


10-20-2017

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Recommended Citation

Golden, N. A. (2017). Critical digital literacies across scales and beneath the screen. *Educational Media International*, 54(4), 373-387. doi:10.1080/09523987.2017.1391523

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This is an Accepted Manuscript of an article published in *Educational Media International*, volume 54, issue 4, in 2017, available online at DOI: [10.1080/09523987.2017.1391523](https://doi.org/10.1080/09523987.2017.1391523). It may differ slightly from the final version of record.

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Critical digital literacies across scales and beneath the screen

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Abstract

Digital technologies and education scholarship tends to focus on either individual creative design or analysis of the political economy. To better understand how ideologies travel across networks, critical digital literacies must focus on enactments beneath the screen, as the linguistic constructs known as software can enact interests across scales of activity to ‘disembed’ local actions and meaning. Investigations of these mobilities and disembedding effects challenge popular notions of digital technologies as neutral, rendering overt the ways that algorithms can naturalize manifestations of power and social arrangements. Such a framework allows for descriptive analyses of the ways hegemonic discourses are enacted through electronically-mediated semiotic activity to shape possibilities in local contexts. Examples of such disembedding effects from the U.S. educational and justice systems are explored, and it is argued that scalar analyses can contribute to future generative critical and descriptive digital literacies scholarship.

Keywords: critical digital literacies; scalar analysis; subscreenic literacies

Tracing semiotic activity across networks

Toward the end of the twentieth century, there was an unbounded optimism that new, electronically-mediated and multimodal literacies could allow for greater civic and social participation. Referring to this time, Luke (in Garcia, Luke, & Seglem, 2018) remarked that there was “a shared focus on equity and social justice, and an aspiration that new media could alter the exclusion of working class, cultural minority and Indigenous communities from and by the institutions of print literacy”(n.p.). Two decades later, broad discourses on digital media, new literacies, and issues of equity are largely free of such hopes. Luke commented recently that digital technology had not fundamentally transformed educational processes or inequities; indeed, in many communities inequality or marginalization has intensified (n.p.).

Discourses and tools can be co-opted towards any variety of ends, and ‘digital literacy’ as a signifier is no exception. Digital literacies, understood here broadly as “semiotic activity mediated by electronic media” (Thorne, 2013, p. 192), are powerful due to their utility in traversing contexts, or amplifying (or diminishing) representations of social realities. As new literacies and technologies continue to outpace the ability of conceptual frameworks to describe them, electronic media can be understood as enactments of semiotic activity themselves, a shift that impacts the ways that we engage critical and descriptive research on digital literacies.

Critical literacy, understood here as reading the word and world as well as writing and rewriting the world (Janks, 2013, p.227), includes analysis of and participation in digital ecologies. These cultures of semiotic activity are intertwined with

identity, position, difference, and access both in and beyond formal learning environments. For this reason, critical digital literacies scholarship has sought to support learners in resisting dominant narratives and building desired identities (Ávila & Pandya, 2013). The two goals of this framing of critical digital literacies are “to investigate manifestations of power relations in texts, and to design, and in some cases redesign, texts in ways that serve other, less powerful interests”(p.3). While the field has largely moved beyond versions of ‘critical’ work that suppose it possible to shed a false consciousness or access a truer form of social reality (Pandya & Golden, 2018), recent ethnographic work offers nuanced accounts of the ways learners engage digital literacies for the purposes of design: crafting an agentive self (e.g., Hull & Katz, 2006); composing multimodal narratives (e.g., Pandya, Pagdilao, & Kim, 2015); organizing for social change (e.g., Stornaiuolo & Thomas, 2017) or dialoguing about teaching strategies (e.g., Hsieh, 2017). This nuanced work is infused with the belief that digital tools can be used for design work on what might be considered humanizing purposes.

This body of scholarship exists in tension with other ‘critical’ work on the digital, done on a broader unit of analysis, that highlights “concerns over privatization and ideological authoritarianism,” (Selwyn, 2014, p.160), including fears of surveillance. How these digital systems operate is often unknown: Pasquale (2015) argues that we are increasingly becoming a “black box” society, in two metaphorical senses, one in terms of a data-monitoring device like those used in airplanes, and the other in the sense of a closed heuristic with enigmatic inner workings (p.3) The use of what is termed “big data” is intensifying surveillance in multiple social systems (Lyon, 2014), and hidden algorithms produce outcomes perceived as objective (Lynch, 2015; Golden, 2017a).

