute.org/editorial/articles/californian-ideology.

Barocas, S., & Nissenbaum, H. (2014). Big Data's Run Around Anonymity and Consent. In J. Lane, V. Stodden, S. Bender & H. Nissenbaum (Eds.), *Privacy, Big Data and the Public Good: Frameworks for Engagement* (pp. 44-75). Cambridge: Cambridge University Press.

Biesta, G. (2013). *The Beautiful Risk of Education*. London: Paradigm Publishers.

Bodén, L. (2015). The Presence of School Absenteeism: Exploring Methodologies for Researching the Material-Discursive Practice of School Absence Registration. *Cultural Studies <=> Critical Methodologies, 15*(3), 192-202.

Böhme, G. (2016). *Ästhetischer Kapitalismus*. Berlin: Suhrkamp.

boyd, d. (2014). *It's Complicated: The Social Lives of Networked Teens*. New Haven: Yale University Press.

boyd, d., & Crawford, K. (2012). Critical Questions for Big Data. *Information, Communication & Society, 15*(5), 662-679.

Breiter, A., & Jarke, J. (2016). Datafying Education: How Digital Assessment Practices Reconfigure the Organisation of Learning. *Communicative Figurations Working Paper, 11*.

Brunton, F., & Nissenbaum, H. (2015). *Obfuscation: A User's Guide for Privacy and Protest*. Cambridge, MA: MIT Press.

Butler, J. (1997). *The Psychic Life of Power*. Stanford, CA: Stanford University Press.

Caines, A. (2017, 22 May). #DigCiz. June 2017 Is Here. Retrieved 10 September, 2017, from http://digciz.org/uncategorized/digciz-june-2017-is-here/

Doxtdator, B. (2017, 26 March). Maybe We're Not Afraid: On Edtech's Inability To Imagine the Future. Retrieved 28 April, 2017, from http://www.longviewoneducation.org/maybe-not-afraid-edtechs-inability-imagine-future/

Emejulu, A., & McGregor, C. (2016). Towards a Radical Digital Citizenship in Digital Education. *Critical Studies in Education*, 1-17.

Eynon, R. (2013). The Rise of Big Data: What Does It Mean For Education, Technology, and Media Research? *Learning, Media and Technology, 38*(3), 237-240.

Foucault, M. (1982). The Subject and Power. In H. L. Dreyfus & P. Rabinow (Eds.), *Michel Foucault: Beyond Hermeneutics and Structuralism* (pp. 208-226). Brighton: Harvester.

Franck, G. (1998). *Ökonomie der Aufmerksamkeit. Ein Entwurf*. München: Hanser.

Freire, P. (1970). *The Pedagogy of the Oppressed*. London: Penguin.

Gabrys, J. (2013). *Digital Rubbish: A Natural History of Electronics*. Ann Arbor: University of Michigan Press.

Gibson-Graham, J. K. (2014). Being the Revolution, or, How to Live in a "More-Than-Capitalist" World Threatened with Extinction. *Rethinking Marxism, 26*(1), 76-94.

Giroux, H. A. (2011). *On Critical Pedagogy*. London: Continuum.

Guattari, F. (2000). *The Three Ecologies* (I. Pindar & P. Sutton, Trans.). London: The Athlone Press.

Haraway, D. (1997). *Modest_Witness@second_Millenium. FemaleMan_Meets-OncoMouse*. New York: Routledge.

Haraway, D. J. (2000). *How Like a Leaf: An Interview with Thyrza Nichols Goodeve*. London: Routledge.

Hartong, S. (2016). Between Assessments, Digital Technologies and Big Data: The Growing Influence of 'Hidden' Data Mediators in Education. *European Educational Research Journal, 15*(5), 523-536.

hooks, b. (1994). *Teaching to Transgress: Education as the Practice of Freedom*. London: Routledge.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., et al. (2013). *Connected Learning: An Agenda for Research and Design*. Irvine, CA: Digital Media and Learning Research Hub.

Janks, H. (2002). Critical Literacy: Beyond Reason. *Australian Educational Researcher, 29*(1), 7-27.

Ladson-Billings, G. (2009). *The Dreamkeepers: Successful Teachers of African American Children* (2nd ed.). San Francisco, CA: Jossey-Bass.

Lee, C. H., & Soep, E. (2016). None But Ourselves Can Free Our Minds: Critical Computational Literacy as a Pedagogy of Resistance. *Equity & Excellence in Education, 49*(4), 480-492.

Macgilchrist, F. (2017a). Backstaging the Teacher: On Learner-Driven, School-Driven and Data-Driven Change in Educational Technology Discourse. *Culture-Society-Education, 10*(1).

Macgilchrist, F. (2017b). Die medialen Subjekte des 21. Jahrhunderts: Digitale Kompetenzen und/oder Critical Digital Citizenship. In H. Allert, C. Richter & M. Asmussen (Eds.), *Digitalität und Selbst: Interdisziplinäre Perspektiven auf Subjektivierungs- und Bildungsprozesse* (pp. 145-168). Bielefeld: transcript.

McRobbie, A. (2015). *Be Creative: Making a Living in the New Culture Industries*. London: Polity.

Miller, P., & Rose, N. (2008). *Governing the Present*. Cambridge: Polity Press.

