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More-than-Social Innovation: The Material and Discursive Enactment of an Open Ed-tech Network

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Dedication

For Jackson. More is more.

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Abstract

More-than-Social Innovation: The Material and Discursive Enactment of an Open Ed-tech Network

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Education policymakers, researchers and reformers are experimenting with "open" urban innovation hubs and ecosystems, calling upon teachers and school leaders to be more "entrepreneurial" in their approaches to change with technology. Open innovation networks are fundamentally multivoiced and participatory by design, but we do not know very much about how they work with technology or what we might expect from them in terms of educational change. Despite the democratic possibilities of open innovation networks, if the history of technology-driven educational reform in this country serves as any guide, we might well expect the status quo in terms of their impact on school-based learning and teaching.

The broad purpose of this revelatory case study is to characterize the composition and enactment of one nominally open, urban ed-tech innovation network, identifying how and why actors swarm and learn around goals and projects that exist in dialogic tension. I take a mixed methods approach to capturing and interpreting highly mediated network

interactions, combining egocentric network analysis, computational topic modeling and multimodal narrative analyses. I show how and why individual *entrepreneurs of the self* position themselves around and become a part of the *spectacle* of the ed-tech network, and how a pervasive market form patterns identity and interest discourses in both digital and physical urban space. The ed-tech network is revealed to act, know and learn in different ways within a variety of distinct *scenes*, including an inter-institutional assemblage of loosely coordinated computer science education actors, a scene of commercial and social entrepreneurs and a precarious community of practice focused on the production of marketable ed-tech professional identities and futures. The study concludes that the ed-tech network as a social technology and a spectacle can indeed convene broad discourse and boundary-spanning activity around the changing goals of school and education for the common good, even as the network is deeply patterned by enterprise. A framework for *carnivalesque* innovation is presented as a way of thinking about how open innovation networks and contemporary open learning environments can better pursue social goals of equity and justice in a marketized context.

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Chapter 1: Introduction

Far from catalyzing "disruption" in education, technology tends to be co-opted in the reconfiguration of the social and institutional status quo (Cuban, 2001, 2013; Sims, 2017; Watters, 2014). Historians and ethnographers of American public education have documented the stubborn resilience of traditional teaching and learning practices in the face of perennial waves of crisis discourse and techno-solutionist intervention (Cuban, 2013; Tyack & Tobin, 1994). In a contemporary manifestation of this discourse, policymakers and educational researchers are experimenting with public-private innovation hubs, collective action initiatives, and calling upon teachers to be more "entrepreneurial" in their approaches to change with technology in schools (Berry, 2015; Borasi & Finnigan, 2010). One thing that makes these boundary-spanning innovation initiatives different from those of the past is the way they leverage the collaborative efficiencies, affordances and *ethos* of the participatory web. These open, networked, public-private service ecosystems may conceptualize and approach educational change in much different ways than the institutional, philanthropic, industrial and governmental institutions of the past. Indeed, these networks are fundamentally *dialogic* and *multivoiced*; we do not know very much about how they work or what we might expect from them in terms of change. They are networks of ambiguously linked knowledge workers, and the ways that they know, learn and act for change in schools are likely quite different from communities of educational reformers of the past. Despite the democratic possibilities of these participatory networks (Shirky, 2010), if the history of technology-driven educational

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reform in this country serves as any guide, we might well expect the status quo in terms of their impact on school-based learning and teaching (Cuban, 2013; Sims, 2017).

The broad purpose of this study is to characterize the composition and enactment of one nominally open, urban ed-tech innovation network, identifying the big problems, goals and ideals around which the network "swarms" (Engeström, 2007) materially and discursively, as well as the multitude of smaller goals and projects which exist in dialogic tension. In taking a *narrative* approach (Lejano, Ingram, & Ingram, 2013), I consider the ed-tech network as an emergent, polyphonic, sociomaterial composite, and shed light on how issues of technology, power and agency influence its composition, enactment and transformative potential.

RESEARCH QUESTIONS AND GOALS

I will interpret the ed-tech network in the context of historical discourses about education, learning and innovation, and focus in particular on how the network operates around broader social goals of equity and justice. My research questions fall roughly into five domains:

(1) *Network enactment:* How is an open, decentralized, multivoiced, urban ed-tech innovation network enacted in different ways, by different groups, and for different ends?

(2) *Boundary activity:* How, why, and to what extent do individual people, concepts and technologies interact and move across structural, functional and cultural boundaries in such a network.

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(3) *Learning and expertise:* How is expertise perceived and enacted across the network, and in what ways does the network appear to learn?

(4) *Transformational potential:* How does the network approach the use of technology for educational goals of substantive equity and social justice?

(5) *Methodology:* How can we frame and analyze cases of open, dynamic, multimodal networks for the study of learning and innovation?

Primary outputs of this study include (1) a series of *more-than-social network* representations, (2) a context-specific set of identity and interest discourses that are used by "ed-techers" to position themselves within and enact the network, (3) an account of work and learning in different "scenes" on the network with implications for the design of connected education, and (4) an account of how story and spectacle are used by ed-techers to transform themselves in pursuit of educational change.

GENERAL THEORY AND METHOD

Drawing on a set of sociomaterial concepts and perspectives on networks derived primarily from activity theory (Engeström, 2008, 2009; Spinuzzi, 2017) and strands of actor-network theory (Callon, 1984; Latour, 2005; Law & Hassard, 1999), I will examine how an open ed-tech innovation network and "meetup" is enacted sociomaterially, characterize it in terms of narratives (Boje, 2001b; Czarniawska, 1998), transformation (Callon, 1984; Latour, 2005), and the co-configuration (Engeström, 2007; Victor & Boynton, 1998) of object(ives) (Russell, 1997). I also incorporate sociological concepts of the entrepreneur of the self (Foucault, 2008), spectacle (Debord, 1995) and the

carnivalesque (Bakhtin, 2004) to understand how and why individuals "swarm" (Engeström, 2007) on an open storytelling network. In positioning this as *sociomaterial* research, my purpose is not to isolate the study at hand from related and very relevant *sociocultural* frameworks, but rather to recognize that the highest level unit of analysis—the *network*—may overflow or resist fundamental sociocultural categories of *community* and *practice,* not to mention the ethnographic methods commonly employed by sociocultural researchers in the study of communities of practice. As my practical intention is to speak to questions of how humans and technology are networked in relation to democratic goals of public education, I prefer a humanist orientation in sociomaterial analysis.

I take a mixed methods case study approach to studying the ed-tech network, examining it as a revelatory case (Yin, 2014) of an open, urban, participatory innovation network. In order to capture and account for the highly mediated interactions that are hidden in online environments and distributed across institutional and geographic contexts, I combine systematic egocentric network analysis with computational topic modeling, narrative methods, artifact analysis and participant observation. This theoretical and methodological approach helps me show how ed-techer interests and identities become entangled, and how the network knows, learns and acts in different ways via a variety of material-discursive *scenes*. I examine the extent to which the *spectacles* of ed-tech around which ed-techers *swarm* are capable of influencing the material production of educational technologies as well as broader public discourses about what school is and could be. Bakhtin's notion of *carnival* is used to help differentiate cases of network spectacle that

involve a concerted surfacing and critique of the dominant norms and infrastructures that pattern network composition and enactment. Critical theories of technology (Feenberg, 1991) and entrepreneurship (Essers, Dey, Tedmanson, & Verduyn, 2017b) help show that while the "open" and "connected" nature of the network presents possibilities for change, we must still *choose* and *act* persistently and critically in pursuit of democratic goals of justice and equity. I conclude by examining what this network of knowledge workers shows us about 21st century literacies, connected pedagogies, and the study of learning and innovation in open networks.

TECHNICAL TERMS AND CONCEPTS

Technology concepts:

- *Technology*: Per Feenberg (1991, p. 14), "technology is not a thing in the ordinary sense of the term, but an ambivalent process of development suspended between different possibilities." Building on Sims, (2017, p. 13), educational technology can be seen as mediating the intertwined processes of "problematization" and "rendering technical" in pursuit of educational innovation.
- *Ed-tech:* A spectacle, network and assemblage of technologies around which materials and people swarm in pursuit of educational possibilities.

Sociological concepts

- *Entrepreneur of the self:* The individual subject in postmodern society (Foucault, 2008). The entrepreneur of the self is in a constant state of adaptation to conform

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to a pervasively marketized neoliberal society. The entrepreneur acts freely, but is controlled *at a distance* by norms of *responsible self-management* (McNay, 2009).

- *Spectacle:* "In societies where modern conditions of production prevail, life is presented as an immense accumulation of spectacles…The spectacle appears simultaneously as society itself, as a part of society, and as a means of unification" (Debord, 1995). This study interprets Debord's spectacle as a form of social organizing that operates in a postmodern society where representations and images are commodified for social control and subjective identification. Spectacle is a "celebration of betterment," and frequently "a narrative and a theatric performance that legitimates, rationalizes, and camouflages violent production and consumption" (Boje, 2001a).

Network concepts:

- *Networks:* Adopting Spinuzzi's language, networks are conceptualized as intentionally "woven" or "spliced" sociomaterial assemblages of human and nonhuman agents (2008, p. 8). Networks may be woven as structured, developmental, humanistic endeavors on the one hand, or emerge as spliced, amorphous, agential rhizomes on the other. Networks may fall somewhere between these extremes, or amount to a hybrid or patchwork.

- *Actors:* I use the word actor in a very general sense to refer to networked human and non-human components of an *actor-network* (Latour, 2005), or to the linked subjects, objects and mediational elements of an object-oriented *activity system* or

activity network (Engeström, 2008). I also use actor to refer to both *egos* and *alters* in the context of an *egocentric network analysis* (Carolan, 2014).

- *Translation:* A process of network transformation derived from Actor Network Theory (Callon, 1984). It occurs through a Machiavellian process of "splicing" (Spinuzzi, 2008).

- *Development:* An object-oriented process of network transformation based in later generations of activity theory (Engeström, 2009). Development is a humanistic process of "weaving" networks (Spinuzzi, 2008).

- *Objects:* An object is a projective and objective "sensemaker" (Kaptelinin, 2005) which is necessary for circumscribing and analyzing object-oriented activity systems. A *runaway object* (Engeström, 2007) is *polyphonic* (Bakhtin, 1984). Networked actors dialogically perceive, describe and act upon runaway objects in different ways and with different motivations. Open source software, like the Linux operating system, has characteristics of a runaway object, as do wicked problems like *global warming* and *educational inequity* around which innovators often "swarm" (Engeström, 2007).

Storytelling concepts:

- *Stories:* I use the word *story* very generally to refer to any of several specific forms of narrative. *Narratives* are retrospective, coherent, plot-driven and often "grand" performances of sense making. Via Boje (2001), *antenarratives* are elemental and preliminary fragments of potential narratives and stories that have not yet been fully mobilized in a storytelling network. Stories, narratives and antenarratives are

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treated as polyphonic (Bakhtin, 1984, 1986) and often agential (Boje, 2011) organizers of activity within a sociomaterial network.

- *Enactment:* Individuals simultaneously create and respond to the network environment in which they sense and act (see Weick, 1995, p. 30). Enactment is the performance of a network through practice, discourse and storytelling (Orlikowski & Scott, 2008).

Equity and Justice:

- *Substantive equity:* Per Guinier (2004) *substantive equity* as a goal of education is distinguished from *formal equality* and *diversity measures* in that it involves the material redistribution of resources and the cultivation of deeper literacy about how oppression operates in a stratified society.

- *Social justice:* Social justice may be served in counteracting inequity and oppression (e.g. through redistribution or reconciliation).

- *Justice-centered technology framework:* Borrowing from Vakil (2018), a justice-centered framework focuses the activity of technology innovation and integration in educational settings on the goals of building critical literacies about technology, equity, social justice, and how these are entangled. Justice-centered technology engages learners in understanding technology as value-laden and asks them to act with technology on ethical issues. Innovation within the context of a justice-centered technology framework may be understood as a form of *resistance* (Giroux, 1983; Solorzano & Delgado Bernal, 2001).

Chapter 2: Literature Review

In this chapter, I draw from educational technology scholarship, the learning sciences, organizational studies, and science and technology studies to situate an increasingly common type of open, urban ed-tech innovation network. I make the case for adopting a sociomaterial perspective and adapting narrative approaches common in organizational studies to reveal how a largely hidden ed-tech innovation network is dynamically enacted in different ways, for different ends, for different actors. A deeper understanding of this kind of innovation network allows us to (1) particularize its characteristic and potentially novel ways of networked knowing and learning, and (2) better understand and design for the transformation of education.

WORK AND EDUCATION

It is important to recognize how much of the most formative research on learning—for example on apprenticeship (Lave, 1977), communities of practice (Lave & Wenger, 1991), situated (Suchman, 1987) and distributed (Hutchins, 1995) cognition, and expansive learning (Engeström, 1987)—were studies of *work*, not school. Furthermore, many of the most famous (and infamous) educational change projects in this country were promoted and funded by industrialists and philanthropists interested in "retooling" the available workforce per the changing requirements of their enterprise. See, for example, Jerome Anderson's (1988) historical account of the role that northern industrial philanthropists played in saving "black public education from total eradication by stressing the value of the Hampton-Tuskegee style of industrial education" (p. 80).

In deepening our understanding of learning and education, we must attend to work not just as a "general societal category or relationship of employment" (Engeström, 2006) specifying the rational-scientific design of curriculum and instruction (e.g. Bobbitt, 1918; Tyler, 1949). Rather educators, educational researchers, and educational reformers should carefully consider work because of its importance in "practical doing and producing concrete use values" (Engeström, 2006). In other words, it is important to look at work not just as a guide for what market- or industry-oriented changes we might make to school curricula or pedagogy, but more importantly because studies of work show us *how and why we learn* as well as *how and why we must pursue change* in the first place. For many enmeshed in the contemporary globalizing knowledge economy, the sociotechnical environments in which they work, learn and act for change no longer resemble the classic office or factory environments within which we have developed school curricula, pedagogies, theories of learning and approaches to innovation. This begs the question: how, exactly, is work changing, and what might these changes reveal about knowing and learning in general and about acting innovatively in schools specifically? What does 21st century work look like, and what are its requisite 21st century literacies?

Social Production and Networked Knowledge Work

Lusch and Vargo (2014) describe our emerging economy as increasingly organized with respect to service-dominant logic as opposed to goods-dominant logic. Service-dominant logic locates value not in the production of a good itself, but in the *consumption, experience,* or *use* of a good by consumers. Value is therefore determined in terms of

services, and services are co-created among networks of firms and customers, or organizations and beneficiaries. In such an economy, entrepreneurs lead, foster and collaboratively contribute to *service ecosystems* that co-create new value through "resource integration and service-for-service exchange" (Lusch & Vargo, 2014). Engeström (2007) highlights how the arrangements of "social production" characterize contemporary knowledge work and how these arrangements are different from those observed in traditional communities of practice oriented towards craft and manufacturing (Table 1). Engeström describes *knotworking* as the predominant mode of knowledge work, occurring among emergent, networked groups of individuals and coordinated by *peer critique* and *negotiation*. He adapts Deleuze and Guattari's (1987) concept of *rhizome* to stress the non-hierarchical, symbiotic, heterogeneous structure and nature of participation in these networks, and notes that globalization and technology-driven enhancements in connectivity both facilitate our productivity and complicate our ability to come to a shared understanding of the object(s) of our activity across these *mycorrhizae* networks.

	NATURE OF OBJECT	LOCUS OF AGENCY	COORDINATING MECHANISM	LEARNING MOVEMENT
CRAFT	Personal object	Individual actor	Identification and subordination	Peripheral participation, gradual transition toward the center
MASS PRODUCTION	Problematic object	Team	Process management	Focal involvement, linear and vertical improvement
SOCIAL PRODUCTION	Runaway object	Knots in mycorrhizae	Negotiation and peer review	Expansive swarming engagment, multi-directional pulsation

Table 1: Historical modes of production and learning. Source: Engeström (2007, p. 8)

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It seems, then, that traditional individualist notions of production and value creation are being challenged by more postmodern conceptions of *entrepreneurial networks* and *service ecosystems* that *co-configure* (Victor & Boynton, 1998) goods and services and blur the distinction between consumer and producer. Lusch and Vargo (2014) stress that the specific value generated within these networks is always individually and phenomenologically determined, opening the door to conceiving the services and products of networked activity as "runaway objects" (Engeström, 2007) of production. The networked knowledge workers learning and innovating in these service ecosystems may therefore come together to pursue specific innovations for a wide variety of very different reasons, ranging from economic profit, social change, the solution of specific problems, educational quality, equity, efficiency, relevance and/or effectiveness. Knowledge workers may know, learn and act in the world in quite new and different ways.

Ed-tech Innovation Hubs

The logic of social production and service ecosystems influencing networked knowledge work is also influencing the way we think about and approach educational change, both in terms of the *process* and *goals*. A quick search of the popular professional networking site Meetup.com shows that there are well over 100 ed-tech meetups, three quarters of which have memberships of over 100 people. The top five are located in major American metropolitan areas and have memberships ranging from about 2000 to over 5000. These meetups all tend to be open access, bringing together entrepreneurs,

educators, designers and coders. The meetups are a web-mediated glimpse of what is likely

a vast, open, rhizomatic service ecosystem of the sort described by Engeström, (2006).

Who are the "ed-techers," and what are they doing? What are the *runaway objects* around

which they are *swarming,* and what are the outcomes?

Difficult problems like educational change have, for decades, been approached

through models of transdisciplinary and cross-sectoral collaboration like funder

collaboratives, public-private partnerships, multisectoral stakeholder initiatives, social

sector networks and collective impact (Kania & Kramer, 2011). More recently, many large

cities and universities have begun providing specific support and infrastructure for tech

innovation "hubs" and startup "ecosystems," many of which seek to innovate in

educational markets.   Emerging urban innovation hubs, according to Toivonen and

Friederici (2015), are characterized by several core functions:

1. Hubs build collaborative communities with entrepreneurial individuals at the center.
2. Hubs attract diverse members with heterogeneous knowledge.
3. Hubs facilitate creativity and collaboration in physical and digital space.
4. Hubs localize global entrepreneurial culture. (Toivonen & Friederici, 2015)

Elsewhere, Toivonen (2013, 2016) characterizes hubs more generally as "Social

Innovation Communities":

> The Social Innovation Community is, at first glance, a perplexing entity that
> escapes easy categorization: it is heavily networked but not to definable simply as
> "a network"; practice-focused but not a community of practice (in Wenger's sense);
> an ecosystem-builder yet not an ecosystem; and concerned with collective
> processes but not with centrally coordinated "collective impact" (as set out by
> Kania and Kramer (2011)). The Social Innovation Community, rather, is to be seen
> simultaneously as a collaborative community (Hecksher & Adler, 2006) as well as
> a collective actor that strives to rewire wider social innovation circuits in a given
> area beyond any one field or campaign (such as education/educational

improvement). This rewiring is performed around, and guided by, an emergent paradigm of social problem-solving that is implicit in the "cultures of changemaking" that mark each actual Social Innovation Community and that are founded upon a collaborative form of individualism. (Toivonen, 2013)

This study approaches the case of "Ed-tech Neotown" as an open, networked, education-focused hub operating in the context of a broader urban Social Innovation Community. But how do we even bound such networks that may lack distinctive communities or practices as cases? How do we study networks that are highly mediated by the web and may be largely invisible to, for example, traditional methods of ethnographic research? Building on prior studies of communities of practice that have been formative to our sociocultural understandings of work and learning (Lave, 1977; Lave & Wenger, 1991; Orr, 1996), this study represents an empirical approach to understanding how individuals enter into, know, learn and act in a contemporary open, participatory, networked contexts of innovation.

FIXATIONS THAT PATTERN TECHNOLOGY AND INNOVATION IN EDUCATION

Historical Discourses

The idea that public educational institutions can catalyze a more ideal democratic society has been a deeply seated and influential narrative in American history (Tyack, 1974). Also common are recurrent crisis narratives that attribute social and economic ailments and inequities to the nation's failing school systems and call for mass reform (e.g. National Commission on Excellence in Education, 1983; No Child Left Behind [NCLB], 2001), "disruption" and innovation in education (see, for example, Cuban, 2013; Sims,

2017; and Watters, 2014 for critical historical perspectives). To the extent that novel technologies are equated with change in our everyday lives, technology naturally features prominently in educational reform discourses. Indeed, technology is often pointed to as a key indicator that change has or is occurring (Cuban, 2001, 2013; Fullan, 2007; Sims, 2017). From Horace Mann's early promotion of blackboards in the 19th century, to Pressy's teaching machines of the 1920s, to Skinner's devices for "programmed instruction," to contemporary applications of networked and algorithmically driven "personalized learning environments," this country has seen perennial waves of techno-idealism focused on leveraging the perceived affordances of industrial and workplace technological innovations to bring efficiency, effectiveness and high standards to our floundering systems of schooling (Sims, 2017; Watters, 2014).

These waves of crisis clamor and techno-idealism tend to be accompanied (if not mitigated) by more critical discourses that soberly emphasize the resilience of the traditional "grammar of schooling" and the tendency for technological innovations to become subverted in service of the status quo (Cuban, 2013; Sims, 2017; Tyack & Tobin, 1994). From this perspective, the history of educational technology in the US is less about its catalytic role in pursuit of what Labaree (1997) identifies as the traditional, contradictory and competing democratic goals of education—social *efficiency*, democratic *equality* and social *mobility*—as much as it is about the cyclical reconfiguration of the status quo in a stratified society.

Christo Sims' (2017) three year ethnographic study of the high profile, high tech, philanthropist-driven "Downtown School" (a pseudonym) shows us how such techno-

idealistic endeavors become disconnected from actual school change, documenting what he calls "cycles of disruptive fixation" (2017, p. 11). Well-intentioned, philanthropic, "entrepreneurial reformers" tend to initiate such cycles, forming alliances with educational experts and insiders to implement their techno-idealistic visions of educational change. As these disruptive interventions tend to be high profile and politically risky, there is tremendous pressure to show success, often in terms of relatively traditional educational metrics, leading to practical and structural isomorphism. In failing to adequately consider the entrenched sociopolitical aspects and interests in schools, the reformers find their innovations systematically co-opted to support traditional teaching and learning practices and traditionally privileged groups of stakeholders. Standing in for real reform, *fictions* of technology-driven change are collectively elaborated, celebrated and—paradoxically— used as justification for further techno-idealistic intervention. Sims, echoing Cuban, Tyack and others, writes that such cycles of disruptive fixation are recurrent in the history of techno-philanthropic education reform in this country, and that they will likely continue as long as reformers pursue tech-driven disruption without considering the social and political nature and goals of schooling in America.

Silicon Valley Fixations

Sims adopts the term "fixation" to denote the "lived fictions through which [entrepreneurial reformers] plan and imagine their project as well as the worlds through which they plan to intervene" (2017, p. 16). Fixations arise from the way innovators frame problems and simplify the contexts into which they are intervening. Contemporary reform

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fixations are rooted in the way that schools are problematized, for example, as overly bureaucratic, oppressive, antiquated and disjointed from the lived experiences and professional prospects of their students. Fixations also stem from the perceived affordances of the various innovation communities that present solutions to these problems. Universities and governments are seen as suffering from the same problems as our K-12 schools, and for many reformers, the ecosystem of technologies, creative practices and entrepreneurial cultures that characterizes Silicon Valley offers the best solution at hand (Cuban, 2001; Sims, 2017). The wealthy technology entrepreneur-turned educational philanthropist is a recognizable trope in the history of American educational reform, and today their *TED Talks* feature prominently in our discourse. Sims invokes Howard Becker's (1963) notion of "moral entrepreneurship" in describing idealistic, philanthropic, well-resourced "entrepreneurial reformers" (Sims, 2017, p. 14). Short on technical knowledge of learning or the complex socio-politics of schooling, entrepreneurial reformers enlist the support of sympathetic technical specialists in pursuing their vision of better education, a vision that reliably reflects their own values, their own personal ways of learning, and their tech-centric fixations. Through Sims' work, we see how prevalent fixations about school change tend to reflect the language, instrumentation, and Silicon Valley ethos of the *design*, *entrepreneurship* and *innovation* communities from which many of our most notable entrepreneurial reformers have risen.

Entrepreneurship

Fixations with entrepreneurial approaches to educational reform tend to rely upon a faith that well-meaning change-makers coordinated in our neoliberal context will be able to identify, articulate and act upon *value propositions* that yield substantive impacts in our educational systems. Schumpeter (1950) defines entrepreneurship as the creation of new value by identifying and carrying out "new combinations of production." Such combinations may arise from the introduction of new goods (products, technologies and services), novel methods of production, new markets, new resources, or new ways of organizing productive activity. Entrepreneurs differ significantly from *inventors* in that they bring *relevance* to innovations by actually integrating them into practice, a distinction implicit in Drucker's (1986) succinct and action-oriented definition of an entrepreneur as someone who "searches for change, responds to it, and exploits it as an opportunity." Value itself can be conceptualized in various ways, and the idea that change agents may operate per multiple bottom lines is at the heart of contemporary notions of *social entrepreneurship* and *social enterprise*.

While canonical studies of entrepreneurship have historically been framed in terms of economics and focused on profit-oriented commercial entrepreneurs (Kirzner, 1973; Knight, 1921; Schumpeter, 1950), entrepreneurship is increasingly examined from social and cultural perspectives, and appreciated as a complex and evolving concept and set of practices (Essers et al., 2017b; Zahra, Gedajlovic, Neubaum, & Shulman, 2009). Yanagisako (2002), for example, particularizes varieties of capitalism, documenting how various allegiances, kinships and alliances influence the entrepreneurial interests and

activities of individuals and groups. Cyert and March (1963) have shown how entrepreneurs tend to have diverse and highly personal motives, and more recently, Essers et al. (2017a) have issued a "manifesto" for a nascent field of "critical entrepreneurship studies" (CES) that moves beyond the traditional functionalist descriptions of entrepreneurial phenomena and stereotypical white, male, neoliberal conceptions of entrepreneurs, and rather particularizes our understanding of the wide variety of entrepreneurial goals, practices, identities and cultures in a global context. Essers et al. seek to reconceptualize entrepreneurship as a "social change activity that moves against the grain of orthodoxy in order to realize spaces of freedom and otherness" (2017a, p. 2). It seems that this framing of entrepreneurship may even include activities properly conceived of as *resistance* or *oppositional behavior* (Giroux, 1983; Solorzano & Delgado Bernal, 2001).