Within existing framings of the digital, this work is relegated to broad analyses of the political economy and analysis of structural inequality.

How might one square the possibilities present in the nuanced ethnographic work on digital design with such dire readings present in research at more expansive units of analysis? Recent scholarship has begun to explore the interplay between these bodies of work, investigating the ways that humanizing uses of digital tools can carry with them undesired and often unknown intentions or ends. Williamson (2015, 2016) has termed the shaping of local possibilities or experiences by distant interests or ideologies “digital governance,” referencing electronically-mediated technologies, software, and algorithms that are increasingly incorporated into educational processes and systems (Williamson, 2016, p.123). Tracing intentions, ideologies, and interests across networks to individual digital participants’ experiences, though, presents challenges to the researcher. The ways that the field has framed digital literacies to date has contributed to the challenge of such investigations. Lynch (2017) contends that we need to pay our attention to “subscreenic literacies,” maintaining that the field remains mired in a framing of digital technologies as instruments, missing the implications of digital technologies as linguistic constructs in and of themselves (p.92). This is termed an “ontological blindspot;” (Lynch, 2017, April) that, in viewing digital technologies as instruments, a wealth of discursive activity, with the potential to influence or shape interactions, occurs below the screen in the form of software. Software, (en)coded linguistic constructs, has the power to enact the will of others across space (Lynch, 2017, April). Williamson (2015) has argued that software can reflect the interests of distant people, organizations, and corporations, and can “govern and shape learners’ actions, thoughts, conduct, and subjectivities”(p.101). How might

these concerns be taken up by critical digital literacies scholarship?

While valuable, descriptive research beyond individual creative design work is needed. Descriptive work investigating the ways that interests or ideologies move across interactionally-produced scales of activity can deepen understandings of how hegemonic discourses are embedded within and naturalized through devices and electronically-mediated contexts and semiotics (Perrota & Williamson, 2016, p.11). I argue here that this project requires analysis of the subscreenic, particularly as it relates to these interests or ideologies traversing networks in ways that can ‘disembed’ possibilities for local meanings or practices. In support of what might be considered humanizing engagements with digital landscapes, I argue that such a focus constitutes a necessary critical literacy for researchers and digital participants in an age when so much semiotic activity is mediated by and through software-powered contexts and tools. Analysis of the subscreenic and associated mobilities of ideology and influence gives rise to questions of how conceptual frames might support investigations across such networks, a challenge present from the time “digital technologies enable[d] literate communication to stretch between people, across contexts and over time”(Kell, 2011, p.607). In what follows, I offer examples of how and why the subscreenic matters to critical digital literacies and as a multifaceted category of analysis. Further, I contend that a scalar approach (Stornaiuolo, Smith, & Phillips, 2017; Stornaiuolo & LeBlanc, 2016) is the best way forward as researchers investigate the ideologies and mobilities intertwined with the subscreenic.

Challenging Neutral Framings of Digital Literacy

Given the wide range of social practices and semiotic activity mediated by and through digital tools and environments, as well as the ways the digital is enacted semiotic activity itself, it is appropriate to speak of digital literacies as opposed to a solitary, reductive “literacy.” Digital literacy, like other uses of “literacy,” suffers serving as a metaphor for competence, as in the endless array of monikers like “scientific literacy” or “financial literacy” (Barton, 2007, p.22). Like the discovery of the platypus, the animal that defied attempts at categorization, or the inadequacy of classical physics to understand light as either a wave or a particle, the challenge of pinning down any one definition of “digital literacy” is that literacies mediated by digital tools, and electronically-mediated networks that are themselves semiotic activity, transcend attempts at categorization.

Moving beyond the staid categories that have defined unimodal or print literacies requires further exploration of “literacy” and its relation to digital landscapes. If a literacy is understood as “a set of socially organized practices which make use of a symbol system and a technology for producing and disseminating it” (Scribner & Cole, 1981, p.236), the notion of what is meant by “digital literacy” is complicated by the fact that the digital can reference technologies for dissemination (e.g., hardware, the internet, a LAN), a socially organized practice (e.g., using software to pay one’s taxes), or writing within a symbol system (e.g., coding to produce new software). The challenge of defining digital literacies is complicated by multiple framings of the use of this nomenclature, each highlighting a particular technical skill, interaction, or mode of distribution (Stornaiuolo & Nichols, 2017, April).