Mittelstadt, B. D., Allo, P., Taddeo, M., Wachter, S., & Floridi, L. (2016). The Ethics of Algorithms: Mapping the Debate. *Big Data and Society, Juli-Dec*, 1-21.

Morozov, E. (2013). *To Save Everything, Click Here: The Folly of Technological Solutionism*. New York: Public Affairs.

New London Group. (1996). A Pedagogy of Multiliteracies: Designing Social Futures. *Harvard Education Review, 66*(1), 60-92.

Pangrazio, L. (2016). Reconceptualising Critical Digital Literacy. *Discourse: Studies in the Cultural Politics of Education, 37*(2), 163-174.

Parikka, J. (2015). *A Geology of Media*. Minneapolis: University of Minnesota Press.

Parker, I. (2007). *Revolution in Psychology: Alienation to Emancipation*. London: Pluto Press Pluto.

Ramiel, H. (2017). User or Student: Constructing the Subject in Edtech Incubator. *Discourse: Studies in the Cultural Politics of Education*, 1-13.

Rancière, J. (1991). *The Ignorant Schoolmaster: Five Lessons in Intellectual Emancipation* (K. Ross, Trans.). Stanford, CA: Stanford University Press.

Raunig, G., & Wuggenig, U. (2016). *Kritik der Kreativität*. Wien: transversal.

Reckwitz, A. (2014). Creativity as Dispositif. In H. Knoblauch, M. Jacobs & R. Tuma (Eds.), *Culture, Communication, and Creativity: Reframing the Relations of Media, Knowledge, and Innovation in Society* (pp. 23-34). Frankfurt am Main: PL Acad. Research.

Rossiter, N. (2011). Logistics, Labour and New Regimes of Knowledge Production. Retrieved 28 April, 2017, from http://nedrossiter.org/?p=260

Rossiter, N. (2016). *Software, Infrastructure, Labor: A Media Theory of Logistical Nightmares*. London: Routledge.

Sadowski, J., & Manson, P. (2014). 3-D Print Your Way to Freedom and Prosperity: The Hidden Politics of the 'Maker' Movement. Retrieved 10 October, 2017, from http://america.aljazeera.com/opinions/2014/5/3d-printing-politics.html.

Savat, D. (2009). Deleuze's Objectile: From Discipline to Modulation. In M. Poster & D. Savat (Eds.), *Deleuze and New Technology* (pp. 45-62). Edinburgh: Edinburgh University Press.

Sellar, S. (2014). Data Infrastructure: A Review of Expanding Accountability Systems and Large-Scale Assessments in Education. *Discourse: Studies in the Cultural Politics of Education, 36*(5), 765-777.

Selwyn, N. (2016). 'There's So Much Data': Exploring the Realities of Data-Based School Governance. *European Educational Research Journal, 15*(1), 54-68.

Selwyn, N., Henderson, M., & Chao, S.-H. (2015). Exploring the Role of Digital Data in Contemporary Schools and Schooling—'200,000 Lines in an Excel Spreadsheet'. *British Educational Research Journal, 41*(5), 767–781.

Selwyn, N., Nemorin, S., & Johnson, N. (2016). High-Tech, Hard Work: An Investigation of Teachers' Work in the Digital Age. *Learning, Media and Technology*, 1-16.

Sennett, R. (1998). *The Corrosion of Character, The Personal Consequences Of Work In the New Capitalism*. New York: Norton.

Shechtman, N., DeBarger, A. H., Dornsife, C., Rosier, S., & Yarnall, L. (2013). Promoting Grit, Tenacity and Perseverance: Critical Factors for Success in the 21st Century. *U.S. Department of Education, Office of Educational Technology & Society*.

Shor, I., & Pari, C. (Eds.). (2000). *Education is Politics: Critical Teaching Across Differences, Postsecondary*. Portsmouth, NH: Boynton/Cook.

Sørensen, E. (2009). *The Materiality of Learning*. Cambridge: Cambridge University Press.

Strommel, J. (2014). Critical Digital Pedagogy: A Definition. *Hybrid Pedagogy: A digital journal of learning, teaching and technology*. Retrieved 20 November, 2017, from http://www.digitalpedagogylab.com/hybridped/critical-digital-pedagogy-definition/.

Süssenguth, F. (Ed.). (2015). *Die Gesellschaft der Daten*. Bielefeld: transcript.

Thompson, G., & Cook, I. (2016). The Logic of Data-Sense: Thinking Through Learning Personalisation. *Discourse: Studies in the Cultural Politics of Education, 38*(5), 740-754.

Watters, A. (2017, 2 December). Education Technology and 'Fake News' [The First of Ten Articles on the Stories Told About Education Technology in 2017]. Retrieved 20 December, 2017, from http://hackeducation.com/2017/12/02/top-ed-tech-trends-fake-news

Williamson, B. (2016). Digital Education Governance: Data Visualization, Predictive Analytics, and 'Real-Time' Policy Instruments. *Journal of Education Policy, 31*(2), 123-141.

Williamson, B. (2017). Decoding ClassDojo: Psycho-Policy, Social-Emotional Learning and Persuasive Educational Technologies. *Learning, Media and Technology, 42*(4), 440-453.

Wing, J. M. (2006). Computational Thinking. *Communications of the ACM, 49*(3), 33-35.