As Zahra et al. (2009) point out, contemporary social entrepreneurs often espouse both social and economic goals and conceptualize value holistically in terms such as social wealth, total wealth, social justice and the resolution of social problems. Building on iconic conceptions of entrepreneurialism drawn from Hayak (1945), (Kirzner, 1973) and Schumpeter (1950), they propose a "typology" of entrepreneurs (2009). "Social Bricoleurs," for example, innovate locally in response to immediate, urgent, local needs and problems rather than as rational agents in a larger economic system. "Social Constructionists" work via institutions to fill gaps in social goods and services left by other government, private and nonprofit agencies. "Social Engineers" engage in Schumpeterian *creative destruction*, innovating to replace existing social systems with new ones that are

better at addressing significant social needs. The systems of support and capital required by these types of entrepreneurs vary, as do the ethical considerations of their practice (Zahra et al., 2009). These ethical considerations become particularly urgent when entrepreneurial activity is born out in the context of the so-called helping professions, such as public health, medicine, social work, international development, humanitarian response, and, of course, *education*. Many of these contexts are characterized by a dramatic power differential between the helpers and the helped, and traditional stances towards risk management include "do no harm" principles and the Hippocratic Oath.

Notable in entrepreneurship and social enterprise is the role of rhetoric and storytelling for communicating and developing value propositions (Spinuzzi, 2017). Knowing, learning and innovation in these contexts is characterized by persuasive, prospective, and abductive rhetorical activity such as *pitching*, *social marketing* and *selling*. Narratives and stories are extremely influential in articulating and developing new value. Indeed, the "value proposition," the "pitch" and the "origin story" are all prominent sensemakers in entrepreneurial discourse.

Design

Design is another prominent fixation in contemporary discourses about educational change, including concepts of systematic design, design science and design thinking. Educational reform, like reform across the helping professions, is caught up in a "design revolution," evidenced by the cross-disciplinary penetration of beautiful, intuitive, user-friendly methodological pamphlets and toolkits produced by the likes of the Stanford D-

School and IDEO. Systematic, reflexive, recursive processes of collaborative empathy, invention and implementation are now culturally ubiquitous, and for many pursuing transformation in the helping professions, this looks like a refreshing contrast to bureaucratic stasis and counterproductive risk aversion. For Cross (2001), studies of design as "reflective practice" reveal a characteristic "natural intelligence of design," that is, "'designerly' ways of knowing, thinking, and acting" (Cross, 1999).

> Just as the other intellectual cultures in the sciences and the arts concentrate on the underlying forms of knowledge peculiar to the scientist or the artist, so we must concentrate on the "designerly" ways of knowing, thinking, and acting. Following Schön and others, many researchers in the design world have realized that design practice does indeed have its own strong and appropriate intellectual culture, and that we must avoid swamping our design research with different cultures imported either from the sciences or the arts. (Cross, 2001, p. 55)

Design, like entrepreneurship, distinguishes itself from scientific practices in that it is unabashedly *rhetorical* and *persuasive.* Also, like entrepreneurship—design is *risky*—it acts *abductively* on incomplete information—exposing both the designers and the populations for which they design to the uncertainties and practical consequences stemming from applied invention and the novel reconfiguration of complexity. Schön's (1984) paradigm of reflective practice has also been deeply influential in understanding the classroom practices of teachers and their *teacherly* ways of knowing and learning (see, for example, Zeichner & Liston, 2013).

Open Innovation

A common way to balance innovation and risk in the face of complexity has been to ensure that user-stakeholders are engaged as collaborators in and co-designers of change. In networked knowledge work contexts, the new collaborative efficiencies and distributed knowledge-building affordances of participatory and social media have raised the profile

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of "open" and "open source" approaches to design and innovation (Shirky, 2010), often modeled after open source software development communities. Open, internet-mediated approaches to design seek to harness the diverse interests and distributed work of the so-called "long tail" of contributors in the production of resources with both broad and specific appeal and application. Contemporary educational innovation initiatives often seek to integrate Open Educational Resources (OER) repositories and communities as a way of developing and proliferating curriculum, and more recently in the MOOC trend we have seen the classroom and pedagogical process itself opened as well. Whether conceived of as spaces for education, design, making, entrepreneurship or research, open epistemic environments have characteristic dynamics of knowing, learning and making change, and present unique issues of power, agency, ethics and politics. Complex issues of power and epistemic agency are evident, for example, in the many ways that canonical scientific communities of practice have simultaneously integrated and excluded participatory citizen scientific communities, sometimes treating "citizens" as cyborg-like assemblages of cloud-linked human sensors for broad-based data collection, parallel data processing and human computing, and other times seeing citizen scientists as more highly agentic colleagues with independent and even competing research agendas (Kullenberg, 2015; Shirk et al., 2012; Wylie, Jalbert, Dosemagen, & Ratto, 2014). The novel processes of open collective synthesis afforded by the participatory web are enabling us to consider new, messy, yet education-relevant categories of cognition, participation, and collaboration that distinguish between, for instance, "collective intelligence" and "collaborative intelligence" (Mayfield, 2006; Figure 1).

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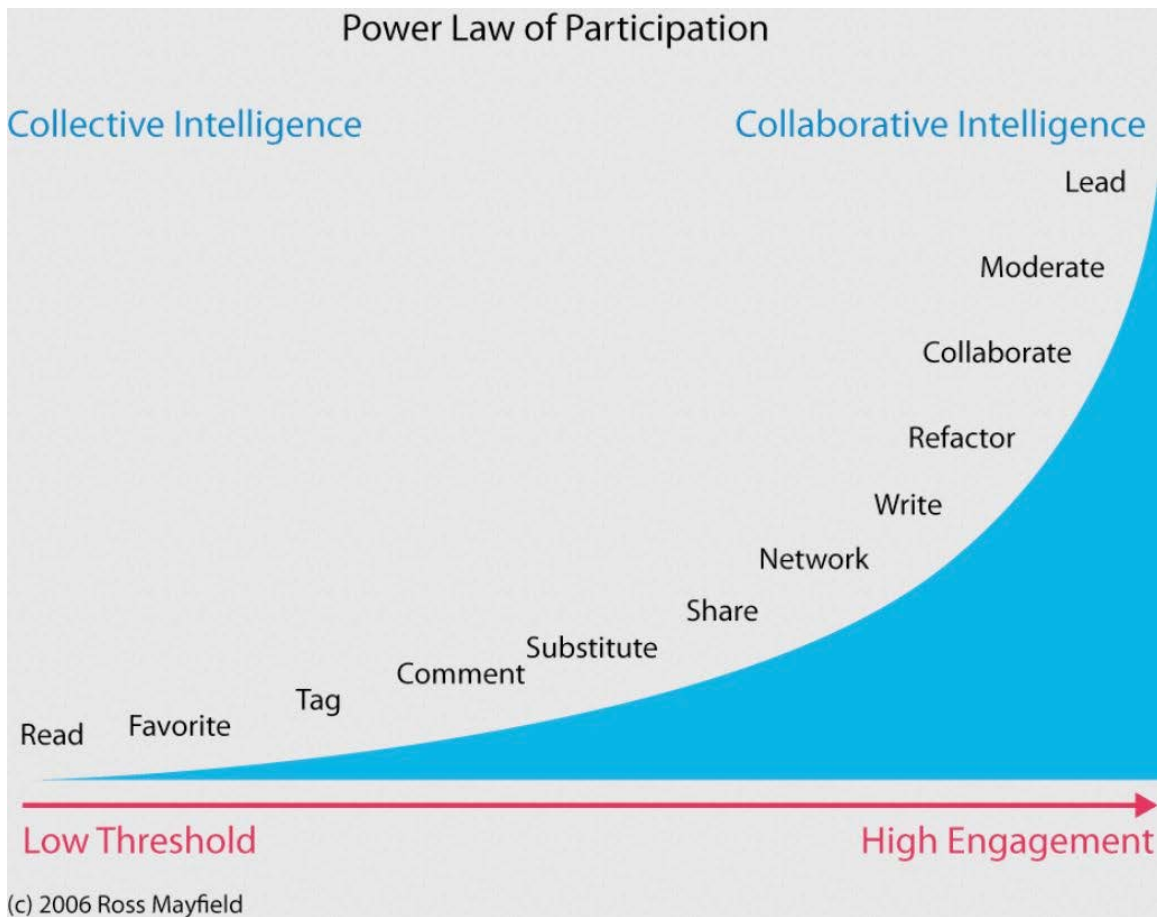
Figure 1: Power Law of Participation. Source: Mayfield (2006)

A Critique Of Current Fixations from an Education Perspective

Work contexts and practices not only influence how we think about school curriculum and pedagogy, but also the very processes by which we innovate to change them. The entrepreneurial and designerly and ways of knowing, thinking and acting that characterize contemporary knowledge work tend to bring a Silicon Valley ethos, toolkit,

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language and set of fixations to contemporary educational reform efforts. Indeed, educational reformers and researchers are looking to entrepreneurial and design communities as more authentic cultures of innovation (e.g. Berry, 2015).

And yet, there is reason to question and critically examine how these innovation fixations play out in an educational context. The goals and approaches to innovation vary widely among entrepreneurs and teachers (Papendieck & Hughes, 2017), and the implications of opening public educational systems to the products and methods of private sector innovation communities are not yet well understood. Burch and Good (2014) argue that the fruits of recent privatization efforts in education have not to date been subjected to a high level of systematic scrutiny. Furthermore, in our standards-aligned and accountability-oriented educational climate, schools tend to retain and empower "managerial" rather than "innovational" leaders and teachers (Gabbard, 2016), and while it is quite likely that many or even most teachers and administrators appreciate the role that technology can play in making needed change, it's not clear how they are ever prepared to seek out, evaluate and leverage potential innovation partnerships, let alone take a leading role in them. School-based innovators are often positioned narrowly as consumers of educational products and services and have to make difficult decisions in the face of a wide array of dazzling, interrelated, and obscure technological solutions. Many educational products on the market are understudied in school and classroom contexts, and may expose learners and educators to new forms of risk despite unclear benefits (Burch & Good, 2014). Furthermore, despite early optimistic narratives about the democratic potential of the "long tail" of the participation curve (Shirky, 2003, 2010), it is quite clear that the collaborative

efficiencies of participatory media do not on their own result in the achievement of better, more effective, more equitable, more just or more democratic schools or society. Participatory media can make school more distracting and difficult (Selwyn, 2016). We now have many cases that show how social networks and participatory media are leveraged by both the powers that be and the marginalized periphery for hate, violence and oppression (Morozov, 2013; D. Stevens & O'Hara, 2015; Watters, 2014).

Furthermore, the ethical context of the "helping professions" may be distinctly different from many other consumer markets for which Silicon Valley knowledge workers design and innovate. We've seen technology innovators in the important nascent field of "digital humanitarianism" (Meier, 2015), for example, critiqued for over-exposing already vulnerable populations of earthquake survivors to risk by crowdsourcing and openly publishing their locations (Morrow, Mock, Papendieck, & Kocmich, 2011). In response to risk, inequity and injustice resulting from techno-solutionist interventions, critical scholars of technology and education have recommended moving beyond discourses about technology *access* and digital *participation*. Access and participation discourses tend to be informed by a relatively deterministic theory of technology and focus on formal notions of equality rather than substantive equity (Guinier, 2004; Papendieck, 2018; Vossoughi, Hooper, & Escudé, 2016). More critical educational reformers want to shift the conversation from technology *for all* to technology *for what* (Soep & Lee, 2016). This will necessarily involve an ongoing interrogation of the embedded assumptions and ethical possibilities of educational technologies, and a challenge to status quo ideas of technological determinism or instrumentalism (Feenberg, 1991). More *justice-* and *equity-*

centered approaches (Papendieck, 2018; Philip & Azevedo, 2017; Selwyn, 2010; Vakil, 2018; Vossoughi et al., 2016) would focus work with technology in school and non-school learning spaces on the building of critical technology literacies, deepening our understanding of how supposedly neutral technologies and techniques are intertwined with social and ethical issues, and how technology must intentionally be used to promote substantive equity and social justice. The resilient grammar of schooling, from this critical perspective, is seen as a product of our broader sociopolitical goals, ideals, assumptions and prejudices; technology innovation that is not attuned to the sociopolitics of schooling is unlikely to be particularly transformative.

CONCEPTUAL RESOURCES FOR STUDYING NETWORKS AND KNOWLEDGE WORK

In order to understand how technology and technology-enabled innovation communities relate to goals of educational transformation, that is, to better understand how today's tech innovators *problematize* issues of education and act upon them by *rendering them technical* (Sims, 2017), we will need to understand the way these networks of innovators think about and approach learning and change. Indeed, we will need to understand how these networks themselves learn and change. To do this, we can draw upon a rich set of sociocultural and sociomaterial theoretical resources.

"Standard" Sociocultural Models and the Situated Perspective

The *sociocultural* or *practice turn* in educational research and the learning sciences, a shift I previously noted for its characteristic attention to workplace and non-school interactions, has been extremely influential in the development of our understanding of

knowing and learning as *situated* and *distributed* in a social, cultural, historical and technological sense (Brown & Duguid, 1991; Greeno, 2006; Hutchins, 1995; Lave, 1991; Lave & Wenger, 1991). Centering on cases of apprenticeship, the key metaphor and mechanism of learning was shifted from *acquisition* to *participation* (Engeström, 2007). "Rather than turning to school-like activities for confirmation and guidance about the nature of learning," writes Jean Lave, the standard sociocultural model "invites a rethinking of the notion of learning, treating it as an emerging property of whole persons' legitimate peripheral participation in communities of practice" (1991, p. 63). In conceptualizing and analyzing "mind, culture, history, and the social world as interrelated processes that constitute each other" the standard sociocultural model lays the foundation for emerging *sociomaterial* perspectives in educational research (Fenwick, Edwards, & Sawchuk, 2015) which, again in Lave's early words, "blur the divisions among component parts of persons, their activities and the world" (1991). Standard communities of practice (CoP) frameworks see "individual learning is inseparable from collective learning" (Orr, 1996). Learning is a process of socialization and enculturation whereby individuals transition from periphery to central participation in a community of practice, and expertise is seen as a function of role and sociocultural status within a community. Innovation, similarly, is "at base a function of changes in community values and views" spurred by "boundary-crossing" and collaboration across "communities of communities" (Brown & Duguid, 1991).

A Critique of Communities of Practice

Standard sociocultural analyses require the delineation of "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2011). From a technical perspective, the CoP framework requires a *domain*, a *community* and a recognizable *practice*.   However, such analytical prerequisites may be quite difficult to discern in the kinds of contemporary networked knowledge work I have describe earlier in this chapter, that is, in a contemporary open innovation network. Engeström (2007) notes several "limiting aspects of prototypical apprenticeship" that become apparent as we seek to study new forms and relations of work:

    (a) A community of practice is a fairly well-bounded local entity which has clear boundaries and membership criteria.
    (b) A community of practice has a single center of supreme skill and authority, typically embodied in the master.
    (c) A community of practice is characterized mainly by centripetal movement from the periphery toward the center, from novice to master, from marginal to fully legitimate participation; opposite centrifugal movement may occur but is not foundational. (Engeström, 2007, p. 2)

I would add that CoP framings of expertise also become problematic in flat, dialogic knowledge work environments where individuals may be tangentially-yet-critically involved in a variety of projects at the same time, and where they may be valued for different kinds of expertise in different contexts. How do we understand learning and innovation in such networks as opposed to traditional communities of practice, and how is expertise perceived and enacted when *central* participants are not so clearly distinguishable from those at the *periphery*, or indeed, "when the center does not hold" (Engeström, Engeström, & Vähäaho, 1999)?

Another key (though under-elaborated and perhaps ungenerous) concern that Engeström raises about the standard communities of practice model is that it was formed or is applied *ahistorically* and does not sufficiently account for oppressive dynamics of power between masters and apprentices. He also claims that in emphasizing centripetal movement from periphery to center, the framework "marginalizes the creation of novelty by means of rejecting, breaking away from, and expanding the given activity" (2007, p. 3).

> In sum, neither Lave and Wenger (1991) nor Wenger [(1999)] situate their communities of practice in the history of real societies and patterns of organizing work. Wenger [(1999, p. 87-89)] does take up history, but only as a general and abstract issue of remembering and forgetting, reification and participation. One looks in vain for discussions on the conditions of implementing communities of practice in highly rationalized hierarchical mass production organizations, or in settings driven by financialization, outsourcing and fragmentation of work, or in various networks, partnerships and strategic alliances. (Engeström, 2007, p. 3)

My purpose in presenting Engeström's critique of the standard sociocultural model is not to question the model's utility or legitimacy as a way of organizing inquiry into workplaces or classrooms *in general*, but rather to make the simple point that situated perspectives on learning, innovation and expertise should be elaborated by looking outside of communities of practice and the apprenticeship paradigm of learning. Engeström and his colleagues have examined learning in the context of "knotworking" (Engeström, 2008), for example, and there are no doubt a diversity of other potentially paradigmatic models of workplace learning and acting. By more carefully studying the environments in which networked knowledge workers interact, we can better understand their experiences as learners, their assumptions about what learning and expertise are, and their characteristic fixations about educational change.

Sociomaterial Perspectives

Sociomaterial perspectives have long informed organizational studies (e.g. Orlikowski, 2007), human-computer interaction (Suchman, 1987) and science and technology studies (Latour, 2005). The ontological and epistemological convictions of various sociomaterial perspectives vary quite widely, and the perspectives often overlap with *sociocultural* perspectives. Indeed, ideas of sociomateriality have been integral in the elaboration of situated and sociocultural communities of practice models (see, for example, Greeno's explication of the "situative perspective" and the role of interaction studies and activity systems for the learning sciences (2006, p. 83)). That said, emerging sociomaterial perspectives tend to bear certain distinctive and distinguishing family resemblances, most obviously in the way that they fundamentally "decouple learning and knowledge production from strictly human-centered socio-cultural ontology, and…liberate agency from its conceptual confines as a human-generated force" (Fenwick et al., 2015, p. 17). Sociomaterial perspectives gaining prominence specifically in *educational* research include those rooted in *complexity thinking* (Davis & Sumara, 2006), at least three or four "generations" of *activity theory* (Engeström, 1987, 2009; Leont'ev, 1978; Vygotsky, 1978), various "diffused sensibilities" (Fenwick et al., 2015, p. 10) of *actor-network theory* (Latour, 2005; Law & Hassard, 1999) and emerging *theories of spatiality* (Gulson & Symes, 2007) and *mobilities* (Sheller & Urry, 2006, 2016; Urry, 2007). A complexity perspective on education tends to frame classrooms and learning environments, for instance, as complex adaptive systems, tracing learning as adaptation, and documenting "conditions of emergence" (Davis & Sumara, 2006). Activity theory (AT), builds on

Vygotskian concepts of *mediation*, *internalization* and *externalization* (Vygotsky, 1978) to examine knowing and learning as distributed across activity systems of people, materials and concepts. Actor-network theory (ANT) and so-called "post-ANT" (Law & Hassard, 1999) perspectives are organized around a fundamental principal of human-material *symmetry*, and focus on how human and non-humans actors assemble and enact *rhizomatic* (Deleuze & Guattari, 1987) networks. New geography, spatiality theories and mobilities paradigms emphasize how knowing and learning are contingently bound up with material spaces and places, and examine the epistemological and discursive affordances of mobility and travel through space and time (see Sheller & Urry, 2016).

Sociomaterial perspectives share a concern for issues of ontology, breaking from modern, positivist, Cartesian distinctions between real and ideal, and gaining analytical traction via *relational* and *performative ontologies* rather than traditional representational epistemologies (Fenwick & Edwards, 2013). In different ways, sociomaterial perspectives sprout from metaphysics which reject or fuse problematic dichotomies of material/ideal, subject/object, and represented/real. Activity theory, for example, is rooted in Vygotsky's Marxist dialectical and relational ontology, where man and the material world are interactively produced and transformed through work. Vygotsky developed his early theories of mediated cognition with the Engelsian conviction that through "labour created man himself" (Engels, 1940). Actor-network theory, on the other hand, does not privilege the ontological status of humans or human minds, and builds upon a flattened "actant-rhizome ontology" (Latour, 1999a). Susan Barad's *agential realism* introduces the relational notion of "intra-action" to explain how the universe is performed in material-

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discursive practice.   *Intra*-action, unlike *inter*action, assumes neither causal relations

between phenomena nor their pre-existence. The universe is the co-constitutive

entanglement of phenomenon, and *agency* is a ubiquitous dynamism rather than a uniquely

human attribute.

> The universe is agential intra-activity in its becoming. The primary ontological
> units are not "things" but phenomena—dynamic topological reconfigurings/
> entanglements/relationalities/(re)articulations. And the primary semantic units are
> not "words" but material-discursive practices through which boundaries are
> constituted. This dynamism is agency. Agency is not an attribute but the ongoing
> reconfigurings of the world. (Barad, 2003, p. 818)

This level of metaphysical wrangling is well beyond our scope, but the important

thing to notice is that in the *relationality* and *performativity* of these ontologies, they all

either blur or outright reject the boundaries between subject and object, concept and matter,

the mind and the world, individuals and assemblages, the social and the material, and the

human and the non-human. This has deep ramifications for those of us who are interested

in understanding how humans and machines interact for learning. Technology becomes

more than *value-laden*, it becomes *agentic* and *intra-actively* constituted with humans. Our

discursive practices and intra-actions with technologies, concepts, stories and each other

amount to "ongoing material (re)configurings of the world" (Barad, 2003, p. 822). The

"cuts" we make between intra-acting humans and machines become a mere "analytical

choice" (Suchman, 2007, p. 268). Donna Haraway's iconic *cyborg* (1985, 1991) embodies

emerging sociomaterial possibility: simultaneously terrifying, thrilling and potentially

liberating. Contemporary theories of cognition that frame learning as *distributed*, *situated*,

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and technologically- and socially-*mediated* begin to look quite tame next to learning conceptualized as *cyborg (re)configuration*.

Let us leave the cyborg here for now. In the next section I will look at how sociomaterial concepts drawn primarily from AT and ANT can be applied to model and analyze networks that learn.

Analyzing Networks with Activity Theory and ANT

Activity theory, in focusing on object-oriented activity systems and network mediated learning, brings a rich set of analytical tools to bear in the analysis of an ed-tech network as a learning and developmental network. From an AT perspective, networks might be thought of as systems or interlinked systems of sociomaterial relations that are developed through the cyclic transformation of objects. Increasing attention is being brought to the multivoicedness of activity systems and activity networks, and Engeström and others have increasingly drawn upon Bakhtinian concepts of *polyphony* and *dialogism* to illuminate the polycontexual nature of objects (Bakhtin, 1986). In complex activity networks, polycontextual accounts of the object exist in dialogic tension (Engeström, 2009; Kajamaa & Lahtinen, 2016; Spinuzzi, 2008). Moving beyond Vygotsky's initial dyadic notions of the zone of proximal development as a somewhat teleological set of transformative interactions between an individual teacher and student, learning at the level of the activity system or network may be thought of as something akin to a collective journey across the zone of proximal development, over the course of which individuals collaborate to identify, analyze, resolve or dissolve contradictions and discontinuities in

their activity and achieve their shared object (Wells, 2011). From Greeno's situative view, learning is conceived of as transformation over time in the nature of the interactions among people and between people and their constructed artifacts (2006, p. 91). For Engeström, "expansive learning" is a cyclical process through which the very definition of the object of activity is reinterpreted, expanded, and acted upon in increasingly enriched ways (Engeström, 2001).

Meanwhile, ANT brings a variety of compatible conceptual resources to the analysis of open ed-tech networks as dynamic assemblages of human and nonhuman actors that are incessantly assembled and disassembled through rhetorical and political negotiations and alliances. Where activity theory retains a fundamental human-centeredness and focuses on development and learning (Kaptelinin & Nardi, 2006), ANT brings a radical concept of *symmetry* and focuses on Machiavellian power dynamics of network assembly and reconfiguration (Miettinen, 1999; Spinuzzi, 2008). "Objects, nature, technology and humans all exercise influence in assembling and mobilizing the networks that comprise tools, knowledge, institutions, policies and identities" (Fenwick & Edwards, 2013, p. 10). ANT also brings a conceptual language to characterizing the negotiations and alliances through which networks are assembled, enacted and transformed (Callon, 1984). These concepts can, for instance, help us understand the dynamics of *swarming* and *negotiated knotworking* that Engeström (2007, 2008a) sees in co-configured networks of knowledge workers.

Spinuzzi (2008), recognizing both theoretical tensions and compatibilities between AT and ANT, works across both to identify a set of characteristics which are useful for

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analyzing and modeling networks. He theorizes networks as *heterogeneous* assemblages of humans and nonhumans, individuals and groups, tools and infrastructure, rules and beliefs, linked in the performance of activities. These heterogeneous components are *multiply linked*, and "could come together at almost any point, generating new sorts of expertise and, arguably, new realities" (2008, p. 193). Networks, over time, tend to develop *black-boxed* (Latour, 1987) assemblages of relative stability which "filter out, limit and manage complexity" (Spinuzzi, 2008, p. 199). In the enactment of an ed-tech network we might find, for example, a kit of algorithms and human analysts operating as a general service for tracking learning interactions in online environments. The analytical modules, tests and outputs (i.e. standard measures of engagement and interaction) may become central to a variety of ed-tech innovation initiatives co-evolving on the network. A great deal of networked learning activity may go into the formation of such black boxes, and they may even be analyzed as activity systems in themselves. Finally, in the way that they represent and re-represent phenomena over time, Spinuzzi describes networks as *transformative*. While an ANT perspective might describe network learning or transformation in terms of shifts in network *competency* or *composition* through power relations and alliance-making, AT focuses on how networks are *developed* through the resolution of contradictions in the *humanistic* transformation of objects.