Gone are the days when scholars (e.g., Glover, 1999) could nostalgically harken to Thoreau's (1854/1966) admonition that "We are in great haste to construct a magnetic telegraph from Maine to Texas; but Maine and Texas, it may be, have nothing important to communicate"(p.54), suggesting, dismissively, that new technologies are simply vehicles for transmission. While researchers should not blindly accept claims that new technologies are a completely-transformative panacea for longstanding problems, "neither should the consequences of digital technology be dismissed simply as a case of 'old wine in new bottles'"(Selwyn, 2014, p.156). Indeed, the difficulty of researching digital literacies stems from the awareness that they engender new notions of space and that existing framings (or "bottles") do not adequately account for semiotic activity within these digital dimensions (Kirkland, 2009, p.9).

The New Literacy Studies (e.g., Gee, 1989; Street, 1984) holds that any understanding of what constitutes literacy is always contested, and that arguments for literacy's utility are ideological. Meaning is thus situated within particular worldviews, and involves invoking options from the available forms of a language (what are termed designs [The New London Group, 1996], or may be considered the lexico-grammar within Systemic Functional Linguistics [Halliday, 1985]). When an interlocutor chooses from these available forms, or grammar, to construct meaning in a particular context, the grammar (or form) shifts to situated meaning in a literacy event (Gee, personal communication, April 30, 2017). It is tempting to think of the subscrenic, the code beneath the surface that shapes the digital interactant's experience, as the grammar of digital landscapes, and indeed, it often operates as such. Code, any given computer language, shapes the contours of what one can do with or within a digital landscape.

Yet code is not *only* grammar: code can engender situated enactments across time and space, reflecting interests perceived as distant (Lynch, 2017, April). Software is itself performative, executing tasks across time and space (Williamson, 2015, p.85). Further, the digital spaces produced by and through subscreenic enactments can be understood as having their own habituses, durable yet shifting modes of engagement that also interact with other social practices (Kirkland, 2009, pp.13-14). Questions as to where these spaces begin and end arise as traditional notions of boundaries no longer hold. The subscreenic can function in various ways: as the grammar of computer languages, the enacted or situated meanings themselves, and the contexts that produce meanings. The old “bottles” we researchers use as we try to contain the complexities of the subscreenic and its relation(s) to digital literacies cannot hold them all that well, something that has implications for our understandings of digital literacies’ affordances and limitations for power and access.

Exploring Power, Access, and Ideology in Digital Literacies

Literacies have always been used to create hierarchies and create certain ‘sorts’ of people, and digitally-mediated literacy practices are no exception. The question of *whose* literacy practices are valued is at the heart of a critical approach, underscoring the ways literacies are central to social processes that systematically include or exclude people from desirable positions (Janks, 2009, p.127). Indeed, normative notions of what constitutes literacy have historically been used to maintain social hierarchies, privilege some people at the expense of others, and reinforce the values and beliefs of dominant groups (Gee, 2015, p.61). This is true of digital literacy as a signifier, which often references functional skills such as a minimal competency with software tools or an

unsophisticated information retrieval process (Buckingham, 2010). This functional definition ignores many of the cultural practices of digitally-mediated semiotics, instead focusing on reductive versions of practices associated with the contemporary knowledge economy workplace. Adding to the complexity is the fact that there are multiple versions of “digital literacy,” operating in different fields and invoking vastly dissimilar purposes (Pangrazio, 2016; Stornaiuolo & Phillip, 2017, April).

As with other literacy practices, the question of *whose* literacies are considered normative is a pressing one in digital literacies scholarship. Much of the field is focused on the digital practices of middle-class youth in the global north (Mills, 2010, p.261). Why certain forms of digital practice become normalized or centered on is a function of what has been termed the “economization of education”(Spring, 2015). The promotion and use of these tools and practices is under the direction of policy-makers and corporate entities that profit ideologically or monetarily from their use (Lynch, 2015, p.24).