Together, AT and ANT provide a variety of interrelated conceptual resources that for describing structure and individual agency in open ed-tech innovation networks, orienting our attention to their material-discursive enactment as "more than social networks" (Lejano et al., 2013, p. 28).

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With an eye toward evaluating the transformative potential of the ed-tech network and understanding how it might sustain the kind of broader public discourses that Tyack and Tobin (1994) identify as prerequisites for substantive action on goals of equity and social justice, I want to introduce a few sociological concepts that I think are useful for situating open innovation networks in an era of neoliberalism.

The Entrepreneur of the Self

The most dramatic and influential deconstructions of *truth* that I see on a day-to-day basis are those carried out by conservative showmen on cable news, not to mention the showman who has ascended to the presidency. Deconstruction is suddenly everywhere, turning up in surprising places for surprising purposes. These days, it seems, concentrated political power is broadly understood as dangerous, and the types of restrictive, oppressive power that we all know and hate from school—the types I learned to see and resist in college by reading Foucault, for example—have been quite publicly revealed and roundly critiqued. In neoliberal times, we are *all* suspicious of power wielded through state and institutional action.

McNay writes that "neoliberalism embodies a type of economic positivism that results in an exhaustive and permanent critique of government and state action" (2009, p. 60). Meanwhile, argues Foucault (2008), the enterprise form is propagated to all aspects of society, marketizing social institutions, our personal relationships, and, critically, encompassing our individual being. "Neoliberal governance involves the shaping of

individual lives in a way that does not violate their formal autonomy," and rather than *limiting* freedoms, subtly controls by the "*multiplication* [of freedoms] in the context of a notion of responsible self-management" (McNay, 2009, p. 60; emphasis added).

The self, in our times of neoliberalism and connectedness, must be constantly reconstructed and adapted in response to the changes and ambiguities in the market, and it is characteristic of the *entrepreneur of the self* (Foucault, 2008) to make sense of emotional relationships, professional skills, knowledge and aptitudes in terms of enterprise and value in a competitive market. Individual subjects in neoliberal times are positioned not within state or institutional frameworks, but within a "multiplicity of interrelated, small-scale organizations or networks," and the "autonomous citizen is s/he who manages these diverse networks—work, household, pension, insurance, private property—in the most responsible and prudent fashion vis-à-vis the avoidance of risk and the maximization of their own happiness" (McNay, 2009, p. 61). Rather than coercive disciplinary power, neoliberal governance patterns practice via a different form of power: *biopower*. Biopower "exerts a positive influence on life, that endeavors to administer, optimize, and multiply it, subjecting it to precise controls and comprehensive regulations" (Foucault, 1978, p. 137). Somewhat counterintuitively, this *positive* biopower is also deeply normalizing in the way that it indirectly regulates the social practices of bodies embedded in the connected mesh of interrelated networks. While formally promoting individual autonomy, differentiation and freedom, neoliberal governance operates "at a distance" (Miller & Rose, 2008, p. 33) through normalizing biopower on individuals positioned precariously in a networked, marketized society. McNay writes, "even the most oppositional of identity movements

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may be neutralized by being transformed into a form of responsible self-management and commodified as a lifestyle choice" (2009, p. 66).

So let's leave Foucault for now, in tense company with the cyborg, and try to figure out what to do about what seems like a rather exhausting, depressing neoliberal predicament for so many of us. How might ed-tech innovators, working within this "multiplicity of interrelated, small-scale organizations or networks" (McNay, 2009, p. 61), resist or grapple with normalizing biopower to pursue authentic social change outside the norm?

Spectacle and Carnival

Building on Foucault, we understand open innovation networks as spliced and woven into the *biopolitical mesh* of neoliberal society. As this study seeks to examine the prospect of cultivating resistance to the educational status quo, we could use some tools to analyze resistance in marketized social contexts. Boje (2001a) adapts Bakhtin's notion of the *carnivalesque* (1984, 2004) and Debord's notion the *spectacle* (1995) for such an analytical purpose.

In *Rabelais and His World*, Bakhtin traces the origins of carnival to the medieval market:

> Carnival is the people's second life, organized on the basis of laughter. It is a festive life. Festivity is a peculiar quality of all comic rituals and spectacles of the Middle Ages. All these forms of carnival were also linked externally to the feasts of the Church... The official feasts of the Middle Ages, whether ecclesiastic, feudal, or sponsored by the state, did not lead the people out of the existing world order and created no second life. (Bakhtin, 2004, p. 686)

In such official, serious (and, in Foucauldian terms, *coercive*) feasts,

> the true nature of human festivity was betrayed and distorted. But this true festive character was indestructible; it had to be tolerated and even legalized outside the official sphere and had to be turned over to the popular sphere of the marketplace. All were considered equal during carnival. Here, in the town square, a special form of free and familiar contact reigned among people who were usually divided by the barriers of caste, property, profession, and age. (Bakhtin, 2004, p. 686)

Carnival had a characteristic grammar, logic and vernacular:

> this temporary suspension, both ideal and real, of hierarchical rank created during carnival time a special type of communication impossible in everyday life. This led to the creation of special forms of marketplace speech and gesture, frank and free, permitting no distance between those who came in contact with each other and liberating from norms of etiquette and decency imposed at other times. A special carnivalesque, marketplace style of expression was formed. (Bakhtin, 2004, p. 686)

The roots of carnival, according to Bakhtin, are in the public market where the populace assembles outside of official institutions, at a distance from coercive disciplining power, where the high and low mix, and where spectator and spectacle become one. For our purposes, this Bakhtinian (1984, pp. 123–124) kind of carnival is:

1. *Spectacular:* Novelty, eccentricity, possibility, disequilibrium and discontinuity are featured as attention-capturing spectacle.

2. *Familiar:* Relations become familiar. Learners and innovators become comfortable in collaboration and critique.

3. *Interactive:* Carnival connects, and brings people into interaction, new modes of relation and dialogue.

4. *Integrating:* The high is positioned with the low, the marginal with the central, the

elite brought down to earth, and the spectators become the spectacle.

Mere spectacle, on the other hand, is simply an enthralling representation. "In all its

specific forms, as information or propaganda, as advertisement or direct entertainment

consumption, the spectacle is the present model of socially dominant life" (Debord, 1995,

p. 13). Boje uses the spectacle to mean the "often violent and oppressive social control

that masquerades as a celebration of betterment by recycling pseudo-reforms, false-

desires, and selective sightings of progressive evolution, never devolution. Spectacle is a

narrative and a theatric performance that legitimates, rationalizes, and camouflages

violent production and consumption. Spectacle is more prevalent and dominant than

carnival" (Boje, 2001a, p. 437).

For the purposes of this study, I will adapt Debord's (1995) notion of the

spectacle primarily as a negative counterfactual to the creative, resistant, transformative

capacity of Bakhtin's (1984, 2004) ideal of carnival. Unlike carnival, mere spectacle

draws lines and differentiates between spectators and the spectacle, and in a neoliberal

context this creates a power differential between consumers and producers of creative

spectacle. I want to set carnival and spectacle at the opposite ends of a spectrum of

market-patterned network activity. Carnival may at times be purchased or coopted as

corporate spectacle, and spectacle may give way to carnival, often depending on how

distinctly consumers and producers of spectacle are distinguished. Building on Boje

(2001a), it is by merging the spectator and spectacle that carnival might innovate—even

within a market form—in a way that resists normalizing biopower.

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METHODOLOGICAL ISSUES IN THE STUDY OF NETWORKS

Network level activity that is distributed across a variety of geographic and digital media spaces presents researchers with a variety of serious design and methodological challenges. While we might normally look to ethnographic studies of workplaces and organizations for guidance in studying an open urban networking hub, the typical methods of participant observation, for instance, are difficult to carry out when human interactions are so distributed, sporadically engaged, and heavily mediated by digital spaces.

Networked knowledge work, in the words of Czarniawska, presents "time, space and (in)visibility" problems for researchers (1998, p. 28).

> Organizing happens in many places at once and organizers move around quickly and a lot. Moreover, many of their activities are intellectual and therefore unobservable, as everybody who has ever tried to observe a person working at a computer well knows. (Czarniawska, 1998, p. 28)

The highly mediated and distributed nature of networked knowledge work presents significant challenges in the use of methods of participant observation, video-based interaction analysis and other tactics associated with core ethnographic methodologies in the learning sciences and organizational studies. While logs of digital interactions on networking and collaboration platforms can be useful for studying aspects of activity, contemporary knowledge workers often work across platforms and networks, and any one set of digital analytics will only offer a fleeting glimpse of activity as a whole. Indeed, most studies of networked communities do not follow activity across networking and collaboration platforms, and I was not able to find any that carefully integrate digital analytics across systems. In the end, despite the fact that our work is heavily mediated by

digital environments, and despite the fact that our interactions with machines and each other tend to be systematically logged, tracked and stored, it is extremely difficult to make sense of the different lines and clouds of digital exhaust we leave across our personal learning and work landscapes. It is unclear what an ethnography of our digital, distributed, mediated lives looks like. Orlikowski and Scott (2008, p. 494) note that methodological challenges to researchers include

> how particular, inherently sociomaterial, organizational forms pattern practice, for example: very-large conversations using Web-based discussion forums; collaborative dynamics within e-Science Grids; habitats of connectivity formed through extensive use of Blackberries and wearable mobile technologies. The challenge in these examples is to find ways of establishing a corpus of data under fieldwork conditions that are distributed, constantly reconfiguring, fragmented into enclaves, or restricted by partial access (Law & Urry, 2004). Possibly promising approaches for addressing these include work on narrative (Czarniawska, 1998; Pentland & Feldman, 2007) and practice-order bundles (Schatzki, 2002).

As organizations engaged in networked knowledge work become less and less visible, Czarniawska (1998) suggests that narratives—to the extent that they simultaneously represent and influence organizational structures and the human interactions that occur within them—present themselves as a useful and accessible data corpus. Narrative research may be able to generate a meaningful picture of sprawling and partially hidden networks.

Challenges to Traditional Network Analysis

Social network analysis (Carolan, 2014; Granovetter, 1973, 1985; Wasserman & Faust, 1994), in focusing on the relations between individuals, provides a structural account of a human networks. Critiquing the utility of traditional social network analysis for

describing and analyzing environmental action networks, Ingram et al. (2014, p. 985)

surface a number of concerns:

> A common way in which networks are analysed and represented is through plotting
> relationships and depicting networks as points or nodes connected by lines.
> However, as Mische (2000, p. 13) observes, 'whereas formal mapping techniques
> and related network analytic routines allow researchers to see overall structural
> patterns that surpass the viewpoint of any given actor (or "node" in a network), they
> lose the multi-textured, contingent, and often ambiguous "give and take" of actual
> interaction' … Serious challenges arise in relating structural aspects of networks to
> environmental action and to evaluative criteria such as cohesion, resilience, and
> sustainability, at least in part because what promotes one positive attribute is
> opposed by another. For instance, density of network relationships (mutual
> interaction among members) is positively related to collaborative action up to a
> point, but very high density can lead to homogenisation of information, lack of
> flexibility and ability to adapt, and less efficient use of resources [(Bodin & Crona,
> 2009)]. Bonding ties (no distinct subgroups within a network of dense interactions)
> are supposed to be linked to increased levels of trust, but at the same time, bridging
> ties (distinct subgroups exist and are linked) are related to innovation and flexibility
> (Granovetter, 1973).

Furthermore, when the goal of our study is innovation, that is, the way the network swarms

around new ideas and acts prospectively, the static structural snapshots provided by social

network analysis (SNA) do not take temporal dynamics of activity into account. When

network-level learning is the focus, whether conceived of as contradiction-driven

expansive learning (Engeström, 1987), or in terms of *transformation* and *competence*

(Callon, 1990), or as some kind of discursive-material *becoming* or *(re)configuration*

(Barad, 2003), it seems clear that network dynamism and historicity must be taken into

account. Some social network analysts have been attempting to incorporate temporality

into the representation of the networks they study. See, for example, Gaudet's (2013, 2014)

longitudinal network analyses of knowledge mobilization networks, or the longitudinal

quantitative analyses of "graph trends" (Potgieter, April, Cooke, & Osunmakinde, 2009) or "graph streams" (Aggarwal & Subbian, 2014). However, social network analyses typically generate static or pre/post snapshots. Crossley (2010) notes that traditional quantitative network analyses tend to distort the very *dynamic and social* nature of social networks that differentiates them from other kinds of networks and argues for mixing qualitative and quantitative techniques in network analysis.

Why try to combine quantitative and qualitative methods? My argument centers upon a number of overlapping limitations of the quantitative tools outlined briefly above (e.g. surveys, adjacency matrices, measures etc.). These limitations can be summarized in two points. First, the abstraction and simplification involved in an adjacency matrix, invaluable though it is, can for certain important purposes amount to over-abstraction and oversimplification. Secondly, following on from this, the process of abstraction brackets out important data which are essential to both a proper sociological understanding of social networks and, as I show in the second part of this paper, to a proper understanding of many key concepts, measures and mechanisms from the SNA literature. "Invariably, we realise that the secret of these networks lies in the nature, workings, and dynamism of relationships between actors that are more than just 'ties.' For this, we turn to narrative" (Ingram, 2014, p. 986).

Specific Challenges to Activity Theory

Engeström has worked to evolve methods of developmental work research to study *knotworking* and the "star-like" expansion and contraction of rhizomatic networks of

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knowledge workers (Engeström, 2007, 2008, 2009). However, these activity theoretical case studies are challenged by two things. First, the objects that attract the attention and efforts of net workers are often polyphonic, and dialogically constructed. They are "runaway objects" that may indeed compel distributed activity but also have different projective meanings and objective applications for different network members. This makes it very difficult to use such objects as "sense-makers" (Kaptelinin, 2005) in the delineation of object-oriented activity systems for analysis. To deal with this, Spinuzzi (2011) has charted out a series of methodological movements to "corral" the runaway object for case study research. These movements involve the identification and elaboration of more phenomenologically concrete "claim-objects" and outcomes at the beginning of the case study process.

A second major challenge to the application of activity theory for the study of knowledge work is that network swarming, expansion and contraction of the network around objects of activity is not necessarily regular or cyclical. The activity cycles of open networks of loosely spliced actors and assemblages may not align in a regular way in pursuit of the cyclical transformation of the object, and the particular assemblages of actors allied in any swarming event may change significantly over time. This again makes it very difficult to decide what and who is part of the activity system at any given moment. Despite these methodological challenges, it seems reasonable to assume that at any given moment of swarming activity, the actors involved may indeed understand the object of transformation in their own way as well as the networked tools and resources available to get the job done.

Specific Challenges to Actor-network Theory

Actor-network theory traces the incessant assembly, disassembly and re-assembly of networks as negotiations of power and politics, as "Machiavellian" interactions (Miettinen, 1999, p. 170). Apart from a notion of *competence* in assemblage (Callon, 1990), ANT does not theorize learning or development of networks. As Spinuzzi notes, this makes it very difficult to study how innovation networks are "woven" (2008) as humanistic developmental projects. When our key concern is network learning and the pursuit of goals of public education, this is a serious limitation. Activity theory, which is rooted in Marxist theory and retains a fundamental "human-centeredness" (Kaptelinin & Nardi, 2006) can provide such a developmental analysis.

Narrative Approaches

From a situated and sociomaterial perspective, narratives and stories are an important way of knowing and working in the world. Brown and Duguid describe the importance of stories in promoting boundary work across "communities of communities" (1991). Julian Orr, in his (1996) ethnography of copy machine technicians, writes that

> the skilled practice of field service work [is] necessarily improvised…, and centered on the creation and maintenance of control and understanding. Control and understanding are achieved through a coherent account of the situation, requiring both diagnostic and narrative skills. Understanding is maintained through circulation of this knowledge by retelling the narratives to other members of the community and this preservation of understanding contributes to the maintenance of control. (Orr, 1996, p. 161)

Reflecting on this same passage of Orr's, Czarniawska observes that the stories told by technicians are not just *about* their work, they *are* their work; these "stories are not

'organizational stories': they are 'stories that organize'" (2004, p. 40). In their narrative study of an international corporate merger, Vaara and Tienari note that "one can interpret this storytelling as a means not only to control sensemaking around the merger by promoting specific [views of the] 'official truth' but also to silence of alternative interpretations…within the corporation" (2011, p. 381). Storytelling, like other ways of *disciplining* (Stevens & Hall, 1998) perception in learning contexts, can be read as an act of power.

A key strength of narrative methods, according to Czarniawska (1998), is that they provide an emic account of what happened *in the room* (or *in the chat room*, or *at the bar* after work, as the case may be). Narratives are historicized accounts, and they link actors and activity to goals, motivations and aspirations. These personal accounts move beyond static, etic structural analyses typical of traditional social network analyses, and reveal the type of personal representations and situated perspectives on the goals and activities of organizations that are often not accessible to researchers who can only be in one place at a time. Czarnaiwska (2004) combines techniques of shadowing, field observation, ethnographic interviews, and narrative interviews in her narrative approach organizational research.

As Boje (2001) points out, classic narrative analysis tends to reflect modernist tendencies in the construction and elevation of overarching, retrospective "grand narrative" explanations of phenomena and organizations. Retrospective grand narratives necessarily obscure or supersede consideration of the malformed and partial stories from which they are constructed. Boje calls these elemental, yet-to-be-integrated bits and pieces of stories

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"antenarratives." They are "ante" in the sense that they are stories told before narratives are constructed. They have yet to be "mobilized" in the construction of what amounts to retrospective, representational and organizational narratives. They are also "ante" in the sense that they can be understood as early "bets" on their future integration into an organizing grand narrative. Boje (2011) shows how organizational dynamics can be understood by tracing the mobilization and assembly of agentic antenarratives into grand retrospective sensemakers. Building on Orr's description of the way stories mediate the practice of copy machine technicians, a sociomaterial perspective might focus on the way stories, narratives and antenarratives operate *agentially* in an ongoing discursive-material reconfiguration of the network. They can be powerful operators and mediators in networks, drawing people across boundaries, and impacting the material constitution and collaborative activity of the network.

The analysis of antenarrative mobilization presents itself as a promising way to characterize polyphonic co-construction of object(ives) across activity networks, capturing both their objective and prospective nature. The study of antenarratives can give valuable insight into the bets ed-techers are making with technology as they *design*, *pitch* and *sell* via the network, and how these visions influence activity and outcomes. The mobilization of antenarratives around projects and products could help us understand how networks assemble and coordinate activity in distinctly distributed, multiperspectival technology innovation networks. Antenarrative analysis, for instance, may be able to help us think more carefully and systematically about *hype*, and the oft discussed but undertheorized notion of the "hype cycle" (Linden & Fenn, 2003).

A Computational Approach to Modeling Discourses

From a narrative perspective, a network can be conceived of as an assemblage of materials, humans, projects and ideas that is organized by and makes sense of the world through storytelling. That is, the network is discursively *enacted* (Weick, 1995). One way to uncover and analyze these discourses across broad digital landscapes is through computational approaches to topic modeling. Latent Dirichlet Allocation (LDA) is a technique for inferring in a systematic, probabilistic manner the "latent topics" represented in a collection of texts. In a narrative analysis, LDA presents itself as a way to infer different discourses that play into individual stories of identity and interest on the network and help us understand how they pattern network enactments.

For the purposes of this study, it is important to understand how LDA differs from earlier "bag-of-words" methods of text analysis that simply classify documents based on relative word frequencies and generally ignore word order. As described in Blei, Ng and Jordan's initial (2003) paper, LDA is a *probabilistic* and *generative* model. Using iterative, Bayesian word sampling from documents in a corpus, LDA infers through a series of model runs a probable set of topics (collections of terms) that generate the documents. Topic probabilities can be assigned to each document in a posterior manner, representing them based on term probabilities. LDA is, therefore, a technical, computational way of operationalizing the Bakhtinian notion of a *polyphony* for the analysis of emergent network discourse: individual stories on the network can be modeled (understood, represented and organized) as emergent, polyphonic mixtures of topics, topics that are themselves inferred through the iterative, probabilistic allocation of words from stories told by individual

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voices in the network. Figure 2 is an example article from a corpus of Associated Press documents reproduced from Blei et al. (2003). The color of each word in the document indicates the inferred topic (latent discourse) from which it is putatively generated via LDA.

The systematic search for latent structures and discourses in unstructured text is in itself nothing controversial; researchers do this all the time through deductive and inductive approaches to coding, qualitative data analysis, literary analyses and historical interpretation. Taking a computational approach to "dimensionality deduction" (Blei et al., 2003), however, allows us to simplify and structure discourse in a very large corpus of digital stories from networked actors, and to do it in a systematic and replicable way.

"Arts"	"Budgets"	"Children"	"Education"
NEW	MILLION	CHILDREN	SCHOOL
FILM	TAX	WOMEN	STUDENTS
SHOW	PROGRAM	PEOPLE	SCHOOLS
MUSIC	BUDGET	CHILD	EDUCATION
MOVIE	BILLION	YEARS	TEACHERS
PLAY	FEDERAL	FAMILIES	HIGH
MUSICAL	YEAR	WORK	PUBLIC
BEST	SPENDING	PARENTS	TEACHER
ACTOR	NEW	SAYS	BENNETT
FIRST	STATE	FAMILY	MANIGAT
YORK	PLAN	WELFARE	NAMPHY
OPERA	MONEY	MEN	STATE
THEATER	PROGRAMS	PERCENT	PRESIDENT
ACTRESS	GOVERNMENT	CARE	ELEMENTARY
LOVE	CONGRESS	LIFE	HAITI

The William Randolph Hearst Foundation will give $1.25 million to Lincoln Center, Metropolitan Opera Co., New York Philharmonic and Juilliard School. "Our board felt that we had a real opportunity to make a mark on the future of the performing arts with these grants an act every bit as important as our traditional areas of support in health, medical research, education and the social services," Hearst Foundation President Randolph A. Hearst said Monday in announcing the grants. Lincoln Center's share will be $200,000 for its new building, which will house young artists and provide new public facilities. The Metropolitan Opera Co. and New York Philharmonic will receive $400,000 each. The Juilliard School, where music and the performing arts are taught, will get $250,000. The Hearst Foundation, a leading supporter of the Lincoln Center Consolidated Corporate Fund, will make its usual annual $100,000 donation, too.

Figure 2: Example of LDA topic inference reproduced from Blei et al. (2003).

FOCUS OF INQUIRY

This study describes and interprets an open ed-tech network within the context of historical discourses on the role of technology in education change, examining in particular how the network is assembled and enacted, and focusing on how it acts around educational goals of equity and social justice. I am interested in how network agents are rhetorically and technologically mobilized in pursuit of educational change, that is, how stories and

inscribed technologies interact in the material-discursive enactment of a "more than social network" (Lejano et al., 2013, p. 28). Adopting the *network* as a unit of analysis and parsing *networked knowledge work* as a heterogeneous concept, I examine how *knowing, learning* and *expertise* diverge from or expand upon conceptualizations developed through studies of apprenticeship in communities of practice. Finally, I examine the educational innovation assumptions and fixations prevalent in the network, and critically examine the open network in terms of its potential for substantive social and educational transformation in a neoliberal era of pervasive marketization.

Research Questions

This study addresses several groups of interrelated questions:

1. **Network enactments:** How is an open, urban ed-tech innovation network enacted in different ways, by different groups, and for different ends? How are stories circulated and how do they influence the enactment of the network and participant identities?

2. **Boundary mobility:** How, why, and to what extent do individual people, concepts and technologies move across structural, functional, temporal and cultural boundaries in such a network? How do boundaries pattern activity?

3. **Learning and innovation:** What does it mean to know, learn and innovate in the network? What do these things look like, and what are the implications for our understanding of 21st century skills and pedagogy?

4. **Justice and equity:** How does the network articulate and approach issues of equity and social justice in education? How do these issues figure into the stories that mobilize the network? Can we identify "conditions of emergence" (Fenwick et al., 2015) of substantive equity and justice-centered innovations from such an ideologically diverse, multiperspectival network.

5. **Methodology:** How can we frame and analyze cases of open, unclearly bounded, dynamic, multimodal networks organized around fuzzy, dialogically constructed goals, or "runaway objects" for the study of learning and innovation (Engeström, 2006, 2009; Spinuzzi, 2011)?

PRIOR EMPIRICAL STUDIES

While there is significant scholarship on the sociomaterial theorizing of networks, open innovation networks have not been researched systematically from a learning sciences perspective or educational change perspective. This is likely due to difficulties researchers might encounter in identifying a *domain*, *community* and *practice* in such open networks, or studying them with standard ethnographic methods.

Recent empirical studies of resilient environmental action networks (Lejano et al., 2013), the construction of multinational corporations through international mergers (Vaara & Tienari, 2011), and the mobilization of agentic narratives precipitating the collapse of Enron (Boje, Rosile, Durant, & Luhman, 2004) demonstrate the potential utility of narratives in examining complex organizations and networks as dynamic, polyphonic and transformative. Pentland & Feldman (2007) developed a "narrative networks" approach

to mapping out the variety of ways humans and information/communication systems relate and act in the material-discursive performance of activities, focusing on the case of airline ticket purchasing. This narrative networks method has been employed within organizational contexts to study, for example, how phone operators act and adapt to new scheduling systems (Yeow & Faraj, 2011). Interestingly, while Pentland and Feldman (2007) initially pose narrative networks as *method* rather than *ontology*, Constantinides and Barrett, in mapping out the narrative performance of emergency worker coordination practices, find evidence that "the narrative networks approach holds possibilities for reconceptualizing – at an ontological level – coordination practices as 'constitutive entanglements' of the social and the material in everyday life" and suggest that "future research could apply the narrative networks approach through a sociomaterial lens, which can provide a broader theoretical ground upon which to understand how narratives entail material objects and vice versa" (2012, p. 292).

Engeström and his colleagues, examining workplace practices and learning, tend to seek out new forms of work, like *knotworking* (Engeström, 2008; Kerosuo, 2017), and document it in terms of developmental interactions, (expansive) learning, and—more recently—Bakhtinian "grammars of collaboration" (Engeström, Kajamaa, Lahtinen, & Sannino, 2015). Employing methods of narrative analysis, Kajamaa and Lahtinen have recently been pushing activity theory even further in the direction of the dialogic—away from its dialectic roots—importing Bakhtinian notions of *carnivalization* in the context of homecare work: "carnivalization emerges when the standard script falls apart and the actors start to construct unexpected meanings for the activity and create innovative solutions for

the conflict of motives, which leads to new mode of collaboration" (Kajamaa & Lahtinen, 2016, p. 188). Yet, this developmental work research and organizational research has been done in well-bounded institutional and organizational contexts or in relatively stable (clinical home care) networks. The study proposed here employs narrative and other methods to examine a more open, shifting, dynamic context of networked knowledge work, and one focused on educational technology innovation.

Though not a study of a network, Sims' 2017 ethnography of the Downtown School described earlier in this chapter leveraged sociomaterial and sociocultural perspectives to particularize the processes by which techno-philanthropists and the experts and educators with whom they work frame educational problems per technical solutions, mobilize socially and politically naive technology interventions, fail, claim that they have innovated, and restart the cycle. He calls these "cycles of disruptive fixation" and describes fixations "as the lived fictions through which participants in a disruptive philanthropic intervention plan and imagine their project as well as the worlds into which they plan to intervene" (Sims, 2017, p. 15). It is a kind of "tunnel vision" (p. 15) that results from interrelated processes of *problematization* and *rendering technical*. "The founders of the Downtown School problematized many aspects of conventional approaches to schooling [which they felt] prevented the school from fulfilling its democratic promises" (p. 13). Simultaneously entrepreneurial reformers and the experts with whom they worked engaged in the process of "rendering technical" the problems and educational contexts in which they plan to intervene. In rendering technical, worlds are simplified and made intelligible, typically to the instruments at hand, and Sims draws similarities in this process to the ANT-derived

notion of *enframing* (Callon, 1998; Mitchell, 2002) as well as to the "reductive idealizations" made by the various technology designers studied by Suchman (2007) and Brown and Duguid (2000). The "entwined process of problematization and rendering technical entail tunnel vision because much of what reformers cannot manipulate with their fixes, particularly entrenched sociopolitical norms and relations, is left out of the picture" (Sims, 2017, p. 13).

An examination of how stories, people, technologies and texts are assembled in the process of "fixation" and reinforced through "lived fictions" across an ed-tech network would seem to be a useful extension of Sim's work. This study is designed to make such a contribution.

POSITIONING THIS STUDY IN THE LITERATURE

This study picks up work initiated by the sociologists and ethnographers of workplace learning and innovation that have been particularly formative in the growing, pragmatic field of the learning sciences, but it employs different methods for a different context and unit of analysis, focusing on the network instead of a community of practice. To the extent that the ed-tech network itself exhibits novel or characteristic forms and relations of work, the study helps identify learning and innovation relations that are different from those drawn from community of practice frameworks.

In examining web-connected activity at the level of the network, this study speaks to research and practitioner discourse on *connectivism* (Downes, 2012; Siemens, 2008). Siemens has presented connectivism as an emerging "learning theory" succeeding

behaviorist, cognitivist and social constructivist theories, per eight "principles of connectivism:"

1. Learning and knowledge rests in diversity of opinions.

2. Learning is a process of connecting specialized nodes or information sources.

3. Learning may reside in non-human appliances.

4. Capacity to know more is more critical than what is currently known

5. Nurturing and maintaining connections is needed to facilitate continual learning.

6. Ability to see connections between fields, ideas, and concepts is a core skill.

7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

8. Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (Siemens, 2005)

And yet, others have questioned its conceptual novelty, and argued that connectivism is less a new learning theory and perhaps more of a useful epistemological or curricular perspective (Kop & Hill, 2008). While clearly the network as a unit of analysis and metaphor for learning is important, it is unclear how connectivism relates to and moves beyond existing learning theory. As Bell (2011) notes:

Although connectivism claims that knowledge can reside in non-human objects and in networks … it is weakly linked to material semiotic approaches, such as actor-network theory (Bell, 2010). Nor does it draw on the extensive work done on the use of activity theory in learning, where the role of mediating artefacts (suggestive of non-human appliances) has been explored... (Bell, 2011, p. 183)

Differentiating connectivism from ANT, Bell notes the "ANT is presented through rich empirical stories of networks and alliances building and fragmenting, whereas Connectivism is argued from referent work, and in distinction to previous theories. It may be that such rich Connectivism case studies are in progress but not yet evident" (2010, p. 531). This network study draws more clearly on the sociocultural and sociomaterial theory employed by learning scientists, workplace researchers and organizational learning theorists, adding a conceptually and empirically grounded critique of what is clearly a compelling epistemological and curricular perspective for many practitioners and researchers of digital learning.

This study also speaks to recent research and discourses that center technology innovation in education specifically on social justice and equity goals. Building on discussions of technology *access*, digital *inclusion* and *participation* (i.e. "technology for all"), many researchers and practitioners are now shifting the focus rather to the *critique* and *use* of technology for substantive equity and social justice (i.e. "technology for what") (e.g. Philip & Olivares-Pasillas, 2016; Soep & Lee, 2016). In particular, I shed light on how an open, ideologically diverse collective frames and acts upon difficult goals of social justice and equity. By attending explicitly to sociopolitical aspects of technology

innovation, this research speaks to critical social innovation practitioners and scholars in the nascent field of critical entrepreneurship studies (Essers et al., 2017b). It elaborates our understanding of what social enterprise, collective action and open innovation is and what it might rather be. The study may be useful to policy thinkers considering the role of entrepreneurial networks for innovation or collective action for educational reform.

Methodologically, this study may provide a useful case or proof-of-concept to activity theory and ANT researchers, particularly those who are interested in using activity theory to model and analyze dialogic, poorly bounded activity systems and networks, that is, the sort of contexts and problems around which a nascent "fourth generation" activity theory is being formed (see, for example, Engeström, 2009). The way that this study frames a network as a case may be interesting to researchers. The study also employs relatively novel mixed methods, including a machine learning approach to narrative analysis and a bimodal sampling approach to network data collection, both of which may be useful contributions to the technical literature. Finally, this study demonstrates a novel way of capturing temporal, emotional and experiential aspects of social networks by integrating structural/functional representations with actor narratives of enactment.

Chapter 3: Methods

I may find an opening theoretical gambit to be compelling, but if I can't reconstruct the author's means of collecting, reducing, and analyzing data, then I will have little faith that the construction of results follows from responsible and consistent treatment of evidence... (Smagorinsky, 2008, p. 408)

There is nothing more sure to kill research and sweep it off into the leftovers of abandoned works, nothing more sure, than methods. (Barthes, 1971, p. 9)

GENERAL APPROACH

This is a *mixed methods embedded case study* focusing on the Ed-tech Neotown network as a *revelatory case* (Yin, 2014) of an open, urban ed-tech innovation network. It is open in the sense that, technically speaking, anyone can join the online meetup and attend monthly meetings of the network (having joined or not). It is urban in that it is identified as a Neotown-area network and is geographically situated in downtown Neotown. The rhetoric and nominal activity of the network is focused on bridging technology and educational communities for educational impact.

This study integrates data generated via three main research strands. First, I take a computational topic modeling approach to inferring a set of latent discourses about ed-techer identities and interests, using *latent dirichlet allocation* (LDA; Blei et al., 2003) to analyze a corpus of over 2200 short public profiles written by members of the Ed-tech meetup. This provides a general sense of the way a very large number of ed-techers position themselves discursively as they "join" the network online via Meetup.com, that is, a sense of who they are and what they want to do. Second, I develop a "more than social" network representation of actors comprising the ed-tech network using an interview-based

name generator instrument administered to a network sample of participants. This provides a structural representation of the network and a participant-generated index of network actors. Finally, through the interview process, I also provoke the telling of stories of network enactment by each participant, and embed actors in different scenes and narratives that organize the network, including my own narrative.

SITES AND PARTICIPANTS

Ed-tech Neotown is the nominal case from which initial participants for this study were drawn. The network assembles face-to-face at TechAssembly, a tech startup incubator and coworking space in downtown Neotown where core Ed-tech Neotown organizers work, socialize and where network meetings are held on a more or less monthly basis. Face-to-face meetings are often organized around panels and presentations that feature innovators, products, issues and trends in educational and technology. Presenters and regular meeting participants are included in the network sample for this study.

Ed-tech Neotown is also manifest online via the Meetup.com platform, a popular social networking site designed to coordinate affinity groups and interest-driven communities in online and face-to-face meetings and interactions. The Ed-tech Neotown Meetup was founded in 2012 and by 2018 listed a membership of over 2,000 "ed-techers," the majority of whom have brief, publicly visible profiles which describe who they are and why they are interested in education technology. The Meetup.com platform tracks the join date and profile information for all participants. This membership list is a much broader frame from which participants were sampled in a purposive way.

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Finally, the Ed-tech Neotown network is visible on mainstream social media platforms like Facebook and Twitter, communicating around certain hashtags. Individuals who interact with the network via these social media channels were also included in the broad sampling frame for this the study.

DATA COLLECTION

Data collection began in March 2018 and proceeded concurrently with analysis for a period of 12 months. I have been a member of the network since 2014, and a regular meeting attendee since 2016.

Network Survey and Semistructured Interviews

Bimodal network sampling

As a key focus of this study is on marginal participation and dynamics of inclusion and exclusion, and recognizing the tendency for classic ANT-informed studies to over-emphasize central and technocratic actors in a network, network sampling was guided by two goals: (1) to represent a "core" network structure as faithfully as possible using a systematic snowball sample and (2) to achieve an understanding of the periphery through parallel purposive sampling for "maximum variation" (Merriam & Tisdell, 2015, p. 98). To achieve these goals, an initial set of four core network actors were recruited based on overt indicators of network centrality, namely regular attendance and key organizing roles with the network. A systematic *snowball sample* (Merriam & Tisdell, 2015) of other actors was then assembled in the manner described by Ingram et al. (2015), whereby sampling is focused on alters most commonly identified by actors and proceeds until alters become

idiosyncratic, that is, identified by no more than one actor. Snowball sampling was guided by a question designed to identify important network actors and objects of activity: "What people in the ed-tech network have been most important to you for your work, and why have they been important?"

At the same time, a *purposive network sample* was taken based on two principles: (1) include actors who have stories of marginalization or peripheral engagement with the network, and (2) include actors who have stories that are critical for characterizing material-representational objects around which the network swarms and the activity systems comprising the network. The goal of this *bimodal* (purposive *and* network-based) sampling strategy was to develop a data corpus complete enough for valid quantitative representation and centrality analysis, and holistic enough to particularize our understanding of why and how individuals in different parts of the network swarm together.

Egocentric network survey

Participants were recruited via face-to-face meetings, over email and on social media. I used a face-to-face or telephone interview format to engage participants in completing a free recall name generator survey (Appendix A). As an *egocentric network survey* instrument (Carolan, 2014), the name generator yielded a corpus of networked individuals (egos) and their perceived connections with others (alters), showing how individuals perceive and understand their embeddedness in a network. As a *more than social network survey* instrument, the network is understood as sociomaterial in nature, and the name generator also prompted participants to identify both human and nonhuman alters: individuals, groups, instruments, and ideas that have been most important to them

their involvement with the ed-tech network. Per best practices outlined by Carolan (2014), the instrument limited the cognitive burden placed on respondents by accommodating a maximum of five named alters of each type. The human and nonhuman alters identified in the network survey were added to an evolving "sociomaterial index" of networked human and nonhuman actors, maintained as a set of linked spreadsheets.

Semistructured interviews

Immediately prior to the interview-based network survey, each respondent was engaged in a semistructured interview lasting 60-120 minutes (Appendix B). The semistructured interview process provoked the telling of stories and generated a data corpus for two main purposes. First, alters were identified as characters in stories to quantitatively expand and qualitatively understand their situated activity and relationships, resulting in a more complete sociomaterial index and more trustworthy picture of the network components and structure. (A similar "mixed methods approach" combining the use of both a free recall name generator instrument with the "mining" of actors from semistructured interview data was shown by Rice et al. (2014) to generate a more complete network representation than either approach alone.) The second purpose of the semistructured interview is to identify and extract stories and narratives of object-oriented network enactment and mobilization over time. These stories and narratives were *emplotted* (Czarniawska, 2004; Lejano et al., 2013) to understand the different ways that the network makes sense of the world and its activity.

The interview process provoked the telling of stories about (1) how and why egos came to be involved with the ed-tech network, (2) the *runaway* (Engeström, 2007) and

material-representational (Spinuzzi, 2011) objects of their activity, (3) what ed-tech network activity looks like to different egos and (4) what boundaries and tensions they perceive and negotiate over time. Probing and follow-up questioning focused on ensuring that egos and alters were explicitly situated within the stories and narratives presented.

Interviews were professionally transcribed and entered into an Nvivo database along with post-interview written memos, forming the basis of a *chain of evidence* for analysis (Yin, 2014). Analysis was conducted concurrently with data collection, and specific lines of sampling continued until data saturation (Merriam & Tisdell, 2015, p. 199).

Constraining a potentially unruly case

Simultaneous attention to human, material and semiotic dimensions of the network had the potential to generate a large, unwieldy and inconsistent sociomaterial index. To guide the assembly of a data corpus that was both manageable and meaningful, data collection decisions (i.e. sampling, questioning) observed the following rules of thumb:

1. Snowball sampling for surveys and interviews was guided *a priori* per respondent-identified human-human relations in pursuit of a quantitatively representative sample of the core social network. These relations show who is most visibly "swarming" to the network.

2. Purposive sampling, story provocation and interview probes were focused on identifying and constraining objects of network activity, and embedding both central and marginal actors in their own stories of object-oriented work. I did not provoke stories from individuals about how they perceived the ed-tech

network in general, but rather sought to reveal the network through stories told

by individual actors about the object-oriented work that they do, and how it is

related, mediated or supported by the network (for example through

collaboration or resource access).

Spinuzzi's (2011) approach to constraining runaway objects for analysis of single activity

systems was helpful in constraining the overall case of the network. However, here the

goal was to identify and sample from a *variety* of interrelated activity systems comprising

the *activity network*. This helped interpret network *scenes* as *multiple embedded units of*

analysis (Yin, 2014).

Participant Observation

During the 12-month study period, I attended all monthly meetings of the network

as well as special online and face-to-face events. As a participant observer my fieldwork

involved (1) observing and participating in network activity and practices (meetups,

workshops, happy hours, panel events), (2) watching how stories were being made on the

fly, (3) collecting stories that were shared *in situ*, and (4) provoking the telling of stories

(Czarniawska, 2004). I recorded observations and stories as written and verbal field notes

during and after meeting sessions, transcribing and entering them into the Nvivo database.

Digital Profiles and Artifacts

From a sociomaterial perspective, we can expect that instruments and artifacts

comprising the network will tend to be *inscribed* (Latour, 1987) in ways that pattern their

use in work and educational contexts. Therefore, artifacts and infrastructure encountered

in the field and identified in surveys and interviews were "read" for such inscription and the *black-boxing* of assumptions and functions in context. This reading was generally structured per an activity theoretical framework (Figure 3) which focuses on the mediational role instruments play in the historical context of one or multiple activity systems, and was also informed by sociological perspectives on neoliberal market forms presented in Chapter 2. I assembled field notes, memos and images of primary digital/material artifacts of network innovation and collaboration, including aspects of the built digital and physical environments in which the network is enacted. Where products and instruments of innovation could not be accessed as *primary artifacts* for analysis, *secondary artifacts* (e.g. product documentation and website descriptions of projects) were used.

The profiles ed-techers wrote for themselves as members of the ed-tech meetup on Meetup.com are public, and include their member name, join date and short responses to two prompts: "Tell us a bit about yourself" and "Why are you interested in education technology?" These profiles are public artifacts in the sense that non-members of the meetup can find them on the Meetup.com website when searching for specific users by name or browsing meetup memberships in aggregate. However, individual profiles are not, to my knowledge, easily searchable in other ways, for instance via mainstream search engines. Profile information and other member statistics were also accessible via the Meetup.com public API. To conduct the topic modeling analysis reported here, over 2,241 ed-techer profiles written at the time of this study were accessed using the API and transformed into a corpus for topic modeling using the 'tm' package in R (Feinerer, 2018).
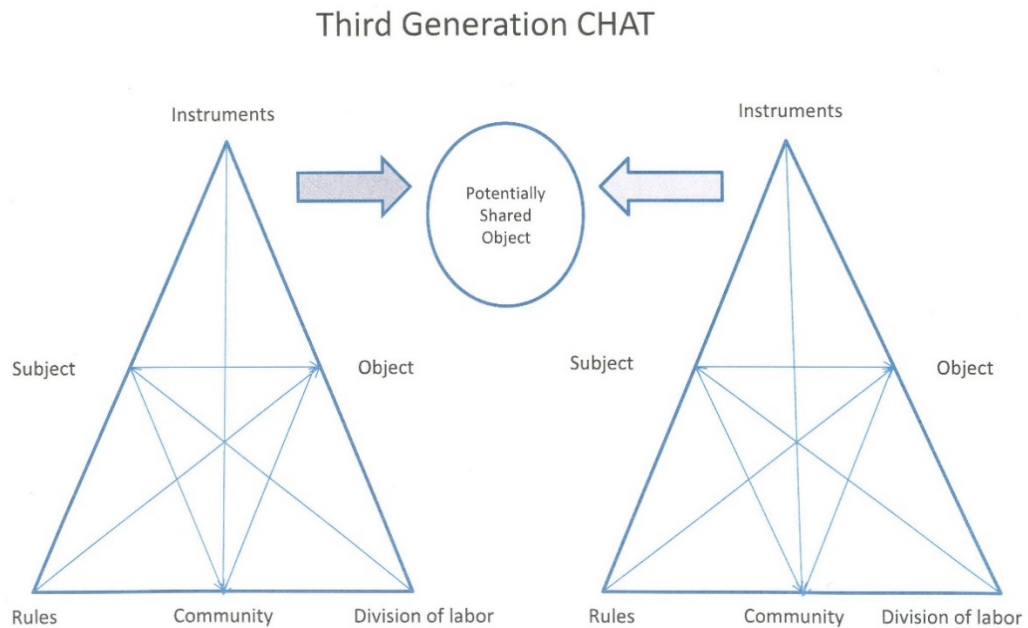
Figure 3. Third generation Cultural-Historical Activity Theory framework

DATA ANALYSIS

All audio, visual and text data were archived in a database directory on Box.com, and all transcribed interviews, memos and field notes were organized in an Nvivo database in this directory.

Topic Modeling

LDA is a commonly used method for identifying latent structure in text corpora, having been employed to model topics within and across larger documents like articles and online reviews (e.g. Evans, 2014; Hu, Chen, & Chou, 2017; Nichols, 2014), as well as

corpora of documents smaller than the typical ed-techer profile, like sub-120 character tweets (Jónsson & Stolee, 2015; Weng, Lim, Jiang, & He, 2010). In order to fit an LDA model to terms derived from a corpus, the number of topics (k) needs to be fixed *a priori*. While there are methods of "cross-validating" the number of topics based on harmonic means and perplexity minimization (Blei et al., 2003; Grün & Hornik, 2011; Ramage & Rosen, 2009), a primary research consideration is the hermeneutic utility of the number and composition of the topics themselves. Models producing very large numbers of topics (e.g. $k > 10$) may become as inscrutable as the aggregate of individual stories from which the topics are inferred. For the purposes of this study, I was interested in producing a small, intuitively useful set of topics for interpreting individual stories. To generate this set, I took a systematic approach to the qualitative evaluation of the hermeneutic utility of topics modeled with different *a priori* numbers of topics (k). This approach involved conducting iterative model runs to predict from 2 to 10 k topics using the 'topicmodels' package in R (Grün & Hornik, 2011), and comparing topics generated at each iteration in a stepwise progression, proceeding from the lowest to the highest k model run (Appendix D). The last topic included in our hermeneutically useful set is the last to persist recognizably across two sequential model runs (k and $k + 1$) based on its term composition. These recognizably persistent topics are adopted for the purposes of this study as *fundamental discursive topics,* or what I call *latent discourses.*

For each latent discourse, I then used the 'wordcloud' package (Fellows, 2018) in R to create a frequency word cloud of the top 20 terms generated by each iteration of the model for which the topic was identified. This provides a summary at a glance of the high

probability terms that tend to persist across model runs, that is, to be regularly assigned to each recognizable topic across model runs. I then examined the 20 profile documents assigned to each topic with the highest degree of probability at the highest *k* run for which all topics are present, and synthesized a simplified, abstracted version of each profile to show how latent discourses play out in their network stories. The overall analysis amounts to a systematic, computational way of identifying and qualitatively interpreting different discourses at play in a large dialogic storytelling network.

The top 20 profiles within each latent discourse topic were also coded in terms of where ed-techers were coming from and where they were going to in terms of work context, and visualized as Sankey diagrams using the 'alluvial' package in R (Bojanowski & Edwards, 2016). The final set of emergent codes is included as Appendix E.

Narrative Network Analysis

The sociomaterial index of network actors was developed as a spreadsheet over the course of the study (see Appendix C for data model and example synthetic data). Responses to the name generator instrument were periodically standardized in terms of ego and alter identifiers, and integrated into the evolving sociomaterial index. At the same time, network alters were extracted in an ongoing fashion from transcribed interview data, standardized and added to the same index. The tabular sociomaterial index was exported periodically as linked edge and attribute tables for analysis and visualization in R using the 'igraph' package (Csardi & Nepusz, 2006). This enabled a quantitative description of

network and ego embeddedness. Measures of *centrality,* most importantly in terms of *degree* (Carolan, 2014), were calculated as possible indicators of *expertise* and *influence*.

Actor centrality and importance on the network were visualized based on in-degree connection and force-based (Fructerman-Rheingold) distribution. "Scenes" on the network—that is, clusters of actors that figure into each other's stories of network enactment—were interpreted based on spatial distribution, in-degree clustering and the standard multilevel hierarchical community detection algorithm in igraph. Network visualization augmented the qualitative analysis of personal narratives of network enactment with a structural-functional perspective.

Meanwhile, interviews were transcribed, read, and *emplotted* using the general approach described by Czarniaswska, that is, by attending to "the passage from one equilibrium to another" (1998, p. 19), linking beginnings, middles and ends to assemble stories or histories of experience in a *storytelling* or *narrative network* (Boje, 2011; Ingram et al., 2015; Lejano et al., 2013). Synthetic narratives were written for interviewees and revised iteratively as the study progressed in terms of sampled characters and plot issues and themes. Working across narratives and incorporating structural representations of network assemblage, a variety of narratives of network enactment within *scenes* were elaborated. Quantitative representations of structural centrality and network density were evaluated in terms of qualitative understandings of expertise and collaboration. As embedded units of analysis, *scenes* were ultimately employed for cross comparative analysis of network composition and enactment within the overall case.

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General Limitations (What this Study Will Not be Able to Do)

In designing this study around a network-level unit of analysis, I have made a tradeoff, pursuing network breadth at the expense of deep ethnographic detail. The scope of this study largely precludes traditional ethnographic modes of, for instance, workplace and classroom observation and interaction analysis, and rather uses historicized reports and an analysis of primary and secondary digital artifacts of innovation. Where possible, digital artifacts and participant observer fieldnotes are used to triangulate with the narratives and claims about practice made by participants, better establishing the trustworthiness of self-reported data.

This study of network enactment was based on personal narratives solicited from participants and a single researcher's analysis of artifacts and material aspects of the sociotechnical environment. While providing a rich, self-reported, account of network activity and composition, it is quite likely that the interview-generated narratives examined in this study only loosely reflect activity in practice. Furthermore, the interview-collected narratives likely introduce certain forms of bias, like social desirability and recall bias.

As network representations are based on stories of enactment, this study examines the ed-tech network as a *storytelling network* in the way that researchers have studied *storytelling organizations* (Boje, 2011) and *narrative networks* (Lejano et al., 2013). However, as representations of the ed-tech network are based to a significant degree on storytelling that was "provoked" (Czarniawska, 1998) via the narrative interview process,

the network precipitated through interviews may not reflect the same storytelling network enacted in practice. To some extent, phenomenological touch points between interview-based network representations and the network as it is practically enacted can be found in the multimodal stories collected through participant observation and digital artifact analysis. However, as discussed in Chapter 2, highly distributed, mediated open networks present researchers with "time, space and (in)visibility" problems (Czarniawska, 1998, p. 28). Working outside the reach of traditional ethnography, we must expect some relative indeterminacy in network representation.

Issues of Quality (What this Study Must do Well)

This study combines qualitative (QUAL) narrative and artifact analyses of network activity and composition with quantitative (QUAN) measures of network structure and the latent structure of discourse. As mixed methods (MM) research, a primary focus of this study is the generation of quality *meta-inferences*, that is, conclusions, understandings or explanations "generated through an integration of the inferences that have been obtained from the results of the QUAL and QUAN strands of a MM study" (Teddlie & Tashakkori, 2009, p. 152). Onwuegbuzie and Johnson (2006) point out that assessing the validity of findings of mixed methods research is particularly complex as it combines "complementary strengths and overlapping weaknesses of quantitative and qualitative research" (p. 48). They propose a bilingual nomenclature of *legitimation* to address this problem of integration. In this section, I will evaluate threats to the quality of this research per four of

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the most salient legitimation types identified by Onwuegbuzie and Johnson (2006), and note measures undertaken to minimize these threats.

Sample Integration Legitimation

Sample integration legitimation involves an analysis of "the extent to which the relationship between the quantitative and qualitative sampling designs yields quality meta-inferences" (Onwuegbuzie & Johnson, 2006, p. 57). In this study, primary threats to sample integration legitimation arise from the way the network sample is taken and how this sample relates to the network as a whole.

Studies have shown that egocentric network measures are indeed sensitive to overall sample density and issues of nonresponse (Carolan, 2014; Rice et al., 2014). The quality of an inference based on network statistics is, in general, reduced anytime sampling is nonrandom, as is the case with the systematic and purposive sample collected in this study. The bimodal sampling strategy I have designed should tend to yield a more complete central network sample near the center, despite purposeful oversampling at the periphery. That said, a high level of precision or accuracy in centrality measures near the periphery is probably not necessary to make basic inferences about the relationship between individual perceptions of expertise and structural centrality.