Understanding how this ideological or monetary profit happens also requires a conceptual frame that can ground empirical investigations that trace the mobilities and linkages of these interests with the experiences of digital participants, particularly in terms of the affordances and limitations of digitally-mediated tools. The initial step at the level of the political economy has been to recognize what has been termed the education-industrial complex, a reference to the networks of corporations and think tanks promoting technophilic ideologies, services, and products (Picciano & Spring, 2013, p.2). It is imperative that the field questions the oft-unquestioned promise of these promoted tools and services, and that we empirically investigate specific the scales of activity that shape the use of these digital tools and practices.

On a fundamental material level, perhaps the most obvious interest in framings of “digital literacy” involves the focus on, and sale of, hardware, which provides its own rationale for existence (and purchase) with its newness, tapping into discourses of new technologies as “transformative” or “disruptive” (Selwyn, 2014, p.155). Thoreau’s (1854/1966) admonition at the dawn of the industrial age may prove apropos in this regard: “Our inventions are wont to be pretty toys, which distract our attention from serious things”(p.54). This is echoed in recent scholarship noting that the rush to include pretty toys such as iPads and ChromeBooks in the learning process has often preceded the necessary explorations of how these tools might shape pedagogies or transform classroom talk (Phillips & Garcia, 2013). Accompanying the profit motive are the ecological and environmental effects of our seemingly-endless production and consumption of hardware, and the rarely-critiqued ideology that suggests that new technologies are always in our collective best interest (Bowers, 2014).

The ideological interests and linkages, though, go far beyond the mantra of bigger, better, faster, and more. Mirra (2017) contends that the term “21st century learning,” a moniker deeply associated with new literacies and digital technologies, functions in ways that ignore—or seek to obscure— domestic and international crises including increasing nationalism, xenophobia, polarized political discourse, and continuing social and material inequities. The term is used in a way that imagines that we are not yet in the 21st century, and glorifies a decidedly neoliberal vision of an interconnected global village, despite the current realities of intensifying disparities, tribalism, and calls for more stringent borders (Mirra & Garcia, 2017, April). The rhetoric around “21st century learning,” though, continues as systems of oppression perpetuate

and intensify despite the near-ubiquity of shiny tools in classrooms throughout the global north. The dominant discourse suggests that (some) people are left out of the knowledge economy because they do not have the competencies that come naturally with the presence of digital learning tools. The notion of workers' literacies, or perceived lack thereof, being the catalyst of shifting labor markets or (an imagined) diminishing productivity is not new. In the U.S. context, Gowen (1994) asserted that, in times of social and economic change, the literacy competencies of the workforce are blamed as the genesis of national hardships, framing "the literacy levels of the current workforce and the 'failure' of schools as the problems that must be solved to make America great again"(p.165). Similar rhetoric persists, though the current literacies most often associated with the ability to participate in the knowledge economy are a functional and human capital-oriented version of digital literacy described by Buckingham (2010) above. It is now laced with the belief that digital technologies, by virtue of their presence, will transform the learning process. This is a form of "magical thinking" (Mirra, 2017), implicitly suggesting that the presence of up-to-date hardware will serve as a "silicon bullet" (Lynch, 2015, p.1) with the power to cure all that ails educational systems and the economy within which they prepare workers to participate. As researchers, practitioners, and policy-makers rush to institute and further digital learning systems, it remains imperative to move beyond the magical thinking and explore what interests and ideologies are being taken up, and how local contexts and practices are influenced across digital networked spaces. This requires descriptive work grounded in a conceptual frame that understands these ideologies as mobile across networked space, and the inclusion of the beneath-the-screen literacies that can convey or shape the taking-up of these interests.

Tracing Disembedding Effects

Researching the ways that interests and ideologies move across networked space is no easy task due to the shortcomings of existing frameworks. As referenced above, existing scholarship on digital literacies tends to be bifurcated, either focusing on the individual participant's creative design work and use of a digital or multimodal technology *or* a political economy of education and technology (Selwyn, 2014, p.160; Pangrazio, 2016, p.168). The conceptual frameworks guiding scholarship in the field must account for the ways units of analysis intersect and inform each other. Lynch (2015) offers a conceptual map that brings together the spheres that constitute software space, bringing together production, promotion, policy, and enactments in multiple spheres (e.g., school leaders, coaches, teachers) with learning systems shaped by code, information systems, and user interfaces. Similarly, Stornaiuolo & Phillip (2017, April) offer a framework illuminating the signifier "digital literacy" as it operates-in-use in multiple historical and social practices, and at different scales of activity. The ideologies and interests of promoters or creators of digital technologies can potentially be traced to the ways that broader discourses influence the affordances and limitations at each scale of activity. Simultaneously, a scalar analysis allows researchers to investigate how meanings are taken up in local, interactionally-produced, spaces.