A more serious issue of sample integration legitimation may be related to how the systematic snowball sample is contingent upon the way individual egos interpret the question through which they nominate prospective respondents, that is, how they interpret "important to the work you do" (Appendix B). This is an *affective* approach to identifying

network links rather than a *role-relation*, *interaction*, or *exchange* approach, which tend to be somewhat less prone to subjective and variable interpretation (Marin & Hampton, 2007). The network sample assembled via different ego perspectives may end up being something of a collage, and generalizations about one part of the network may not apply to the whole. However, describing the polyphonic nature and story of the network is a core research goal. Furthermore, this particular threat to generalizability is somewhat mitigated through the integration of the QUAL strand of narrative analysis, which should make differences in how the network is perceived, understood and enacted more apparent than they would be if a name generator were deployed on its own.

Name generators, while extremely common in social network analysis, are prone to the effects of order, recall and recency bias (Carolan, 2014; Rice et al., 2014). Respondents, for example, may forget to identify important alters, they may preferentially identify alters with whom they have most recently interacted, or they may become fatigued over the course of data collection and nominate relatively few alters at the end of a survey. The mixed methods approach to network data collection that is taken in this study—adapted from Rice et al. (2014)—mitigates, to some extent, all of these forms of bias. By dedicating time at the end of each semistructured narrative interview to the completion of the formal network name generator instrument, respondents had the opportunity to reflect upon their experience and recall important actors. Narratives were also mined for additional significant alters that may not have been nominated in the name generator.

The complete set of digital profile information extracted from Meetup.com that is used to model latent discourse does not necessarily represent the same population that

actually *attends* face-to-face meetups. However, this study makes no claim of statistical representativeness, and rather expects and seeks to examine qualitative differences in network discourse across modal manifestations (i.e. online vs. face-to-face).

Inside-Outside Legitimation

Inside-outside legitimation relates to "the extent to which the researcher accurately presents and appropriately utilizes the insider's view and the observer's views for purposes such as description and explanation" (Onwuegbuzie & Johnson, 2006, p. 57). This study incorporates personal, subjective, emic narratives of network participants in interpreting what the network is and how it is enacted. At the same time, I exercise my own etic conceptual and epistemic agency in interpreting topic models as latent discourses, quantifying network connections as structural maps, systematically extracting and emplotting network narratives and presenting my own narrative of experience. I undertook the reflexive, recursive work of squaring of etic and emic perspectives by taking field notes as a participant observer, and through the writing of analytic memos. I also conduct regular interview-based member checks to ensure that my synthetic narratives and network visualizations reflect the lived experience of study participants.

Weakness Minimization Legitimation

Weakness minimization is the "extent to which the weakness from one approach is compensated by the strengths from the other approach" (Onwuegbuzie & Johnson, 2006, p. 57). As previously noted, name generators invite a variety of types of bias and egocentric network analysis in general is sensitive the way questions about relations are interpreted

and to missing data. In mining the semistructured interviews for actors and characterizing their relations, the QUAL strand of this MM design compensates somewhat for these issues. At the same time, inferences drawn from narratives about the structure of the network are concretized through the measures and representations generated from the QUAN strand of this the study. The narrative histories of network enactment make up for the way that the QUAN strand might represent the network as a static, formal structure, adding an important aspect of dynamism and polyphony. Finally, the QUAL processes of term tracing and narrative abstracting of profile stories also helps make latent discourses identified through QUAN methods of LDA topic modeling interpretable and meaningful.

Conversion Legitimation

Conversion legitimation involves "the extent to which the quantitizing or qualitizing yields quality meta-inferences" (Onwuegbuzie & Johnson, 2006, p. 57). Both social network analysis and analyses based on computational topic modeling are what Teddlie and Tashakkori would call "inherently mixed data analysis" (2009, p. 273). QUAL data was indeed quantized by mining semistructured interview data for network actors and adding them to the sociomaterial index for QUAN network measurement and representation. While qualitative decisions were made by egos in nominating alters for inclusion and by the researcher in mining important alters from interviews for inclusion in the sociomaterial, these decisions were rooted in the narratives of individual respondents, producing a mixed QUAN/QUAL representation of narratives. Digital profiles were quantitized as probabilistic representations of inferred topics, or latent discourses. To the

extent that these QUAN-generated discourses were used as analytic categories in interpreting ed-techer profiles stories and storytelling more broadly on the network, metainferences were supported by qualitizing.

RESEARCHER AS AN INSTRUMENT

I have a background in biological sciences and developed as a quantitatively-minded researcher in a global health community of practice. My initial understanding of *research as praxis* evolved through collaborations in participatory, community-based approaches to the design and implementation of health and resilience interventions in Southern Louisiana and East Africa, approaches which invest the *subjects* of study with a high degree of agency not just in the collection and validation of data, but also in establishing research goals and methodology. As an educational researcher, I move (somewhat uneasily) between a critical poststructuralist and social constructionist stance when working out issues of ontology and epistemology. I find myself ontologically pragmatic, if not willfully agnostic. As a researcher, I operate under the presumption that ontology is an issue of practical politics, that axiology patterns and is patterned by the material and that social change can indeed occur through (difficult) epistemological struggle.

Chapter 4: Results

In the first part of this chapter I will examine the stories that ed-techers tell as they join the ed-tech network on the Meetup.com platform, and present latent discourses about identity and interests that help us understand *who* enacts the network and *why*. In Part 2 I look at *how* ed-techers tether themselves to ed-tech, presenting my own narrative of interaction with the multimodal story and infrastructure of the network. I show how the network provides an efficient technological interface for assembling *entrepreneurs of the self* (Foucault, 2008; McNay, 2009) around *runaway objects* (Engeström, 2006) of education and technology. In Part 3 I visualize the ed-tech network from the perspective of some of its embedded actors, and characterize what I call "scenes" of enactment using narratives and network representations, and in Part 4 I look at how the stories and discourses that characterize these scenes pattern the ed-tech interventions that emerge from them. Finally, in Part 5, I summarize findings in terms of the research questions related to network composition, activity, learning, boundary crossing, transformational potential and methodology.

PART 1: LATENT DISCOURSES ABOUT ED-TECHER INTERESTS AND IDENTITIES

Essentially, all models are wrong, but some are useful. (Box & Draper, 2007)

Who is the ed-tech network? Where are ed-techers coming from and where are they going? How do they present themselves to the network, and what are the objects

around which they are swarming? Here, using LDA, I will model a set of "latent discourses" in a complete corpus of over 2,200 profiles written by ed-techers to introduce themselves to other ed-techers on Meetup.com. This computational approach to examining interests and identities is one way of resolving the fuzzy runaway objects that interest ed-techers, and of understanding how they use these objects to orient their (very different) activities as ed-techers. LDA represents each individual meetup profile story as a *composite* of all the inferred discourses, though some discourses may represent stories with a higher probability than others. LDA, therefore, is a technical, computational way of modeling ed-techer stories as *polyphonic* (Bakhtin, 1984).

Ed-techer Interests

Using the term tracing approach to analyzing LDA topic models described in Chapter 3, I identified four latent discourses about ed-techer interests in educational technology that were recognizable and persistent across all nine LDA model runs (configured to infer from 2 to 10 topics; Appendix D). For each interest discourse, I include a table that consists of a word cloud representation of term frequencies across model runs, along with abstracted (summarized) versions of the 20 meetup profile stories that reflect the discourse with the highest probability (i.e. *gamma* estimated via the 'topicmodels' package). The wordcloud shows the collection and relative frequency of terms (word *stems*) allocated to each topic across the nine latent discourse model runs. The narrative abstracts help interpret how these discourses emerge within and pattern (represent) individual storytelling.

Why are you interested in educational technology?	Representative Meetup Profile Abstracts
Teaching and Learning Interests Some ed-techers tell stories of their passion for teaching and learning, their desire to learn more about how to change and get better with tech. They are often teachers or former teachers (8 of 20).	A. I mentor robotics clubs in schools, and like to see kids learning new things and getting excited about engineering and technology. B. I am a former teacher and current school administrator, and I am interested in instructional design, issues of access and equity, using technology to teach and getting better at it. C. I am a current teacher and I think technology is changing classrooms. I want to learn from educators and others about how to get better at engaging tech. D. I'm a current teacher. I want to learn new reasons for using technology in the classroom, and new ways of engaging it. E. I was an accountant for 18 years and am now a current teacher. I want to learn enough about tech to be able to relate to and stay relevant to my students. F. I am a current teacher. I want to learn inspiring ways of integrating tech in my classroom.

Table 2: Discourses about teaching and learning interests inferred via LDA.

The first discourse (Table 2) feeds into a variety of profile stories in which ed-techers express a passion for teaching and learning. These are stories about ed-techer desires to learn more about teaching, and to learn more about technology for classroom applications. I call this the *teaching and learning* interest discourse. Notably, many of these storytellers say that they are teachers or former teachers. On the whole, this discourse represents a network interested in practitioner-driven transformation of teaching and learning practices. One current teacher writes:

> *I think technology is changing classrooms. I want to learn from educators and others about how to get better at engaging tech.* (Table 2 abstract A)

The *chronotope* of these stories, that is the way they situate characters and action (i.e. teachers and teacher learning) across space and time, is specifically constrained; teachers tend to present themselves as classroom-based practitioners looking outside of the classroom to learn, collect, and bring back new technologies and methods to school. For example, another current teacher wants *to learn new reasons for using technology in the classroom, and new ways of engaging it* (Table 2 abstract D). The stories tend to convey ed-techers in pursuit of technological transformation of their own teaching practices and the learning practices of their students.
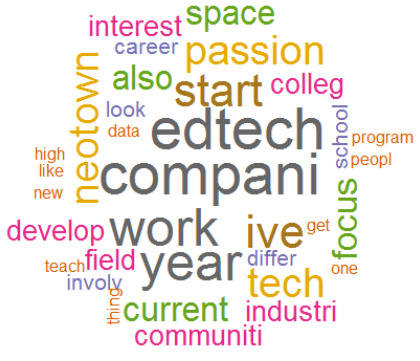
Why are you interested in educational technology?	Representative Meetup Profile Abstracts
Commercial Career Interests Some ed-techers tell stories that position them in terms of ed-tech careers and the work they do with companies and commercial products. They tend to be looking to collaborate and share what they know and what they are producing. (15 of 20 work for companies or startups, 2 of whom are recruiters. Former teachers and recent university graduate are also represented in the sample.).	A. I am an engineering director. I represent a company with ed-tech products, and want to engage the community to expand, hear needs and have a bigger impact. B. I am a co-founder of an online coding education company, and I want to connect with people and ed-tech orgs in town. C. I am a recruiter for a major academic publisher and want to network with ed-tech leaders. I want to host a meetup so we can showcase our current work in tech. Things are changing, and we need to be involved and connected with the ed-tech community. D. I am a former teacher and am currently in town exploring the market for a Norwegian ed-tech startup with a digital language leaning platform. I want to start some pilots locally, and help the company expand nationally. E. I am a student and aspiring entrepreneur with a robotics STEM education platform recently gaining attention at major media and education conference. I also have been teaching STEM and robotics in orphanages in India, partnering with some American Universities in a global robotic challenge, with gamification.

Table 3: Discourses about commercial career interests inferred via LDA.

The second discourse about interest in educational technology generates stories about ed-tech as "work," "career," "industry" and "company" (Table 3). I'll call this the *commercial career* discourse. Ed-techers organizing their stories with this discourse are often interested in transforming their company and its position in the industry and education ecosystem. A *recruiter for a major academic publisher* wants to

network with ed-tech leaders. I want to host a meetup so we can showcase our current work in tech. Things are changing, and we need to be involved and connected with the ed-tech community. (Table 3 abstract C)

Compared to the *teaching and learning* discourse, these stories are less reliably focused on learning to transform classroom practices, and more about collaboration and interaction in a commercial context, that is, among companies and between companies and schools. One *co-founder of an online coding education company*, for example, wants to *connect with people and ed-tech orgs in town* (Table 3 abstract B). These stories position ed-techers as people who develop their careers in an industry context by creating education-oriented products and sharing knowledge. A *former teacher* is *exploring the market for a Norwegian ed-tech company* (abstract D), for example, and a *student and aspiring entrepreneur* has *a robotics STEM education platform* (abstract E). While the *teaching and learning* discourse patterns stories of learning (or consumption) of ed-tech knowledge and products, the *career commercial* discourse generates stories of the production of ed-tech. Together, these two discourses reflect a tacit market dynamic on the open network, and suggest that actors seeking to consume knowledge and technology are assembling and interacting with actors who claim to produce it.
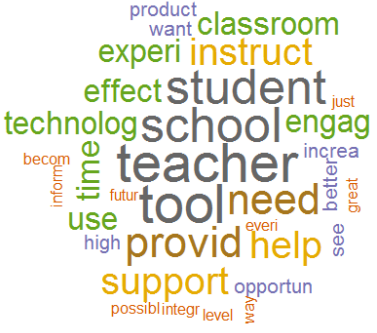
Why are you interested in educational technology?	Representative Meetup Profile Abstracts
School Support Interests Ed-techers talk about their interests in and relationship to schools, teachers and students. Former teachers, education technolgoy coaches and entrepreneurs, for instance, work from the outside of school to disrupt and change what they often describe as outdated, overly bureaucratic and unprofessional classroom and school environments.	A. I create software. I would be a teacher, but it is too bureaucratic and doesn't pay, so I am educating myself about tech that can help teachers do their jobs better. B. I am an ed-tech professional who is new to Neotown, and I want to provide tools to help students, teachers, parents and administrators, and improve the educational system in measurable ways. C. I am a former teacher and I think tech can help teachers accomplish goals of saving time, money and differentiating instruction. D. I am a grad student in education, a current teacher, and I am concerned about narratives that insist teachers are the problem and that tech should replace or control them. I want to show others that this is not the case and use tech as a resource to enhance teaching. E. I am a former teacher (TFA) and current business consultant, volunteer tutor, and I promote an African American history and scholarship program. I want to address the achievement gap by starting an ed-tech startup that helps students prepare for college by using virtual reality and gamified simulation. F. I am a high school student, entrepreneur and technologist, founder and CEO of an ed-tech company, and I am trying to get my ed-tech company up and running. As a student, I understand struggle of schools.

Table 4: Discourses about school support interests inferred via LDA.

A third inferred discourse about interests is characterized by terms like "school," "need," "support," "teacher," "student," "tool" and "provide" (Table 4). Upon inspecting the stories representing this discourse, we see ed-techers who position themselves as knowledgeable change agents in schools. Schools are often presented in negative terms as overly "bureaucratic" (meetup profile), teachers as misunderstood, mistreated,

"commodified" (meetup profile) or unsupported, and students as disempowered and isolated from technology. Technology is presented as an intervention to increase connectedness, effectiveness, efficiency and accessibility of school-based education. The storytellers employing this discourse are, in a small number of cases, current teachers working inside schools. A grad student and current teacher is *concerned about narratives that insist teachers are the problem and that tech should replace or control them* and wants *to show others that this is not the case, and use tech as a resource to enhance teaching* (abstract D). However, these ed-techers more often situate themselves as helping school from the *outside*. A software creator claims: *I would be a teacher, but it is too bureaucratic and doesn't pay, so I am educating myself about tech that can help teachers do their jobs better* (Table 4 abstract A). Some are providers of tech (startup cofounders, software engineers) and five of twenty sampled are former teachers. I call this discourse the *school support* discourse. Like the *teaching and learning* discourse, it is focused on the transformation of schools and classroom practice, but it differs in that storytellers tend to position themselves as interested in *providing* knowledge and technical solutions from the *outside* of school rather than *learning* about ed-tech and working from the *inside*. In this sense, stories representing the *school support* discourse are similar to those using the *commercial career* discourse, but the narrative focus is less on market positioning and exchange value as it is on the school- and classroom-oriented use value of ed-tech knowledge, tools and expertise. For example, the *career commercial* discourse is employed to convey interests like *hosting meetups* (Table 3 abstract C), *exploring markets* and *starting pilots* (abstract D) for the purpose of cultivating and entering the ed-tech

market, while the *school support* discourse is more focused on *helping teachers* (Table 4 abstract A), *differentiating instruction* (abstract C), and *enhancing teaching* (abstract D).

Ed-techers employ the *school support* discourse to position themselves as ready to solve

urgent problems of classroom-based education by intervening from outside the school.

Why are you interested in educational technology?	Representative Meetup Profile Abstracts
  Global Social Change Interests Some ed-techers situate their educational change interest in a broader context. They want to address chronic and global issues of poverty, economic development and inequity by making education better and more accessible to more people.	A. I have been a designer, publisher volunteer and teacher in science and technology education, and I believe tech is key to transforming educational systems and society. B. I am an experienced builder, implementer and evaluator of educational technology, and believe it has great potential to improve engagement, outcomes and is a great equalizer. C. I am an engineer who is new to Neotown, and I'm interested in education technology because it is important for life, and I am interested in how future generations will access quality education. D. I am a university student in Neotown but from India, and I want to learn as much as I can about education because growing populations need access to quality education. I think tech is key to education where resources are scares. I want to help all children and develop the country of India. E. I am interested in building tools and services to fix education, as it is a broken business, particularly in underdeveloped nations. It underserves kids, underpays teachers and treats them like commodities. Tech can help. F. I am an engineer and soon a doctoral student focused on teaching social entrepreneurship, and I believe education is the most important tool we have for shaping our future, so I want to be a part of making it better and more accessible.

Table 5: Discourses about global and social change interests inferred via LDA.

The last latent discourse inferred by LDA (Table 5) is notable for a shift in chronotopic scale. The stories constructed with this discourse tend to be organized around a chronotope of long term, global "development," for example, working on "complex social problems" at a "world" scale rather than at the classroom and school or individual level (meetup profiles). Ed-techers employ this expansive chronotope to position themselves in service of goals of social transformation (Table 5 abstract A), global educational quality and accessibility (abstracts B, D and F), international development (abstracts D and F), and as shapers of our collective futures (abstracts C and F). Many of these storytellers appear to be university students and recent graduates (e.g. abstract D). While the *commercial career* discourse is often also visible in these stories, for example those about *social entrepreneurship* (abstract F) and international economic development, the stories emerging from what I call the *global social change* discourse are similar to the *teaching and learning* and *school change* discourses in the way they emphasize the use value of technology. For example, the value of interest in these discourses is emphasized in terms of *transforming educational systems and society* (abstract A), increasing *access to quality education* (abstract C), and *improving engagement and outcomes* (abstract B) rather than cultivating, connecting with or accessing an ed-tech market. This is not to say these ed-techers don't blend market and use values in their story (like in abstract E and F), just that this discourse focuses on the latter. Finally, unlike stories engaging *school support* and *teaching and learning* discourses, the *global social change* stories more reliably

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articulate the value and impact of education and technology in broader social terms rather than at the level of the school, individual student or teacher.

Interpretative synthesis

The latent discourses and stories above suggest that we understand the network as interested in using educational technology to transform *teaching and learning* practices, further *commercial career* interests, provide (outside) *support to schools* and pursue *global and social change*. These interest discourses are computed representations of some of the broad, compelling runaway objects around which the network discursively "swarms" (Engeström, 2006). In this discursive swarming, we can see evidence of a tacit market division between ed-techers working *in school* who are seeking to "learn" about and consume educational knowledge and technology (i.e. the ed-techers represented in Table 4), and those who use *career commercial*, *school support* and *global social change* discourses to position themselves as providers of "solutions" and "help" from outside of school.

LDA represents each story as a collection of terms drawn with varying degrees of probability from these different discourses. Individual stories on the network will always represent multiple latent discourses inferred through LDA, though some with higher relative probability. Taking this as a computational way of modeling the Bakhtinian notion of the polyphonic text (Bakhtin, 1984) or the activity theoretical notion of a dialogic object (Spinuzzi, 2011), it is possible to examine how discourses combine in different ways to different ends. For example, *commercial* and *global social change* discourses are

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mobilized together to generate stories of ed-techers framing and acting upon humanitarian goals using the language and concepts of the market:

> *I am interested in building tools and services to fix education, as it is a broken business—particularly in underdeveloped nations—that underserves kids, underpays teachers and treats them like commodities. Tech can help.* (Table 5 abstract E)

Meanwhile, another ed-techer mobilized *teaching and learning*, *commercial career* and *school support* discourses to justify an out-of-school approach to educational changemaking:

> *I create software. I would be a teacher, but it is too bureaucratic and doesn't pay, so I want to educate myself about tech that can help teachers do their jobs better.* (Table 4 abstract A)

These two profile stories orient ed-techers with respect to both use and exchange value of the work of educational change. Borrowing conceptually from Foucault (2008), they amount to what I call *entrepreneurial narratives of the self*. An entrepreneurial narrative of the self is what links an ed-techer to important, socially useful, compelling goals of educational change in a way that also positions them as marketable knowers and providers of knowledge in an open ed-tech network that is tacitly patterned by enterprise (producing-consuming) dynamics. For example, one *former teacher (TFA), current business consultant and volunteer tutor* wants to *address the achievement gap by starting an ed-tech startup that helps students prepare for college by using virtual reality and gamified simulation* (Table 4 abstract E). The ed-techer articulates a market-based startup approach based on a *novel combination* (Schumpeter, 1950) of virtual reality and gamification for the production of social and educational *use value*. In this ed-techer's entrepreneurial

narrative of the self, ed-tech emerges as a polyphonic object that weaves together use value and exchange value via *career commercial* and *social change* discourses.

Ed-techer Identities

Using LDA and term tracing, I identified seven persistently recognizable latent discourses based on meetup profile responses to the prompt "tell us a bit about yourself." I call these *identity discourses* to distinguish them from the *interest discourses* described above. I will examine these identity discourses in the order in which they were inferred in the stepwise progression of LDA model runs.
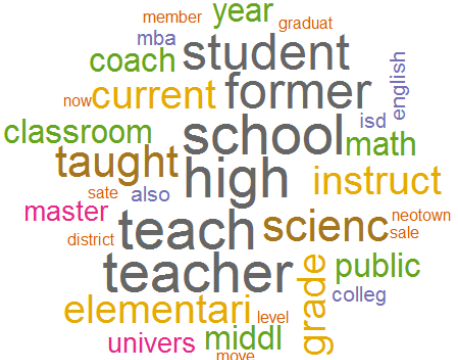
Tell us about yourself	Representative Meetup Profile Abstracts
  Teacher Identities Some ed-techers position themselves as prospective, current and former teachers. Former teachers: 13 of 20 Current teachers: 3 of 20 Prospective teacher: 1 of 20 Former TFA: 4 of 20 University student: 9 of 20	A. I'm a former teacher, current teacher observer, and I'm interested in tech for student learning and teacher growth. B. I'm a current teacher, graduating student, and I'm interested in staying up to date and exposing my students to tech. C. I'm a former TFA teacher, current masters student in policy, and I'm interested in understanding how technology can help teachers provide differentiated support for students. D. I'm a former TFA teacher, current MBA student, and I'm interested in working for an ed-tech startup and helping students with tech and entrepreneurship. E. I'm a former TFA teacher, current MPA student, and I'm interested in bringing a teacher's perspective, like my own, to technology. F. I'm a former teacher, current district instructional tech director, and I'm interested in growing and sharing by collaborating with other innovators.

Table 6: Discourses about teacher identities inferred via LDA.

I call the first latent discourse to emerge a *teacher* identity discourse (Table 6). Almost all ed-techers using this discourse reported being either a former teacher (13/20 sampled; e.g. Table 6 abstracts A and F), current teacher (3/20; e.g. abstract B) or preservice teacher (1/20). Of the 13 identifying as former teachers, nearly a third (4) reported being former Teach for America (TFA) teachers (abstracts C-D). Overall about half (9/20) also reported prospective, current or recent university student status, suggesting that ed-techer teacher identities may be newly formed or forming. The remaining ed-techers using the teacher identity discourse included a school robotics coach (possibly a volunteer), an instructor in a post-secondary for-profit academy and a school-community liaison.

Tell us about yourself	Representative Meetup Profile Abstracts
word cloud containing terms including: entrepreneur, founder, web, tech, product, project, focus, includ, help, engin, busi, market, compani, softwar, creat, digit, consult, stem, design, game, develop, train, work, system, passion, manag, base, interest, build, start, profession, onlin, technolog, program, special **Commercial Professional Identities** Some ed-techers position themselves as professionals and in terms of their roles that make business and companies work, often in the tech industry.	A. I'm a UX developer, and I'm interested in making education available for everyone B. I'm an ed-tech project manager, professional developer, and ed-tech is both a professional and personal interest to me. C. I'm a computer engineering degree-holder, product marketer and business developer, and I'm interested in the benefits of ed-tech at global scale. D. I'm a business development specialist in IT, and I'm interested in educational technology. E. I'm a software and web developer, product manager at ed-tech startup, and I'm interested in learning more about the field and the tech challenges faced by educators. F. I'm a product and project manager, formerly in advertising, but now focused on ed-tech and a competency-based education platform. I'm interested in getting more involved with the community. G. I'm in software and application testing, and I'm interested in making education accessible to everyone.

Table 7: Discourses about commercial professional identities inferred via LDA.

The next discourse inferred through LDA is represented by terms like "business," "software," "develop," "manage" and "profession" (Table 7). Upon inspection, these profile stories position ed-techers in business and tech industry roles, like *UX developer* (Table 7 abstract A), *project manager* (abstract B), *ed-tech business development specialist* (abstract D), *marketer* (abstract C) and *software and web developer* (abstract E). The discourse is used by ed-techers to identify themselves in terms of roles and divisions of labor in the context of firms. I call this a *commercial professional* identity discourse.