The concept of scales is useful in thinking through recent debates in literacy studies that stem, in part, from the emergence of new technologies and literacies. As digital literacies involve networks, multiple people, and manifold contexts, it becomes increasingly difficult to study literacy events, which are generally understood to be "bounded" in space and time (Kell, 2011, p.607). This muddies understandings of what it

means to research local, situated literacies when meanings, interests, and ideologies seem to travel across contexts through digital (and other) networks and tools. Critics have argued that there are “limits [to the] local,” maintaining that something is lost when researchers attribute responses or effects to the local level when they may be the result of decisions or interests initiated elsewhere (Brandt & Clinton, 2002, p.338). This critique of the New Literacy Studies’ understanding of literacies as locally-realized, situated social practices is predicated upon the view that literacy practices are themselves responses to new technologies (p.352), and that literacies have the power to disrupt local meanings or practices (p.354). Street (2003, 2004) responded with a fierce defense of the local, arguing that interests that might be considered global or distant (e.g., news media from a distant country, the naturalization of a particular form of English, or a framing of the ideal learner/worker for the knowledge economy) are “often mediated by local interests”(2003, p.2829). These “distant” literacy practices are taken up in specific, local ways that involve a dialectical process that is more complex than “external imposition or local resistance” (2004, p.328). This process, which has the potential to disrupt or dislodge local meanings or practices, is explained as a form of ‘disembedding,’ the “separation of interaction from the particularity of locales”(Giddens, 1991, as cited in Street, 2003, p.2829). One example of disembedding is a money system, which relies on symbolic value conferred distantly, but whose value is instantiated in local practice. This concept of disembedding, Street (2004) argued, can be applied to all forms of communication, including digital and multimodal communicative practices. Street contended that “literacy...is always instantiated, its potential realised, through local practices...this must also be true of other, multimodal communicative practices” (2004,

p.329). With the use of the concept of disembedding, the researcher can take into account the sense of distance of interests and ideologies from local conditions while sustaining rich descriptions of local mediations, conditions, and practices as these interests and ideologies are enacted (Street, 2004, p.329)

The challenges, though, outlined above, of researching literacies and “distant” interests as they travel across networks are significant. How might disembedding effects be traced from multiple or faraway contexts and understood to be realized through local practice? It is here that the concept of scale is of use. A scalar analysis can inform linkages across networks and offer the field expansive understandings of digital literacies as they are enacted. Scale is a tool useful for exploring spatial and temporal relationships, existing within “categories [that] are not pre-formed but locally contingent, interactionally produced, and actively negotiated” (Stornaiuolo, Smith, & Phillips, 2017, p.17). This is in contrast to theoretical frames grounded in a priori hierarchical categories of analysis (e.g., micro, meso, or macro) that eschew understandings of scales as discursively negotiated and dialectically produced. Scalar analyses have been used to investigate available identities within educational spaces (e.g., Nesper, 2004), U.S. federal educational policy (e.g., Pandya, 2012), and teachers’ cross-cultural collaborations (e.g., Stornaiuolo & LeBlanc, 2016). Researching the scales of activity enacted within the experiences of a digital literacies participant involves complexities including the use of and interactions between multiple technologies, objects, spaces, people, languages, and platforms. Here, I propose the use of scalar analysis to investigate some of the ways that interests and ideologies can arise from “distant” spaces and disembed possibilities for meaning and action in a particular local space. This approach

can demonstrate how activity at one scale of activity can have the power to “disembed” activity elsewhere (e.g., the scale of activity produced through the interaction between subscreenic code and a digital participant).