Tell us about yourself	Representative Meetup Profile Abstracts
 make start music edtech communiti new year move time last peopl area two ive sinc work enjoy recent just state look live involv current neotown interest like tech graduat career industri comput love space **Discourse 3. Mobile Identities** Some ed-techers positon themselves as people on the move, professionally or geographically. They include tech industry transplants, early career teachers and professionals, students and recent graduates.	A. I'm new to town, a software developer, and I'm interested in supporting the ed-tech community by maybe organizing a hackathon. B. I'm a few years in town, current teacher, music blogger, and I love the weird and wonderful vibe of Neotown, learning ed-tech trends and integrating tech in my classroom. C. I'm new to town, a former teacher, and I'm interested in organizing a hackathon. D. I'm a longtime resident and fan of the city, and I'm interested in representing my company that provides virtual labs. E. I'm new to town, a former TFA computer teacher, recent MEd, and I'm interested in working in education technology. F. I'm new to town, a tech professional, and I'm looking for a job. G. I'm finishing a history PhD, and I'm interested in joining a startup. H. I'm a current teacher on sabbatical, and I'm interested in collaborating with teachers and staying up to date on educational tech.

Table 8: Discourses about mobile identities inferred via LDA.

The next discourse to surface (Table 8) is distinctive in the way it is employed chronotopically: ed-techers present themselves in states of motion or stasis through space and time, that is, in terms of where they have been, where they are, and where they are going in terms of their work context. Many of these storytellers present themselves as recent transplants to the city (Table 8 abstracts A, C, E and F). Some of these ed-techers are *new to town* and *looking for a job* (abstracts F and G), while others want to start new

things, like hackathons (abstracts A and C). Many also express a passion not just for ed-tech but for the broader ecosystem and cultural *"vibe"* of Neotown (abstract B), including "music," food and "sunshine" (meetup profiles). Ed-techers identifying as longtime residents employ this discourse to cast themselves as having grown up in, become *fans* of (abstract D), or fallen in love with the city. This is a discourse that patterns identity stories in terms of cultural, professional, temporal and geographic transition. It is a chronotopic mobility discourse, and it is used by ed-techers to identify as new, old, local or from abroad. I call this the *mobile* identity discourse.

Tell us about yourself	Representative Meetup Profile Abstracts
involv life can meet tech peopl get connect world love kid design enjoy like want way new look just idea thing learn innov interest find make **Connected Identities** Ed-techers sometimes position themselves in terms of a desire meet, share with and learn from other people.	A. I'm a long-time product manager, and I'm interested in meeting people to build stuff, change education, and host networking events B. I'm a self-starter who would love to meet others, and I'm interested in becoming an instructional designer in corporate context C. I'm a technology professional with ideas and experience to share, and I'm interested in STEM education and technology adoption by students. D. I'm an afterschool educator who likes to craft and share ideas and projects, and I'm interested in learning from others about programming and robotics education E. I'm a recent college grad hungry for new ideas and processes, and I'm interested in learning how education is changing F. I'm an innovator helping kids use social media, and I'm interested in sharing my mission of promoting childrens' well-being

Table 9: Discourses about connected identities inferred via LDA.

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Ed-techers use the next discourse (Table 9) to present themselves as people who "love" to "meet" people, "connect" and "share" "new" and "innovative" things (meetup profiles). This *connected* identity discourse is used to emphasize ed-techer desires to be enmeshed as creators, sharers and learners in an innovative community. A *longtime product manager*, for instance, wants to *meet people to build stuff, change education, and host networking events* (Table 9 abstract A). These ed-techers emphasize openness, *sharing* (abstracts C and F) for *learning* (abstracts D and E) and collaborative creation (abstract A). Ed-techers from a variety of work contexts engage this discourse.

Tell us about yourself	Representative Meetup Profile Abstracts
Expert Identities Some ed-techers position themselves as technologically experienced, with a particular passion for education.	A. I'm an experienced tech industry professional, social entrepreneur, and servant leader, and I'm interested in finding equitable and profitable leaning solutions for children B. I have a background in higher ed and k-12 technology, I was a former school tech director, an open source proponent, and I'm interested in going back into the educational sector C. I'm a university academic and tech industry professional passionate about bringing robotics to industry and educational markets. D. I'm experienced in technology and startups, and I'm passionate about education.

Table 10: Discourses about expert identities inferred via LDA.

The next identity discourse (Table 10) helps ed-techers position themselves as experienced technology experts with a "passion" for education (meetup profile). The stories representing this discourse are quite diverse, but upon inspection, ed-techers engage what I call an *expert* discourse to emphasize historical dedication to and experience in the educational technology domain. Some ed-techers emphasize that they are, for example, *experienced in technology and startups* and *passionate about education* (Table 10 abstract D), while others emphasize *background in higher ed and k-12 technology* (abstract B). From private sector (abstract A and D) and university (abstract C) work contexts, these ed-techers write that they engage technology for educational change at different levels, from primary to "higher" education (meetup profiles).

Tell us about yourself	Representative Meetup Profile Abstracts
project communiti engin director graduat serv colleg organ master current found state also lead univers work now degre time studi program stem **Discourse 6. Institutional Identities** Some ed-techer position themselves as leading or emerging from institutions, universities and state or municipal programs. These ed-techers often affiliate with universities.	A. I was born in the state, a first generation college-bound, valedictorian of my class in 1995, a State U. Neotown graduate, and I love STEM and entrepreneurship. I'm now working on eradicating poverty through education reform as the training director of a state charter association. B. Master's Degree: Education Policy (State University) Bachelor's Degree: Health Policy (Raymonds College) Work Experience: - Director of Partnerships (The Teacher Program); Senior Advisor (The Teacher Program); Site Director (The Teacher Program) C. Originally, from South Town, I have a degree in early childhood education from State University Neotown. I worked for a public media corporation on kids programming, and am now a Masters student and marketing intern at a local education company. D. I earned my North City University in Cultural Studies, where I studied creative drive, exploring concepts and cultural implications of contemporary media arts. I've worked as an educator in several major cities.

Table 11: Discourses about institutional identities inferred via LDA.

The stories generated via the sixth identity discourse, again, reflect a diversity of professional backgrounds and positions (Table 11). Looking at the high probability terms, we can see it has something to do with word stems like "univers," "graduat," "colleg" and "work." Inspection of the profiles reveals that ed-techers are using this discourse to elaborate their university affiliations, degrees, and work experience as directors and managers of programs and institutions. One ed-techer, for example, writes:

I was born in the state, a first generation college-bound, valedictorian of my class in 1995, a State U. Neotown graduate, and I love STEM and entrepreneurship. I'm now working on eradicating poverty through education reform as the training director of a state charter association. (Table 11 abstract A)

Ed-techers often use this discourse to describe themselves as qualified and experienced leaders, specifying recognizable institutional affiliations, typically universities. I call this a discourse of *institutional* identity.

Tell us about yourself	Representative Meetup Profile Abstracts
research startup entrepreneur social founder edtech compani consult focus servic data build ceo start firm busi help provid space **Discourse 7. Entrepreneurial Identities** Some ed-techers position themselves as entrepreneurs, builders, creators of companies, founders of startups and makers of social change.	A. I'm an entrepreneur who wants my kids to learn to think differently and for themselves, and I'm interested in learning about what is being done around the globe in ed-tech and how schools can foster talents and enable students to pursue interests B. I'm a founder of an education publishing group that was acquired, current consultant and mentor for education entrepreneurs, and I'm interested in encouraging business in the world of education technology that makes a difference to students C. I'm a CEO of an ed-tech startup focused on higher ed, and I'm interested in moving my startup's services into local universities D. I'm a designer and researcher transitioning to Neotown. E. I'm an alumnus of incubator and accelerator programs, a social entrepreneur, and I'm interested in making an impact on the education market and meeting demand among students for better learning and growth through education. F. I'm a CS and journalism educator, founder of a non-profit that empowers young girls using media and tech, and I'm interested in increasing access to tech and providing necessary mentorship.

Table 12: Discourses about entrepreneurial identities inferred via LDA.

Finally, we have what I will call an *entrepreneurial* identity discourse (Table 12).

These ed-techers use the discourse to story themselves as *designers* (abstract D), *startup*

CEOs (abstract C) and *founders* of entrepreneurial for- and non-profits (abstracts B and F)

that "research" and "focus" on issues and markets, and "build" things that "help" and

"empower" (meetup profiles). The "social" outcomes of entrepreneurial activity are often

featured in this discourse (abstracts A, E and F). For instance, one ed-techer who describes

them self as an *alumnus of incubator and accelerator programs and a social entrepreneur*

is interested in *making an impact on the education market and meeting demand among*

students for better learning and growth through education (abstract E). As opposed to the

managerial and technical roles described using the *industry professional* identity discourse,

entrepreneurial stories emphasize high-agency, independent, market-oriented identities,

like startup founders, "freelancers," "free-agents" and "consultants" (meetup profiles).

Interpretive Synthesis

Analysis of meetup profiles shows how individuals story their identities, like their

interests, in ways that speak via multiple discourses. Assuming most of these profiles were

written when ed-techers joined the meetup, they are best read as *entry stories*, o*r*

introductions, that signal affiliation with identities and interests in different combinations.

One ed-techer, for instance, invokes a *teacher* identity, an *institutional* identity and an

interest discourse about *global change* to present himself to the network:

> *I'm a former public school teacher and current recruiter for a charter school and*
> *current MBA student at State U. Neotown. I want to revolutionize education on a*
> *global scale.* (abstracted meetup profile)

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In this particular *entrepreneurial narrative of the self* the ed-techer interweaves *teaching* experience, a description of market-oriented preparation and *global change* interests.

Overall, at least four latent discourses are leveraged by ed-techers to describe their interests upon joining the meetup: *teaching and learning, commercial career, school support* and *global social change*. These latent interest discourses can be considered very general articulations of the "runaway objects" around which the ed-tech network swarms materially and discursively. Taken as a set of probabilistically modeled topics, the discourses both represent and are inferred from the profile stories told by ed-techers. Taken as a set of runaway objects, they both pattern and emerge from ed-techer storytelling.

Similarly, there are at least seven discourses about identity that ed-techers leverage to describe themselves upon joining the meetup: *teacher, commercial professional, mobile, connected, expert, institutional* and *entrepreneurial.* Identity and interest narratives are often combined within single stories in ways that position ed-techers in different marketable roles and capacities (identities) around different runaway objects of educational innovation (interests). I call these kind of market-aware stories *entrepreneurial narratives of the self.* These narratives *tether* ed-techers to the network in ways that articulate their market and use value.

It turns out that the profile stories written by ed-techers also often convey historical and prospective interests and identities. I will now look at network dynamics and boundary crossing in these stories read as narratives of professional pathways.

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Ed-techer Professional Pathways

Figure 3 provides an overview of how ed-techers talk about where they are coming from and where they are going in terms of their work contexts. I call this their *narrative professional pathway.* Panels A through D show the narrative pathways of the top 20 individual ed-techers in each *interest* discourse. In each of these panels, the column on the left is comprised of blocks representing the work context(s) from which individual ed-techers report coming in their profile story, and the right column represents the work context to which they have or are aspiring to transition based on prospective narration. The blocks are sized proportionally to the number of ed-techers including the context in their pathway. In cases where ed-techers identified multiple past work contexts in their profile story, their pathway has been split and distributed among them. If it was not clear that ed-techers were changing work contexts, their pathway are represented as continuing within the same work context. In cases where insufficient information was included in the profile to identify historical or prospective work context, pathways are mapped as "unknown".
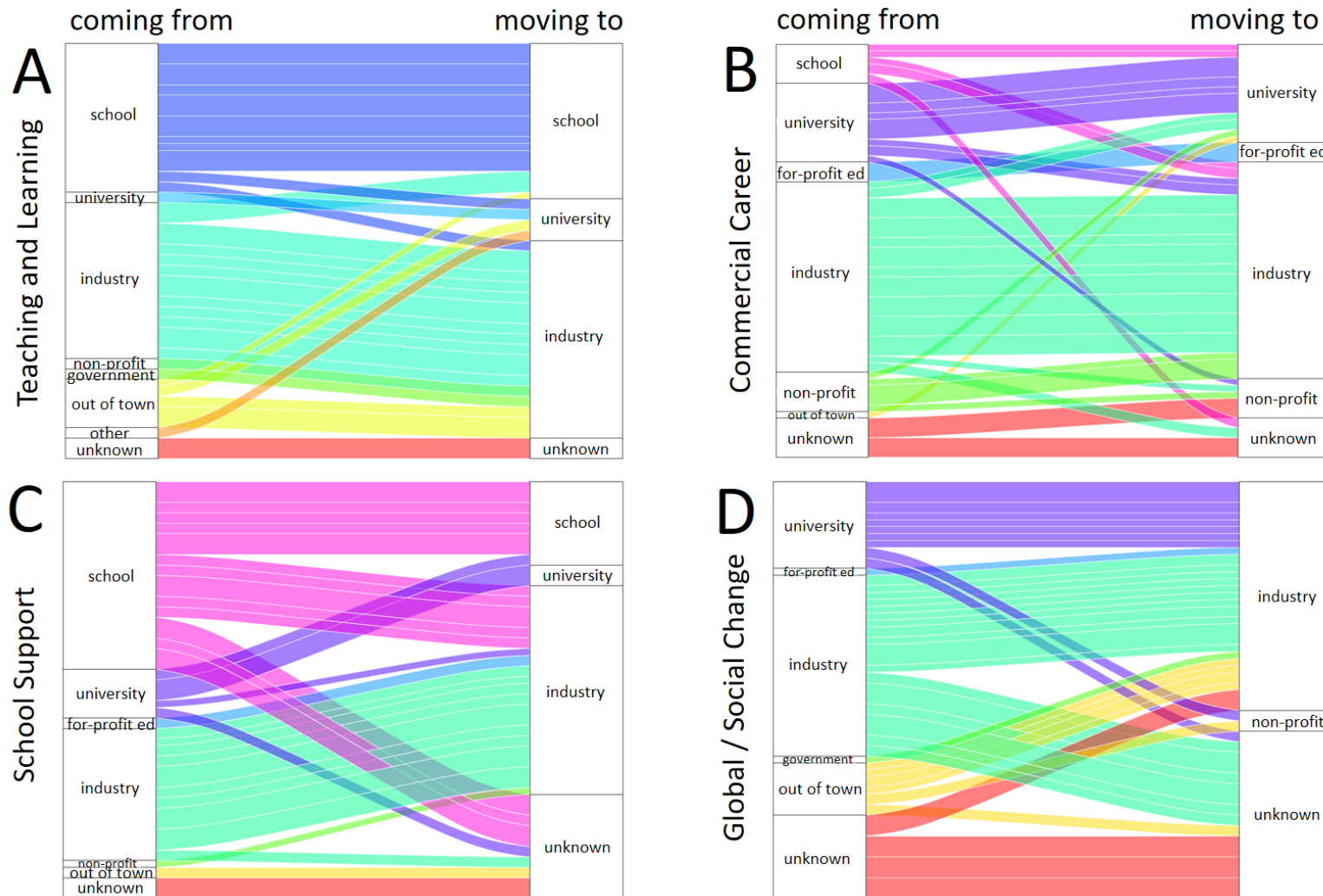
Figure 3. Narrative professional pathways of ed-techers by interests.

Examining all interest-specific panels in Figure 3 together shows three important things about ed-techer pathways. First, ed-techers report swarming to the network from a variety of work contexts, including school, university, for-profit industry and non-profit contexts. Second, the ed-techer narratives are *dynamic* and they story themselves as *crossing contextual boundaries*; ed-techers very often present themselves in professional transition, for example, from school to industry, or university to school. Third, the *assortment* of work contexts that feature in ed-techer pathway narratives and the ways that ed-techers describe their *movement* between contexts differ by interest. Trends in the professional pathways of ed-techers look different depending on the interest. I will point out the salient trends within each interest group.

Panel A of Figure 3 shows how ed-techers who present themselves as interested in *teaching and learning* tend to come from schools, and that on the whole these ed-techers story themselves in ways that suggest they will *remain* in school contexts or *move* into schools from other domains. Relative to other ed-techers, a high number of these pathway narratives emerge from and move to school. As shown in the earlier analysis of interest discourses, ed-techers with teaching and learning interests describe themselves as learners of ed-tech and may be coming to the meetup to refine their teaching practice or create new opportunities for their students.

Ed-techers who leverage *commercial career* interest discourses (Figure 3B), on the other hand, tend *not* to come from schools, and those that do appear to be on their way out to universities or industry. This does not mean that ed-techers going to school do not have *commercial career* interests; it is possible that the goals of commerce may not be valued

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in schools, that school-based practitioners may not feel comfortable expressing careerist ambitions, or that they may be unaccustomed to emphasizing the commercial market value of their skills rather than the social or student-based use value.

A relatively large proportion of the ed-techers who characterize themselves in terms of the *school support* discourse (Figure 3C) story themselves as *leaving* school for industry. As described earlier, this is a discourse that tends to cast schools as dysfunctional, bureaucratic and unsupportive of teachers. Some ed-techers may be using the network to facilitate a transition from a school-based practitioner role to an external school support role.

Ed-techers employing *global social change* discourses (Figure 3D) do not generally present pathways that feature school-based work contexts at all. Where a pathway trend can be discerned, global social change discourses tend to be used by ed-techers to position themselves prospectively in industry. This may reflect a difference in the discursive norms and cultures of schools as opposed to university or industry. Schools may be more focused on classroom and student-level change outcomes, and less conversant in issues of global change and impact.

Interpretive Synthesis

On the whole, the analysis of both *latent discourses* and *narrative professional pathways* presented in this section supports the notion that the open ed-tech network is indeed a diverse public sphere, and therefore capable of convening the kind of broader discussion about school, technology and society called for by historians and scholars of

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educational change (Tyack & Cuban, 1995; Tyack & Tobin, 1994). The network assembles ed-techers who story themselves in terms of *teacher, commercial professional, ed-tech expert* and *entrepreneurial* identities. Ed-techers often describe themselves as geographically, culturally and professionally *mobile* and *connected*. The analysis of pathway narratives shows how many ed-techers present themselves in professional transition and suggests that ed-techers swarming to the network are not just doing so to change school, teaching or society, but also their own work context and professional identity.

Latent discourse analysis shows how ed-techers position themselves around broad objects of educational technology innovation—*teaching and learning* practice, *school change, commercial careers* and *global and social change*—and how these different objects are associated with different pathway narratives between work contexts. Ed-techers interested in *teaching and learning*, for instance, are relatively more likely to story themselves as coming from, going to, or staying in school. These ed-techers, many of whom are teachers, also position themselves as learners of technology. Meanwhile, ed-techers who assemble around *school change* goals story themselves as leaving school using a discourse that paints school as dysfunctional, oppressive and overly bureaucratic. Ed-techers with *career commercial* and *global social change* interests do not generally story themselves as coming from or moving to school. Ed-techers interested in s*chool change, commercial careers* and *global and social change* tend to present themselves as having ed-tech knowledge, technology, solutions and services. A tacit market form emerges from the corpus of meetup profile stories, as ed-techers with teaching and learning interests cast

themselves as consumers and learners of ed-tech while out-of-school ed-techers present themselves as producers and knowers.

In the next section, I will show how interests and identity interact with the sociomaterial infrastructure of the ed-tech network, that is, how the ed-tech network functions as a multimodal social technology to facilitate swarming and the production of both ed-tech and ed-techers.

PART 2: MULTIMODAL ENCOUNTERS WITH THE ED-TECH NETWORK

How does the network attract, engage and convene a diverse public sphere around ed-tech? What does swarming look like as an interaction between individuals and network sociotechnical systems? I will use a personal narrative to show how I came to know the ed-tech network via three different sociomaterial manifestations: the Ed-tech Neotown website, the Ed-tech Neotown meetup site, and the face-to-face Ed-tech Neotown events that were held mostly at the TechAssembly startup incubator and co-working space in downtown Neotown. In recounting my own history, my goal is to externalize how I thought and felt as I experienced the multimodal narrative of the Ed-tech Network, and to highlight how the social and material aspects of the network interacted with and influenced my values, interests, subjective identity and participation.

Ed-techNeotown.com

I moved to Neotown in 2014 from New Orleans to begin a PhD program in technology and learning with an interest in pursuing *global social change*. Prior to moving, I had worked for over a decade in international development and health sciences education

at a university in New Orleans. I called myself an action researcher and was very interested in how new forms of learning communities were emerging from conditions of global connectedness. I wanted to study participatory learning communities and, specifically, learning via connected modes of citizen science. Having had a previous PhD effort disrupted in part due to Hurricane Katrina, I had carved out a staff-level niche in the university that allowed me to participate in international capacity building and community health projects. However, after nearly eight years of frequent travel and sometimes precarious grant-funding, I became a father. I sought the status, agency and relative stability that many of my university-based collaborators enjoyed as tenured faculty. I sought a more secure and agentic *institutional* identity.

Arriving in Neotown, the first person to tell me about the city's ed-tech scene was my fellow doctoral student, Jerry. He plugged it as a good place to get connected and meet people, and also told me about how he had won a recent ed-tech "hackathon" organized by Ed-tech Neotown. A hackathon is typically a multiple day event that brings designers, entrepreneurs, programmers and others together to identify problems, build teams on the fly and quickly design and prototype solutions. I was impressed. Now defunct, the Ed-tech Neotown website is still cached on the Internet Archive (https://archive.org). Figure 4 is a modified still extracted from the video-based homepage. It represents the internet-based manifestation of the network as I first encountered it in 2014.

Figure 4: Ed-tech Neotown website splash page.

A trendy video-based splash page features a black and white video of a busy bridge over Neotown Lake, a large river reservoir that is simultaneously a site and symbol of idyllic urban recreation as well as a notorious logistical and cultural divide between north and south Neotown. The video is hectic, a stylized, sparsely framed gif presenting a jittery sped-up vision of urban activity. It shows cars, cyclists, handholding couples and single joggers flitting frenetically back and forth over the river, a mashup of purposeful commuting and concerted recreation. The shot appears to be taken from midway across the bridge, angled up from a grassroots perspective at the tall downtown buildings of Neotown. Except there is no grass; we are positioned on the concrete sidewalk. The steel guardrail of the bridge draws the eye into the heart of the cityscape, across which a message is emblazoned:

<div align="center">

WE ARE
ED-TECH NEOTOWN
CONNECT. COLLABORATE. INNOVATE.

</div>

On the internet, Ed-tech Neotown presented itself to me first as a collective "We" with a simple, directly stated mission situated in the midst of a frenetic and shifting urban environment. It was a way into the city, a bridge across a barrier, and simultaneously a link to professional destinations as well as a destination in itself for personal and recreational pursuits. Ed-tech Neotown's splash page presented a street level view and pathway to the horizon, slicing directly into and through the downtown landscape. As a recent transplant and someone seeking a place in a shifting urban cultural context, the website appealed to my *mobile* identity.

A "team" of four people were listed on the front page. Digging deeper into the content assembled by the producers of the Ed-tech Neotown website, I uncovered a "Meetup" page that described the network as "the hub" for inspiring discussions, "member spotlights," hands-on workshops and amazing keynotes, as well as an "Incubator" page that affiliated the network with TechAssembly. The incubator page described a suite of services developed to cultivate ed-tech startups and link them with educational markets. There were also pages for volunteer opportunities and jobs in ed-tech, and a blog. The blog posts, all written by one team member named Peter (pseudonym), started out monthly and document five months of network activity, announcing early meetups, conference presentations, greenroom parties at events in the city, support from big education companies and collaborations with schools. After five months and six entries, however, blogging ceased. A repeat visitor to the site over the next several years would have encountered the same frozen snapshot of a dynamic network. Peter would later tell me that

most ed-techers used social media to connect and communicate, and so he tended to neglect the network's site on the internet.

However, if we keep reading, extending the chronotope of this ed-tech story on the web, another narrative of goals, value and impact emerges, and another way of understanding the network is revealed. Skipping ahead through the internet archive, we find the domain name up for sale for $499 in May of 2018. Then by November, the domain directs browsers to a Japanese blog by a man named Eddie who writes about what it takes to get married in one's 40s. While Eddie may indeed be a real person with authentic romantic aspirations, it is more likely that he and his blog have been invented or co-opted for the purpose of "squatting" on a domain of perceived market value. Indeed, by February of 2019, we are "Forbidden" to see Ed-techNeotown.com altogether (Figure 5), and according to the ICANN registry the domain is currently registered to a Japanese "internet company" with a subsidiary that sells domain names.

Forbidden

You don't have permission to access / on this server.

Additionally, a 403 Forbidden error was encountered while trying to use an ErrorDocument to handle the request.
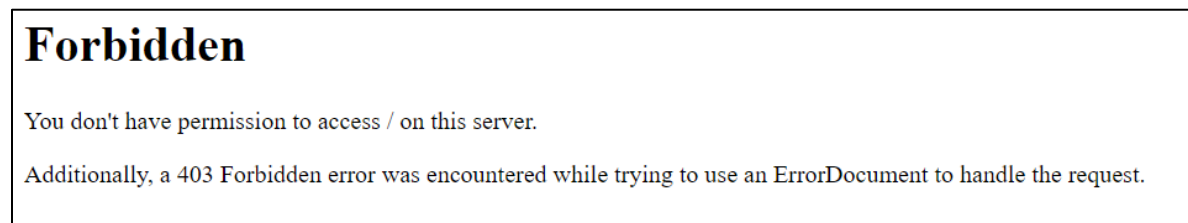
Figure 5: Screenshot of the re-purposed network domain, February 2019.

Perhaps someone has paid the Eddie a premium for the domain, speculating on its future value. Perhaps some Eddie is just cooking up something new. In any case, the extended story of Ed-techNeotown.com reveals how the ed-tech network that initially

attracted my attention and the attention of many ed-techers can be converted to market value, traded on the internet and transferred as a property in service of someone else's goals, whatever they may be.

Interpretive Synthesis

By pursuing the longer story of this digital domain, we see how the network is valued simultaneously as a goal-oriented, connected, human "We" in a shifting, busy world, as well as a nodal aggregation and *brand* on the internet. The collectively understood use-value of this network can easily be recapitulated in terms of the market-value of the brand on the internet, and both values are a function of the human attention the network is perceived to command. Attention, won in my case by appealing to my *mobile* and *connected* identity and my interest in *global social change*, can be purchased and sold as a brand by "Eddie" for ambiguous or radically new purposes. In this way, the ed-tech website on the internet is a "spectacle" (Debord, 1995) that can be commodified, purchased for $499 and co-opted for private endeavor. "In societies where modern conditions of production prevail, life is presented as an immense accumulation of spectacles…The spectacle appears simultaneously as society itself, as a part of society, and as a means of unification" (Debord, 1995). And, in a contemporary consumer society of the spectacle in which social interactions and attention are mediated and directed by digital representations on the internet, a perceived or potential aggregation of attention—like the Ed-techNetwork.com domain—can be bought, accumulated and sold for profit.

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While open networks like the ed-tech network (and the internet itself) may cultivate and leverage an ethos of access and equitable participation, in a neoliberal context where individuals are normed "at a distance" per a ubiquitous market logic (McNay, 2009), open networks will by default reflect the status quo. The runaway object of ed-tech around which I and other ed-techers swarmed on the internet—the object to which we tethered our attention in passionate pursuit of social and educational transformation—was purchased and co-opted as spectacle for $499. Contemporary entrepreneurs of the self—innovators, changemakers, transformational teachers and educational entrepreneurs alike—must develop critical habits and literacies about how interests and identities are supported, co-opted, bought and sold as spectacle in the biopolitical mesh.

I will now leave the internet and pick up the multimodal spectacle of the ed-tech network via its primary social media platform: Meetup.com.
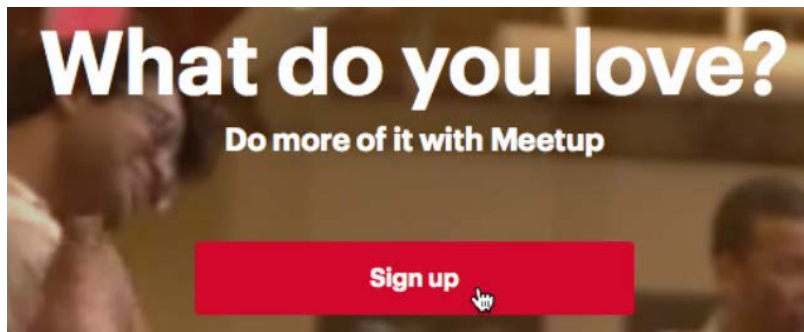
Meetup.com

Figure 6: Current sign-up page on Meetup.com.

Meetup.com is a social networking site that helps people connect around interests and facilitates the organization of face-to-face meetings. I knew about the meetup site

before moving to Neotown, and as a transplant it presented me with a wide array of possible communities, things to "love," to be passionate about and to "do more of" (Figure 6). I was *mobile*, in a state of personal and professional transition. I was worried that I had uprooted my family, and that we would have trouble taking new root. I wanted to engage in Neotown's social scene and make my world and the worlds of my wife and five-year-old daughter larger than the three of us. Meetup.com provided me with a way to at least *imagine* the prospective identities I might pursue in my effort to re-invent myself in a new city.

Arriving from the dense urban swamp of New Orleans, the healthy, outward-bound spirit of the Sierra Club Meetup appealed to me. I clicked the Join button with ambitions of hiking, making friends and getting fit outdoors in a world with fresher air and clearer water. Having come to Neotown with ambitions of studying how participatory media enables interest-driven technoscientific learning communities, of course I could not resist clicking the Join button for the Aquaoponics Meetup too. The members of this meetup called themselves "Aquaponeers!"

I received periodic emails about face-to-face gatherings for these meetups, but I never attended. While Meetup.com provided a simple, thrilling act of speculative identification, I was pretty busy with work, school and parenting, and I didn't know my way around very well. I was also fundamentally intimidated by the prospect of introducing myself to strangers in a new community. While I didn't put it together at the time, I would today make the point that *joining* what you love is not the same as *doing* what you love, let alone *more of it*.

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It was not until January 2015, about five months after moving to Neotown, that I joined the Ed-tech Neotown meetup. I did it because the instructor in my introductory course on educational technology recommended that the whole class try attending a meetup together. He forwarded an alert he had received via the Meetup.com platform conveying the message that the meetup would feature 15 local ed-tech companies, and that it would be an opportunity for participants to both learn by asking questions as well as influence and advise the companies by sharing ideas. There would be "delicious food and drinks" courtesy of the coding education startup acting as the meetup "sponsor" (text from meetup message).

While deeply suspicious of *commercial* educational technology interests, I reasoned that as an aspiring *expert* in educational technology with an academic *institutional identity*, I should seek to understand the ed-tech meetup as it related to my academic field. So, partly out of curiosity and partly out of duty to my disciplinary community, I joined the meetup that same day, writing myself into the ed-tech network narrative as best I could, despite not knowing a great deal about what it was or how I was going to relate to it. I presented myself, like so many precarious graduate students do, using jargon, explicit references to academic credentials and by affiliating with not one, but *two* different universities:

> ***Tell us about yourself.*** *I am a doctoral student at UT in the Learning Technologies program. I also work at Tulane University to design and implement international educational development programs—mostly in the health sciences and disaster resilience domains.*
> ***Why are you interested in education technology?*** *I am interested in participatory innovation processes and figuring out better ways to understand and design with*

respect to the "social envelope" in which education technologies are implemented. (slightly modified from my profile)
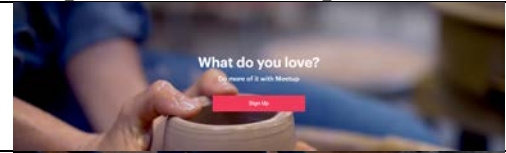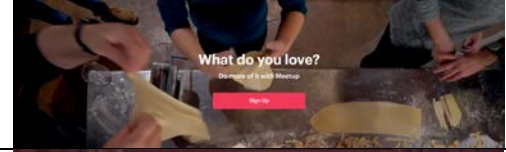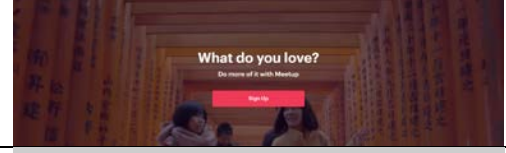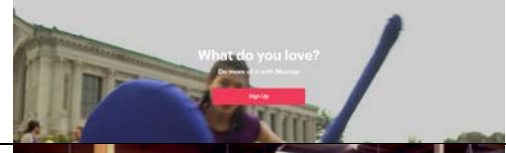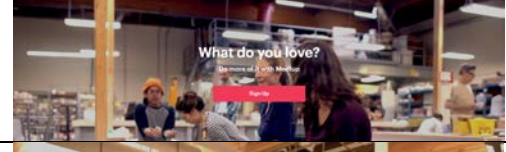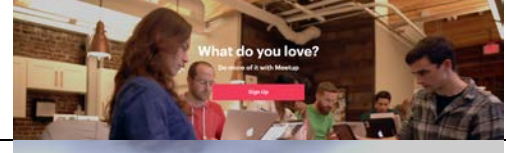
This fairly stodgy, opaque representation of my *institutional identity* and *global and social change* interests was, in retrospect, probably not the most engaging network profile. Luckily, relationships and affiliations on the Meetup.com platform are simple, efficient, low-stakes and low-barrier affairs, and *love* and *the doing of things* amounts to a mere button click. Minutes after becoming an "ed-techer," I received "a warm welcome" in my email inbox from an "organizer" named "EdWave" who—like Peter—signed emails on behalf of The Ed-tech Neotown Meetup Team. The next day, I got on my bike, rode past campus and into downtown to do, for the first time, the actual face-to-face work of "meeting up."

Interpretive Synthesis

The ed-tech network assembles not just around ed-techers and their goals, but also around, within, and through social media, that is, a technology that brings certain efficiencies to the connected work of crafting and recrafting identities. As an entrepreneur of myself, my constant industry is the reconfiguration of my subjective identity within the biopolitical "mesh" of my day-to-day life on the internet and social media (McNay, 2009). As a social technology, Meetup.com *problematizes* the complex work of social integration and *renders it technical* (Sims, 2017) as an issue of searchability, findability, clickability and joinability. Meetup.com, for me, was initially a technology for social speculation, a simplified technical overlay on the world that provided a synoptic perspective on a

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multitude of extant communities and possible future identities, while at the same time obscuring the uncomfortable, emotional, logistical work of social integration, interaction and becoming. As a service in a fluid, digital knowledge work ecosystem, it black-boxes a set of mechanisms for linking my current narrative of self to a wide variety of compelling *prospective narratives* of my future self (Table 2), bringing efficiency to my ongoing work of self-reconfiguration. I encountered Meetup.com as a variety of searchable, sortable spectacles, each made conveniently available to me for the emotional work of *speculative identification*. The value proposition of Meetup.com is this: in exchange for my membership and attention, with the click of a button, I get instant, visible affiliation with something I "love" and the opportunity to re-invent, brand and tether myself among others who also love some version of that thing. Meetup.com offered an easy way for me and other prospective ed-techers to write ourselves into stories about the compelling runaway objects of ed-tech.

Table 13: Speculative identification on Meetup.com

Snapshots from Meetup.com video	How this speaks to me (now)
	Adam! You might love making pottery! Wouldn't that kind of tactile, material synthesis be a great break in the day-to-day digital miasma? You could be known by things people eat and drink out of every day. Remember how George Ohr, "Mad Potter of Biloxi," signed that little pot: "I am the potter who was." Don't you want to be a potter who was?
	Oh, Adam! You should consider cooking lessons, and learning more about making pasta, for example. Jackson would probably love this—like a date night that is a lot more fun than just eating pasta. These people probably drink good Italian wine too. Remember Bolsena after Katrina, and the Calamari Lounge?
	Adam, you could learn more about cultures and languages you don't know very much about. This, for example, is something about Japan… Whatever, you really need to learn better Spanish. Shame on you for your bad Spanish.
	Adam! You know your daughter would enjoy recreational combat. New father-daughter thing? Plus, it's good for girls to practice smacking dudes. She's going to have some pretty serious fighting to do.
	You do love workshops! You grew up working in Dad's upholstery shop. You are of *workshop folk* and have *workshop needs*! Remember making helicopters with your daughter? Remember the industrious, inebriate buzz of the Krewe du Vieux den leading up to Mardi Gras? Man, all you do is make stuff alone on your computer these days.
	Adam, look, these people are doing things on their computers *next to each other*. Anything could be happening here, really. This sort of meetup might allow you to do the things you love to do on your computer, alone, but in the company of other alone people.
	Well, at least you could play some volleyball! That's basically a fun thing that you never do, right? Your daughter needs a team sport. You're raising a liberal individualist with no appreciation for collective endeavor.

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As it turned out, the work of meeting up and social integration was not—for me—as easy as it sounds. I will now make one more modal transition, moving from digital narrative space to pick up the story the next day at the geographic site of the meetup: TechAssembly in downtown Neotown.

TechAssembly

There are many bike racks around TechAssembly, cycling being an efficient and popular mode of green transport within the downtown sector of the city. Driving cars to the meetup, on the other hand, is difficult, and parking near TechAssembly is an expensive, unpleasant challenge. As a resident of central Neotown and a cyclist, I found my way to the meetup quickly and efficiently. I locked up my bike and scaled the twenty or so broad steps at the main entrance to the building.

TechAssembly is a co-working space, an entrepreneurial mentorship network, and a startup accelerator seated in a large, shiny building in downtown Neotown. It is a block from one of the city's most well-known centers for nightlife, within walking distance of hundreds of bars and restaurants, and a few blocks away from a convention center that hosts a number of large global conferences and media events. Entering the building, one finds oneself in a large, glass atrium comprising nearly two whole sides of the building and extending to its top. The atrium has an open, outdoor feeling, and the action on the city streets is visible even while inside. There is a bar in the middle of the atrium, a lounge area with comfortable furniture near the front desk of the hotel that shares the building, several classrooms and meetup spaces distributed around the periphery and a bay of elevators in

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the center to one side. Looking up, one can see layer upon layer of office space, with glass elevators pinned to the side of the vertical expanse, shuttling people up and down. Standing on the floor of the atrium, one has the distinct sense of being in a staging area at the bottom and outside of a busy thing.

Figure 7. TechAssembly's robot mascot.

For this first meetup and many later meetups, I checked the location on my mobile app, jumped in an elevator and shot up to the 18th floor. The design of this floor would be familiar to anyone acquainted with the tropes of Silicon Valley open office architecture or startup chic. There are glass-walled flex spaces with large digital displays on the walls and movable tables and chairs. Rooms tend not to be square or fully closed; they are often partially subdivided in surprising or architecturally opportunistic ways. Much of the 18th floor is open, with clusters of desks, tables, cubicles and workstations distributed in such a way as to afford nearly all co-workers a sublime view of the Neotown cityscape. Co-workers who pay more get a door that closes.

The 18th floor has an eclectic, industrial, finished-unfinished aesthetic, with designerly lighting suspended from bare concrete ceilings, exposed silver ventilation tubes and brightly dyed and polished concrete floors. The projects and plans of co-workers are inscribed everywhere on glass tables and washable white walls. A bulbous red beanbag chair that resembles an enormous synapse lounges by the elevator, and a keg is nestled between the indoor bike rack and community kitchen space. The decor features graphics of industrial gears, and a cartoonish robot mascot pops up in various places, printed on walls and sometimes in three dimensions. The robot is a vintage model, humanoid, and to me, always seemed distinctly anxious (Figure 7). On the whole, TechAssembly presents itself to me as expensive, accessible, reconfigurable, hackable, familiar, open, nostalgically industrial and boyish, with its cartoon robot motif and keg. While invoking the symbolic stylings of a factory, it is clean, carefully designed, and filled with expensive technological flourishes and idiosyncratic art.

A young member of the staff collected my name and email address on their iPad and helped me find my way to my meetup. I used my university email address, again assuming an *institutional* identity affiliation that I felt would be understood and carry the most weight in this community. I wrote only my first name on my nametag because that is what the person in front of me did, and I walked into the crowded room where the meetup was being held.

Interpretive Synthesis

The TechAssembly building, with its central urban location, its airy atrium, bar, and flexible meeting spaces, is styled as a place of mixing and openness. And yet, situated in a downtown environment, some ed-techers are better able to access the location due to proximity, special transportation, flexible time or the ability pay for expensive parking. It is not an easy trip to the meetup from the south side of town, let alone the suburbs where, for instance, many teachers live and teach. Like the internet itself, the meticulously designed openness of the building is patterned per a neoliberal market form: fluid, open office space is partitioned and sold, with the most private and closed off areas fetching the highest prices. TechAssembly's business model is based on *rent* and *equity in startups*.

The Ed-tech Meetup

This meetup, like all subsequent meetups I would attend, played out via a rough script. Participants assemble in the atrium, shoot up the elevator in small groups and pairs, exit into a small lobby, pass the beanbag synapse, deposit their name and email address in the iPad, grab a "local craft beer" or soft drink from an large ice-filled chest, and find something to eat—usually sandwiches from a chain I used to eat at in high school, but sometimes Korean-Mexican fusion from a popular local restaurant. This is called "open networking" time, and for me at my first meetup, it was a time of awkward shuffling about and stilted chit-chat. I am not confident in my chit-chat game, and I hated open networking.

Approximately 30 minutes after the scheduled start of any meetup, the organizer— almost always Peter—stands at the front of the room and delivers a welcome. In a relaxed

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and reliably witty fashion, Peter thanks everyone for coming, thanks TechAssembly for hosting, and thanks the sponsors for the beer and Korean fusion. He then delivers what I have come to think of as the "vital stats" of the ed-tech meetup: (1) the size of Ed-tech Neotown as measured by the total membership on the Meetup.com platform, (2) the total number of face-to-face meetups convened to date, and (3) a tongue-in-cheek estimate of the total number of cans of "local craft beer" consumed to date by meetup attendees. While the beer count tends to be met with laughter, after hearing it reliably reported month after month, I find that it takes on a substantial degree of ecological validity as a material measure of network activity. In any case, the ritual delivery of the vital stats makes the reflexive case that the ed-tech meetup is growing because it is fun, relaxed and, well, growing. The meetup is becoming, in TechAssembly's own marketing language, a "center of gravity." In an economy that trades on our networked attention and a society that is organized around accumulation of and identification with commodified experiences, the meetup is becoming, in Debord's (1995) language, a valuable *spectacle*, an event that attracts attention and creates opportunities for individual and corporate branding, communication, promotion and, potentially, creativity, collaboration and transformation (Boje, 2001a).

Peter then moves on to present a list of upcoming events, activities, and opportunities related to education and technology, and he closes his introduction with an overview of the evening schedule. The schedule varies depending on the format; in the case of my first meetup, it was a "spotlight" on the 15 local ed-tech startups. Abandoning

my open networking game for my even more awkward expo table game, I started making my way through the event. I chatted with a young entrepreneur who was developing a platform for elementary school kids to make and share video book reports. It seemed engaging, the kids' reports were smart and passionate, and I got the sense that the whole project was on a collision course with student privacy regulations. I saw a demo of a Facebook-like social networking app for schools and I tried hard to talk about it without mentioning Facebook. I overheard someone say that the guy near the entrance who was enthusiastically demonstrating an educational board game with 3D printed pieces was actually a brilliant entrepreneur who had already had a "successful exit," that is, he made a lot of money selling a prior startup. His new ed-tech startup was just a "fun side project." I eventually ran into my classmates from the university and we got to know one another better, enjoying the food, drinks and the change of environment. We talked about what we were studying, what brought us to Neotown, and how everyone in the room seemed to be from somewhere else.

I was about to leave when Peter got on the mic one more time. Signaling the close of official programming, Peter announced the "Lightning Round," opening the mic to anyone in the room for a one-minute "pitch." A parade of ed-techers then assembled from the crowd and lined up for a 60 second turn at the mic. I don't recall exactly who presented that night, but based on the many lightning rounds I've since seen, it could have been a young coder with a new app, an engineer with a problem and solution, a non-profit representative plugging a new program, a charity coordinator in need of volunteers, a

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former math teacher with new curriculum, an ed-tech company with a job opening, a startup founder enrolling beta testers or, as I would one day be, a researcher recruiting for a study. One by one they delivered their pitch, announcement, idea, call for help, or plan. The meetup spotlight that had initially been trained on the headlining acts—the 15 star startups—had shifted to feature whatever idiosyncratic voices decided to emerge that night from the crowd of participant-spectators.

Formal programming for a meetup always ends with the Lightning Round. When the parade of pitches has passed, Peter typically thanks everyone for coming, notes how much local craft beer there is left to drink, and the meetup transitions back to "open networking" (which I have learned to hate less). Sitting people stand, form small conversation circles, leave in groups and pairs, and the last remaining ed-techers usually help Peter clean up and tote the beer to his car in the parking garage below TechAssembly. Meetups end around 9 or 9:30pm. I got home from my first meetup shortly after my daughter fell asleep, so I didn't see her that day, which bothered me as a busy father and caused me to reflect critically upon the value of the experience. I didn't go to the ed-tech meetup again until about six months later when I started doing some early research on entrepreneurial educational change, and I wanted to recruit ed-techers as participants.

And what if we extend the chronotope, stick around after Peter has departed with the last of the beer, and keep reading beyond the end of the official narrative of the evening at TechAssembly? Based on what I have seen as a participant observer at TechAssembly meetups, the room will likely be filled the next evening with more local craft beer and a

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new tech-focused event, for instance about mobile or AI. And the next evening, another meetup about startup financing might reconfigure the same tables, move the same chairs, and follow roughly the same script. Then the next evening, it might be the meetup hosted by the security innovation vertical, and a table at the expo will feature bullet-stopping police drones. And the next evening the educational games entrepreneur might be plugging his other fun side project focused on sensor technology for self-driving cars. It's a different spectacle every night, but the stage and form of the story is similar. For TechAssembly, these spectacles attract people and startups who *rent* urban space.

Interpretive Synthesis

Looking across these multimodal manifestations of the ed-tech network—on the internet, on Meetup.com and in TechAssembly—my narrative of network entanglement reveals how ed-techers and entrepreneurs of the self like me use the designed openness and connective efficiencies of both digital and physical network infrastructure to identify and affiliate with ed-tech as a series of spectacles. My own process of speculative identification on Meetup.com involved a series of subjective, emotional interactions with *images* of possible futures and communities for me, such as those I imagine in Table 13. These images, playing in part on my own *mobile* identity and state of *precarity*, spoke to my retrospective and prospective narratives of self.

The typical form and accessible "vernacular" (Bakhtin, 2004) of a face-to-face meetup event at TechAssembly is designed to engage, mix and *entangle* ed-techers with different identities and interests around a common spectacle. Peter is an ed-tech

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impresario, curating a monthly showcase of exotic, novel and potentially very useful visions of technologically mediated schooling, learning and creation. The meetup is also a *commodified spectacle* of technology (Debord, 1995) that is useful in forging educational technologies and companies, featuring marketable ed-techer identities and renting urban space. Despite the designed openness of the meetup, in a neoliberal context the spectacle is permeated by an enterprise logic: ed-techers are entrepreneurs of both themselves and their technological solutions in a marketized educational change ecosystem.

I also want to highlight in this narrative how meetups regularly—and *by intentional design*—become *carnivalesque* in form: spectators emerge from the crowd to become the spectacle (Bakhtin, 2004), featuring themselves and their own apps, visions, ideas and projects in the "Lightning Round" at the end of the meetup. Everyday folk of industry and education who do manage to drive, park and find their way to the 18th floor at TechAssembly can assume *expert* and *entrepreneurial* identities, presenting their subjective visions of *school support* or *global social change*. They can assume a technologically sophisticated ed-techer brand and identity, and mingle alongside the startup stars, genius creatives and *moral entrepreneurs* (Becker, 1963; Sims, 2017).

In the next part of this chapter, which examines narratives of network enactment in different *scenes*, I will argue that these carnivalesque moments have the potential to transcend mere "corporate spectacle" (Boje, 2001a; Boje et al., 2004), and that they reflect a critical capacity of the *designed openness* of the ed-tech network. The idiosyncratic,

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bottom-up, "retail" level activity of innovation is fundamental to the network's potential for substantive social transformation.

PART 3: SCENES OF NETWORK ENACTMENT

In the first part of this chapter, I generated a high-level picture of the identity and interest discourses that orient network enactment, and in the second, I presented a personal narrative to show how the network functions as a social technology, entangling ed-techer interests and identities around spectacular runaway objects. In this third part of the chapter, I will look at how individual actors work and learn in relation to one another in pursuit of the transformation of these objects.

Visualizing the Storytelling Network

Figure 8 is a structural representation of people on the network who are "important" to the work carried out by the 17 network actors I interviewed (Appendix A). Links between actors represent relationships that were either specifically reported as important by each ego via the name generator instrument or imputed to be important in a *post hoc* fashion based on their narrative account of their work.
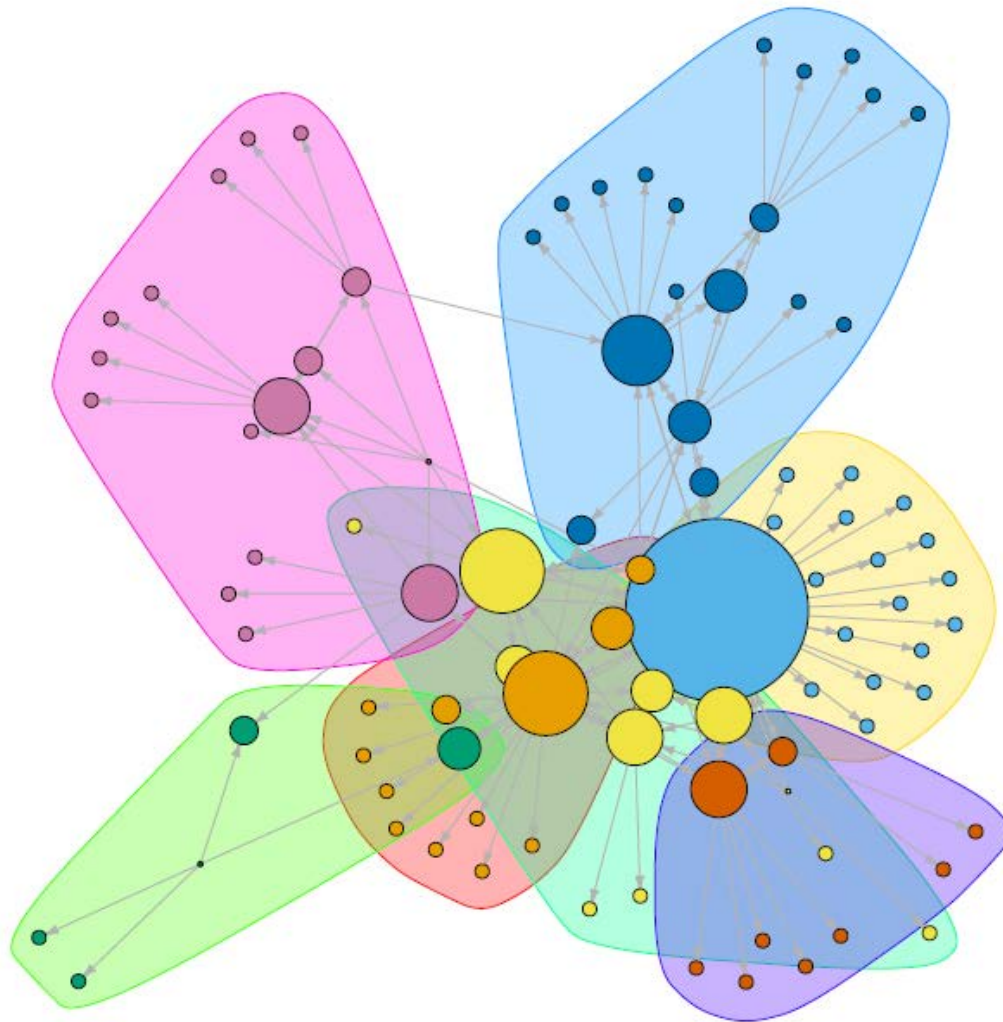
Figure 8: A structural representation of the ed-tech network.