Understanding Software as Semiotic Activity

Discussion of “digital literacies” easily becomes removed from questions of ethics and practice, and mired in specialized vocabularies. To give a sense of what is at stake here, I explore examples from the U.S. educational and justice systems, and offer evidence of what scalar analyses might contribute to generative critical digital literacies work. These brief examples highlight how the linguistic constructs known as software can carry interests and ideologies across scales of activity to shape local possibilities for action and meaning. Further, these brief examples underscore the need for empirical work describing how these interests and ideologies are dialectically taken up, enacted, and resisted in local spaces. This is of particular importance given technology’s vaulted status as neutral and objective, naturalizing manifestations of power and social arrangements (Golden, 2017a).

Naturalizing systemic racism through software

Software plays a central role in maintaining separate and unequal educational opportunities for marginalized youth. While digital ecologies can play a central role in racial formation (Nakamura, 2008, p.1681), they can also serve to naturalize existing hierarchies of racial privilege and discrimination. Fine and Ruglis (2009) reference public schools in communities of color and communities of poverty that are “increasingly segregated and obsessed with testing and classification...[and] fully inadequate to the task of educating for rigor and democracy”(p.23). The obsession with testing and

classification is enabled through software space that converts lived realities, learner strengths, and communal needs into a number, cluster grouping, or other data point (Golden, 2014; Lynch, 2015a; Lynch, 2015b). These data points can produce or reproduce systems of privilege and oppression. Fine (in Weis & Fine, 2012) writes of her experience at a community meeting on a new public school that was to replace a school considered to be failing New York City children, describing the ethos of class and racial privilege that pervaded the discussion. Parents at the meeting assumed the new school would be for “3s and 4s,” the highest test scores, data points that obscure systemic opportunity gaps through “the language of demographic neutrality”(p.193). These numbers in a database conceal relevant knowledge not able to be articulated by a scale of 1-4, including access to rigorous curricula, well-prepared teachers, instructional resources, class size, course offerings, and so on, all obscured by the final data point which then determines future educational opportunity (in this case, the possibility of attending the new school). The previous school

earned an empirical database that reasonably justifies the designation ‘failure,’ unleashing processes that would result in a school closing. This strategy of educational reform—segregate children by race/ethnicity, class, and academic history into varying strata of schools; measure and publicize differential outcome data; declare crisis and close the school; reopen it for more selective public/charter students—is a [U.S.] national trend. (p.193)

This process is also indebted to the disembedding effects of the software-powered databases. Educational access and deservingness is effectively outsourced to algorithms that produce data laundered of relevant inputs, maintaining racial and class privilege and contributing to the oppression of marginalized learners.

Systemic racism is naturalized through software in the U.S. justice system as well. Decisions are now informed by proprietary software employed to determine the risk factors in play for an individual defendant. More specifically, these software packages are “used to set bail, determine sentences, and even contribute to determinations about guilt or innocence,” despite the fact that the algorithms or inputs that guide them are not public (EPIC, n.d.). Referencing the Northpointe, Inc.’s software-enabled tool Correctional Offender Management Profiling for Alternative Sanctions, or COMPAS, which is currently used in many jurisdictions across the nation (CJPP, 2016), Freeman (2016) argues that a reliance on proprietary algorithms violates defendants’ right and ability to question the information used during the sentencing process (p.88). These proprietary algorithms use generalized group data to assess risk, thereby precluding the possibility of individualized assessments or sentencing (p.89). Like other risk assessment algorithms, identity categories such as age, region, family background, race, and employment status are used to determine future risk, resulting in cases in which two people accused of the same crime may be given radically different bail or sentencing outcomes based on perceived group membership. Not only are the inputs beyond the individual’s control, there is no way to challenge the results (EPIC, n.d.). There is evidence of racial bias built into the system: a recent study (Anguin, Larson, Mattu, & Kirschner, 2016) in a Florida jurisdiction found that the algorithm was “particularly likely to falsely flag black defendants as future criminals, wrongly labeling them this way at almost twice the rate as white defendants” while “white defendants were mislabeled as low risk more often than black defendants”(n.p.). Because this software comes from the private sector, it is not subject to state and federal laws, including laws intended to mitigate racial

discrimination. Other concerns about the use of these algorithms include the challenges of including all or enough relevant data, and the ways that certain factors are weighed (e.g., employment status, lack of housing) that can reduce or intensify the resulting risk category. Proponents of risk assessment algorithmic tools like COMPAS argue that this software will improve with more accurate data, and that these tools are meant only to provide data points to judges when making decisions. The recommendations enacted through this software, though, have a disembedding effect, interrupting decision-making factors from other scales of activity (i.e., not the subscreenic algorithms). Freeman (2016) argues that there is “the influence of the ‘technology effect’ [that] deteriorates the trustworthiness of judiciary discretion”(pp.97-98). The subscreenic algorithms can be weighed in ways that call into question human decision-making based on potentially-relevant factors operating at other scales. As Freeman (2016) puts it, “judges are humans who do not carry the air of mystique and grandeur that technology bears”(p.106).

Producing pedagogical subjects through learning analytics

Digital governance impacts educational systems as well, eroding the spaces for debates about what counts as relevant data in “data-driven” teaching and learning (Golden, 2014). Teachers report losing decision-making power as a result of neoliberal education reforms (Golden, 2017b), and their agency is increasingly being outsourced to the private sector, rationalized through discourses on accountability, testing, and data (Lynch, 2015a, p.108). This involves software as data infrastructures and policy instruments: one example is a system of governance in education in England in which digital policy instruments continually appraise learners’ actions to render them discernable and susceptible to digitally-mediated pedagogical intervention (Williamson,

2016, p.138). In lieu of teachers' agency and professionalism, software systems are increasingly used to collect, measure, and predict, and offer pedagogical strategies and interventions, disembedding existing pedagogical processes. Private sector interests dominate as data are collected and used to dictate appropriate pedagogical interventions. The options of large-scale databases produce identity categories for learners through the limited options available for rendering intelligible student personal data, and "the logic of selection...ensure(s) that the will of the users aligns with the ontology of the interface"(Lynch, 2015, p.40).

Scalar analyses can be useful in tracing the interests of stakeholders and exploring the way they are represented in, and produce, software to achieve stated goals. Williamson (2015) investigated the specific ways entities in England sought to delegate pedagogical decision-making to algorithms that can shape aspects of learners' competencies (p.83). Examining five different organizations' forays into educational technologies, Williamson traced the ways that these entities seek to create and employ "big" educational data to make "learners visible, knowable, and amenable to pedagogic intervention"(p.97), either human or automated. Learning analytics and adaptive software systems necessarily create simplified categories in the creation of this knowledge, and the anticipatory interventions can shape the learner as a particular sort of learning subject, disembedding possibilities for other pedagogical strategies and ways of assessing learners. Perrota and Williamson (2016) found this in comparative analyses of online learning platforms, in which "methods used for classification and measurement...are partially involved in the creation of the realities they claim to measure"(p.2). As with the justice systems software, contextual factors, individual variance, and patterns of

engagement for members of perceived groups are treated “as essential entities...run[ning] the risk of crystallising knowledge about those group”(Williamson, 2016, p.139). Data produced by these software-powered learning analytics systems shift from contingent to naturalized, totalizing truths about where a learner belongs in a digital learning hierarchy (Perrota & Williamson, 2016, p.10). Stakeholders in digital learning tools can thus make bold claims about the utility of their products based on learning outcomes shaped by circular rationales and processes.

Welcoming Critical Digital Literacies Across Scales (and Beneath the Screen)

Given these examples of how algorithms operating beneath the screen can carry interests and disembed possibilities for action and meaning, critical digital literacies scholarship must investigate multiple scales of activity and explore linkages between broad interests and the experiences of digital participants. This is of particular importance in an educational climate in which for-profit entities envision a time when digital “21st century” learning initiatives have replaced the overwhelming majority of face-to-face learning opportunities (e.g., Luksha & Peskov, 2013, p.10). Empirical work must highlight paths forward as deeper knowledge on the relationships between software space, social arrangements, and learning processes. Social processes can be naturalized in software space, obscuring discriminatory practices and providing digitally-mediated “neutral” readings that contributes to a system of logics that rationalizes and legitimizes structural oppressions, but there are possibilities for interrupting these hegemonic processes. Research on digital literacies must not only continue describing individual creative design work or analyzing the political economy; but engage descriptive work that empirically investigates how interests travel across networks and how they are

dialectically enacted or resisted. The mobilities between and across these scales is of importance, and employing such a conceptual framework enables descriptive analysis of how hegemonies in education are produced through devices as well as electronically-mediated contexts and semiotics.

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