In the network map, actor relationships are rendered in two-dimensions per the Fruchterman-Reingold algorithm in igraph, which uses a "physical force" analogy to link and arrange actors across space. From a narrative perspective, Figure 8 is an assemblage of actors that feature in "important" ways in stories of network activity. Linked clusters of

actors feature as important characters in each other's stories of enactment. Assuming that the stories collected via actor *interviews* reflect and pattern to some degree network storytelling and enactment in *practice*, Figure 8 can be considered a representation of a *storytelling network* (Boje, 2011; Lejano et al., 2013). Relationships on the network are directed: arrows from each interviewed ego point to the alters they identified as important. Using the standard multilevel community (MLC) detection algorithm in igraph (Csardi & Nepusz, 2006), I grouped actors based on these storytelling relationships. The colored zones in Figure 8 circumscribe groups of actors who tend to figure into each other's stories of network enactment. Node color indicates membership in the same group. Important to note is that MLC assigns each actor to only a single group. However, storytelling groups clearly overlap, and actors often feature as characters in multiple storytelling groups at once, as indicated by their connections.

Using another standard network measure, *degree*, or the number of connections an actor has to other actors, I am able to quantitatively represent and compare the narrative roles played by individual actors on the storytelling network. The relative importance of individual characters in overall network narration is indicated by adjusting the size of each actor to reflect their *in-degree*, that is, the frequency with which they figure into the stories of others (Figure 8). The *overall* degree of a given ego on this network is a combination of its *in-degree* and *out-degree* measures. On the narrative network, in-degree is the number of times an actor is identified as an important character in the stories of others, while out-degree is the number of actors a particular ego identifies as important in their

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own story. Out-degree cannot be calculated for the majority of actors in the ed-tech network, as they were not included in the sample of 17 interviewees, so I use in-degree as the quantitative measure of centrality (and determinant of node size).

For web-based networks, in-degree is often equated with "authority," while out-degree indicates "hub" status (Kleinberg, 1999). An *authority* on the internet is a node or website to which many other nodes/sites link; they are commonly interpreted as being *influential*. On our storytelling ed-tech network, however, in-degree (and centrality more generally) may not *necessarily* equate with community authority, competence in a common practice, canonical expertise or knowledge accumulation. Rather, high in-degree actors are better understood as actors who feature frequently as important in the stories that others tell about the work that they do. That is, in-degree on this ed-tech network is an indication of *character importance* or *narrative utility*. Regardless of whether any of the work narrated by participants actually happened or had any sort of substantive outcome, these central, high in-degree figures on the network are useful in the way actors historicize and make sense of networked productivity and learning. To *entrepreneurs of the self* in a society of commodified spectacle, high in-degree actors might also be thought of as having a useful or valuable *brand*; high in-degree actors on a storytelling network are actors with whom other actors *want* to affiliate.
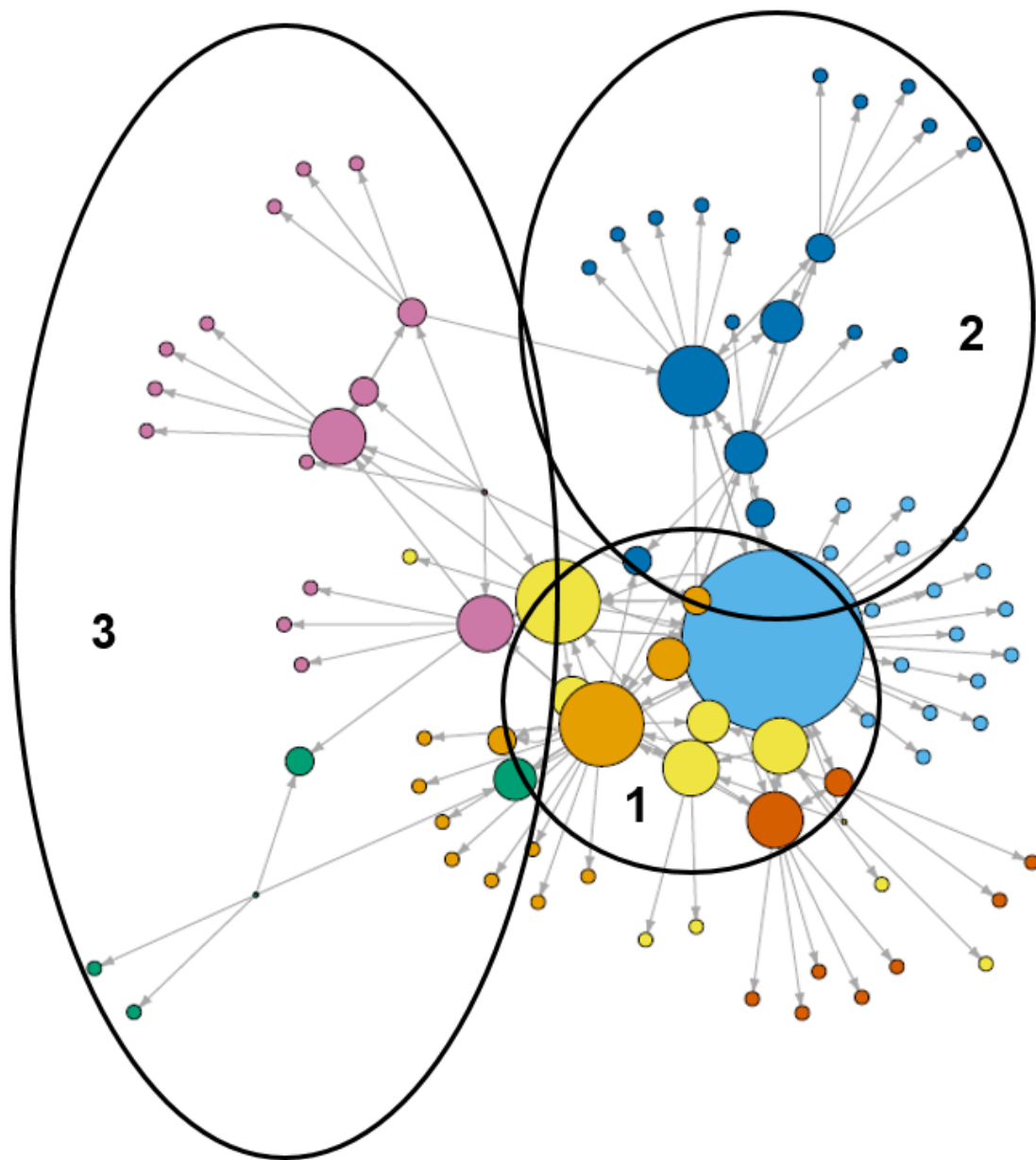
Figure 9: Three scenes of network enactment.

By examining actor clustering, in-degree centrality and these algorithmically formed storytelling groups, different types of actors and different parts of the network can be distinguished. Adopting the vernacular of urban ed-techers, I'll refer to distinctive aggregations of actors on the storytelling network as *scenes*. Figure 9 shows three such scenes, or *linked characters and plots on the storytelling network.* For the sake of clarity, the colored group zones based on MLC have been removed in Figure 9 (and subsequent network visualizations), and MLC group status is indicated by node color alone. Scene 1 is the core Ed-tech Neotown community, Scene 2 is assembled around computer science (CS) education, and Scene 3 is comprised of people who engage discourses about entrepreneurship. I will now explore network enactment within these scenes, starting in the densely linked center.

Scene 1: The Ed-tech Neotown Scene

The most densely linked and overlapping part of the ed-tech network is centered around two figures of particularly high narrative utility in terms of in-degree: Peter and Silas (Figure 10). I will examine their stories first, and then look at the community of practice that has assembled around them.
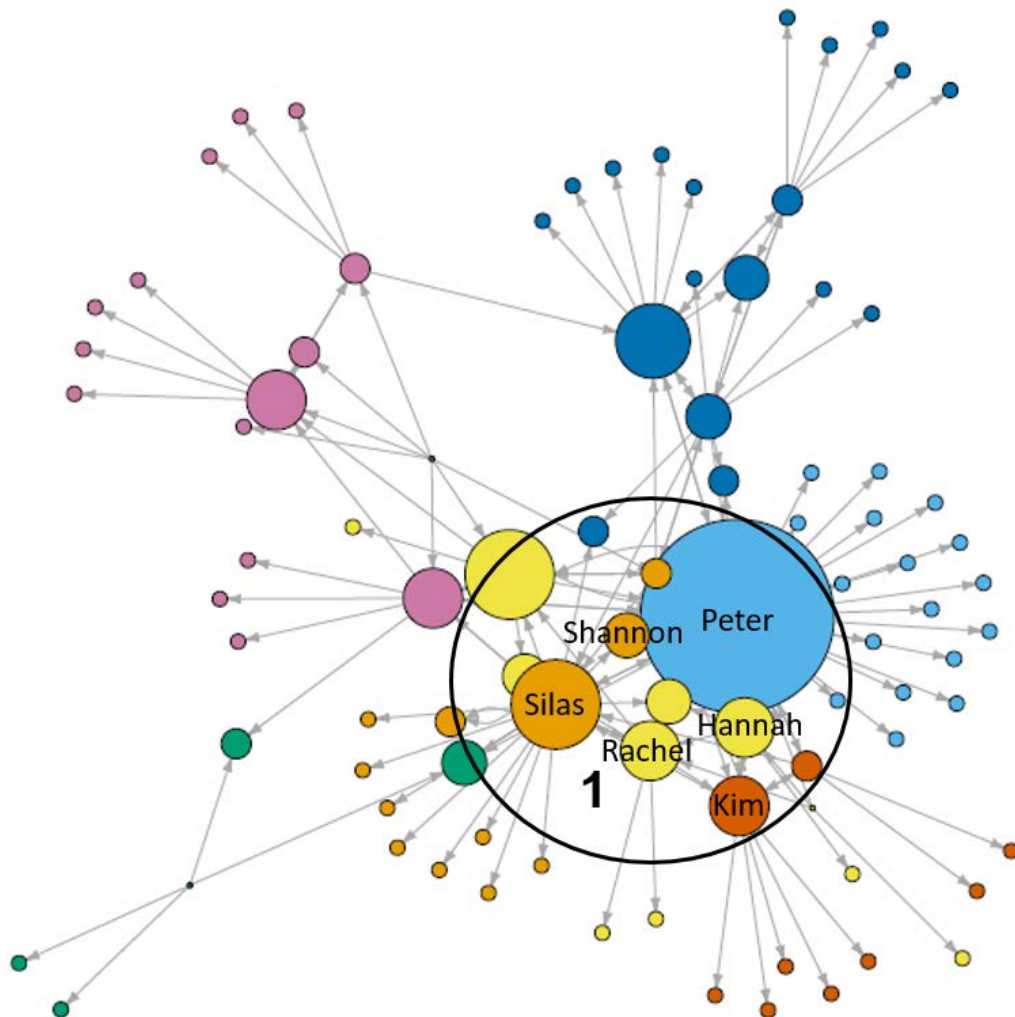
Figure 10: Actors in the Ed-tech Neotown scene

Peter

Peter is identified by interviewees with knowledge of the history of the network to be the founder of the meetup. He started his career as a teacher in Midwesterntown at a large urban school district, entering the profession in part because his father was a teacher.

Peter felt he was good at teaching and he worked very hard to help his kids learn, but committed as he was, he was frustrated that he was not treated as a "professional" in schools (interview transcript), that is, as someone who knew things about teaching and was serious about getting better. Peter was introduced to ed-tech meetups by an assistant teacher in his classroom who also happened to work for an education company. She urged him to come to a meetup, initially against his will, but when he finally did attend, he was enthralled by the experience. "I got to go leave my job at the school, and go eat, like chips and guac, and you know, drink a good beer [and] be geeky about education" (interview transcript). Back at school, he found himself wondering why he was sitting in professional development activities where he wasn't learning and where he was always positioned as someone who didn't care about education. When he saw the main organizer of the Midwesterntown meetup hired by a major education technology company, he realized the meetup was not only enjoyable, interesting and informative for his teaching practice, but that it could be used effectively for professional positioning.

Before moving to Neotown and taking a job as an English teacher, Peter scouted the city to see if there was a local ed-tech meetup. He was surprised that there was not, so he started the Neotown Ed-tech Meetup, patterning it after the Midwesterntown meetup he already knew. He wanted to create a community where people could get together in a cool environment, eat chips and guacamole, drink local craft beer, and "be geeky" about education. He was impressed by how the meetup platform could be used to network people around "anything under the sun, really," and he set a "benchmark" for himself: he would

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consider himself successful if he could grow the Ed-tech Network larger than the impressively healthy local meetup for "tea-drinkers!" Initially holding small gatherings (~30 people) in local coffee shops and co-working spaces like TechAssembly, the meetups grew much larger and the number of ed-techers would indeed eventually exceed that of the tea-drinkers. Within 5 years, The Ed-tech Neotown Meetup would become the largest ed-tech meetup on the Meetup.com platform, with an official membership of over 2,000 ed-techers.

As a *teacher* with *teaching and learning* interests, Peter found the most personal value in small, interactive meetup formats and group discussions that got into the details of classroom technology practice. In the early meetups especially, he worked very hard on "content," making meetups hands-on in ways that catered to the needs and concerns of classroom practitioners (interview transcript). However, he learned by studying large meetups in other cities that panel formats were the trick to meetup expansion. By featuring a panel of people who are well-known and who can splice their own large networks into the meetup, the face-to-face events become larger and Meetup.com membership grows. For Peter, large meetups were not only an indication of his success as a meetup organizer, but on a practical level, they made things easier. TechAssembly preferred to host meetups that drew large crowds, and a large member base made it easier to find sponsors. Food and drinks for a typical meetup cost $350, which companies were more than willing to pay to be co-branded with a *large* and *growing* ed-tech spectacle, that is, to be featured as an event

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sponsor and have their brand make its way into the email inboxes and social media feeds of thousands of ed-techers.

Peter's initial inclination was to recruit provocative outsiders and edgy thinkers in education to present their perspectives on technology in education: "I wanted it to be edgy and really push people outside of their comfort zones" (interview transcript). However, he ran into problems right away with his first speaker:

> I kind of pushed, I think, a little bit too far. We had this guy who, you know, seemed really nice. He emailed me a couple of times. We talked over the phone. And he spoke about how education and especially education technology had…it was devoid of any educational substance, was what his claim was. It was all fluff, and like smoke and mirrors. And so he got up there [at the meetup] and said that it was akin to 'pornography' because it was, you know, this stuff that we were putting out there and using technology tools for...it didn't actually prepare students for the real world in the same way that pornography doesn't prepare people for their, you know, sexual relationships later in life. It was kind of a weird comparison, and everyone in the room is just kind of uncomfortable. Like, what are we talking about? You know? And so it was cool...in a sense. But then from that point on I really vetted the conversations and made sure that the speakers were more aligned with using, you know, data, and using experiential lessons from the classroom about how to do things differently. And so we kind of got more on the straight and narrow, but still being very 'in your face' opinioned about what's happening, and what changes they were seeing. (Peter, interview transcript)

Peter learned that if his speakers were too critical of ed-tech, and more specifically, if the meetup message did not connect with a tech-invested audience, his meetup numbers might dwindle, and small numbers made it more difficult to find space and a sponsor to pitch in for beer and chips. So, Peter began to seek out "in your face" speakers who were still "aligned" with the "straight and narrow" interests of the tech-invested crowd attending the meetups and the companies and startups sponsoring them (interview transcript).

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Peter's work as an ed-tech founder and impresario ultimately helped him transform himself: he now works at TechAssembly.

> So I kind of found myself at the center of a community that I've sort of more or less created, and that was really...for me it was the long term goal of creating [Ed-tech Neotown]. Outside of helping people connect collaborate and innovate, for me it was a way to forge a path for my own career and find opportunities to work in the [ed-tech] world that I fell in love with in Midwesterntown. (interview transcript)

Peter's current day job is not focused specifically on education or ed-tech. He feels "guilty" about leaving the "sweet kids" in the classroom, but generally feels that his volunteer work as an Ed-tech Neotown founder and continued (if distracted) co-organizer and participant has allowed him to have a bigger reach and "impact" at scale than he would have as a classroom teacher (Peter, interview transcript).

Silas

Silas is the second most frequently cited character on the network. A former teacher, Silas was a school leader where Peter taught when he moved to Neotown. The two consider themselves co-founders of Ed-tech Neotown, the brand that they invented to encompass both the meetup as well as the ed-tech "accelerator" described on the Ed-techNeotown.com website. Silas describes himself as a "change agent," and through a diverse set of experiences teaching in, leading and starting schools, he has learned that not all schools "want to change," and schools that don't may not be "the best fit" for him (interview transcript).

Transitioning professionally from school leadership to an ed-tech startup, Silas supplemented his in-school change agent knowledge with an out-of-school "vendor side" perspective on school innovation. He talks about education and schools in a complex way,

in terms of interrelated systems, procurement cycles, innovation cycles and their discontinuities. From Silas's perspective, the "big ones" (large companies) in ed-tech are not doing a very good job of serving students or teachers—they are largely recycling old-ideas and pedagogies—but they have the "manpower" to engage and sell to the large number of distributed schools and districts in the country, and the resources to manage their unwieldy procurement processes.

> So having been on the vendor side, the challenges are very real in the way that district procurement cycles work, right…Our company fell apart because we couldn't get payroll. Had to sell the company because we were waiting too long on checks to come in. Right? And you can't operate that way, you can't operate on, you know, eight months to nail down a contract, and then another six months after the contract starts to get on that contract. It's just, it was almost unsustainable. And so we're always chasing funding, right? And so, if you're always chasing funding, you can't focus on your product and your customers, and so it was this wicked [problem], and I think we're not untypical. I've seen this across companies that I've worked with. (Silas, interview transcript)

For Silas, the smaller startups and newer companies that really are doing something different and innovative—thinking about and addressing problems of teaching and learning in different and better ways—cannot last long enough to assemble the people and capital to propagate their innovations in the educational ecosystem.

> And the wisest exit strategy I can give you, a young company, is…figure out a way to get sold to one of these big behemoths and go do something else. And the problem is that they're going to either integrate it and keep it going, [and] for the people who are involved in it, that's the sort of solace you get from selling. Or what often happens is they're like, this is too close to something we're already doing, or we want to do it a different way, and they shelf it. They buy it, never use it, and it never sees the light of day. And that's sad. (Silas, interview transcript)

In his last major Ed-tech Neotown activity, Silas spearheaded a collaboration with EdWave, a global information network that supports private sector innovation in education, to host a "summit" called Tech-Connect (pseudonym) in Neotown, bringing local schools together with companies for educational problem solving.

> It should have been awesome. But the way that they chose the companies to [be represented at the summit was not right]. Our intent was that they went through a process with the school district to define very specific problems, which we did. And then basically, you take the problems and you find people working on solutions. So, you [EdWave] use your great influence and connections globally to find the best companies and convince them to come be a part of this because our people are looking for solutions. But that just did not match up. There were just these random, whatever, random companies would pay [EdWave] to come and do it. (Silas, interview transcript)

Silas *wanted* to leverage the global reach of EdWave's network to link schools with providers of solutions that they actually needed. However, the summit was co-opted as a spectacle, as companies paid for their solutions to be featured, and, according to Silas, a disconnect emerged between the tools assembled at Tech-Connect and the tools required by schools for educational problem solving.

Learning from this, Silas wants to see smaller, more innovative ed-tech startups and companies better supported so that they can sustain a vision and product across multiple academic funding cycles, and so that they can interface efficiently with schools for design and marketing. He wants to see investment in the Neotown ed-tech startup ecosystem, and he wants that investment to be used to help schools and these smaller companies work very closely on framing, understanding and applying technology to real problems of education. "I believe, there's a ton of money to be made, if you do it, right. If you do ed-

tech, right, you can beat the big people, the big ones at their, at their own game, right." But doing it right is hard.

Interpretive Synthesis

Silas and Peter both leveraged Ed-tech Neotown to not only curate and present problems and issues of education, and feature potentially transformational perspectives on education, but also to establish their reputations as innovators, facilitating their transitions between professional spaces. Peter weaves a *teacher* identity discourse together with critical *school change* and *commercial career* discourses to story himself as a committed and passionate teacher with valuable professional teaching interests and skills, but who is de-professionalized and constrained in school context. When Peter adopts a professionally and geographically *mobile* identity as a newcomer to Neotown, he strategically replicates the general form and vernacular of his Midwesterntown meetup to help him move from school to TechAssembly.

As a teacher, Peter initially appreciated meetups for the way that they allowed him to freely pursue educational goals outside the restrictive, *disciplining* (Foucault, 1978) context of school. In Neotown, Peter creates a meetup that reflects his subjective values— it should be about beer and guacamole, not tea-drinking. As an ed-tech impresario, the spectacle he creates must be provocative and compelling, but he must also be careful to feature speakers and ideas that do not alienate the ed-tech companies that support the material organization of the meetup. In this way, we see how, despite having escaped the

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restrictive *disciplining power* of school to the free and open ed-tech market, normative *biopower* (Foucault, 2008) operates "at a distance" to influence the free choices Peter makes about the meetup, subtly patterning the ed-tech spectacle in service of market values.

Silas, meanwhile, also saw corporate interests influence the kind of technologies he assembled and featured for school. Even with Silas's very sophisticated insider understanding of school change and his outsider vendor perspective on market-based innovation, the summit he spearheaded to link schools and companies in identifying and solving problems was distorted by market dynamics. The spectacle, conceived of as a very useful, *carnivalesque* convening, bringing schools and tech providers together in a level conversation about the real problems of education and relevant solutions, gave way to *corporate spectacle* as ed-tech companies paid to have their solutions featured regardless of problems at hand. Silas believes that smaller, retail level startups and companies must be better supported and sustained if truly innovative products and partnerships are to emerge from the ed-tech ecosystem, else they are co-opted or purchased and shut down in service of larger corporate interests.

A Community of Precarity

Shannon, Rachel, Hannah and Kim are also situated in this central, densely connected part of the network (Figure 10). They are younger professionals who all, at one point, have been co-organizers of the meetup. With the exception of Rachel, they are also *former teachers*. Like Peter, they tell stories of *escape* from school while carefully articulating that schools, while ineffective, exhausting and unrewarding places of work, are

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critical places for shaping children and society. They celebrate and valorize teachers for working hard in schools while at the same time tapping into *school change* and *commercial career* discourses to characterize their own pursuit of employment and activity outside of school as an escape to a more professional educational identity. In the ed-tech industry, their teacher experience has a certain market value, and they can be recognized as creative, intellectually agentic and entrepreneurial.   The co-organizers volunteer partly to gain exposure within the commercial ed-tech scene by interfacing with companies and organizations to secure funding and produce programming for meetups, hackathons and other network events. In the case of Kim, just being located downtown helped him find a way into the ed-tech industry with a company called Avenue Learning (pseudonym). Having been credentialed as a teacher in another state, when he moved to Neotown he found himself unable to teach.

> I tried to get certification, and was like, oh that's gonna take too long, I need to work. Started working in restaurant. Managed a restaurant for a while, got really burned out. I worked [downtown near TechAssembly] in a bar-restaurant and said, [passing an ed-tech company called Avenue Learning on the street], Oh 'learning!' Wow! what's this place? Let's see, what it's about. It's as simple as that. I worked on 4th street at a bar-restaurant, and said, oh what's this place? I had some tech experience, you know, with the computer repair place, so I got in entry level making 17-18 bucks an hour doing support. Six months in, they said "Oh you're a teacher! We need someone to talk to teachers. You know the product now, blah blah blah." They moved me into an account management role. Did that for a while and ended up doing really well. Ended up in strategic accounts, managing top 21 districts in the country. I had lived in Argentina a year before I started teaching high school English, so the VP of business development at that time said, hey you like to travel. And he was like, can you help me with this one account, this thing in Korea? Did pretty well. Saw some growth pretty quickly. Then it was, can you do this, can you do this? And I said, we need to formalize. So I gave him a job description and said, this is what I want to do for you. (Kim, interview transcript)

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Unable to operate in a disciplinary school context due to a credential issue, Kim stumbled upon a pathway to a well-paying professional career that he was literally writing himself.

This central scene, comprised of overlapping stories told by high in-degree characters, is the only part of the network that appears to operate as a community of practice. The "volunteer work" that Peter, Silas, Rachel, Hannah and Kim all do, or have done, is situated within the domain of educational technology, is carried out by a community of regular meetup attendees and is characterized by routine practices related to the growth of the network as a whole. Newer co-organizers like Hannah learn from more experienced co-organizers like Peter to assemble social networking platforms (Meetup.com, Facebook, Twitter) with cultural and material resources (local craft beer and Korean-Mexican fusion) for the production of regular face-to-face meetups, career fairs and tech expos. The nature of the practice and of knowledgeable network performance (i.e. expertise) is revealed in this story of a breakdown:

> Peter became aware that followers of Ed-tech Neotown on Facebook and Twitter were receiving a flood of identical messages about the upcoming meetup. He contacted Hannah, who was managing the media, telling her that she "shouldn't post that much!" Peter was very concerned that the large number of messages would be perceived as "spamming" and that ed-techers would unsubscribe from the network or block communications. Hannah realized it was a misconfigured service for automatically propagating messages across different social platforms, and that a cross-posting recursion had generated nearly 300 identical posts. (meetup fieldnotes)

With Peter and Kim's help, Hannah fixed the recursion. At the next meetup, both Peter and Kyle publicly addressed the "spamming" incident and urged the assembled ed-techers not to unfriend or unfollow Ed-tech Neotown.

The ed-techers in this core community track the "vital statistics," especially total meetup membership, with great concern as an indication of their expertise and impact; they have, after all, chosen to entangle their identities with the spectacle of the network, and if there is no crowd, or if the crowd dwindles, their affiliated identity diminishes on the market. Co-organizers learn to grow the network as they grow their own reputation.

Most meetup co-organizers are recruited into paid professional positions, typically at ed-tech companies. Peter, for his part, is now very busy and concerned about who will sustain the network going forward.

> **Peter:** Over the years though, I've had so many people who've helped out for a little bit. And essentially, what they'll do—it's volunteer work—they'll use it, put it on their resume, meet somebody, get recruited, and then they're off to the races. And, you know, leave the classroom and go get a job working for whomever.
>
> **Adam:** Why have you stuck with it for so long?
>
> **Peter:** Aaah…I don't...I think it's because it's...because I started it, I just feel like it's my baby, and like I don't...I feel like...my...in a lot of ways I feel like my reputation is tied to the success or failure of Ed-tech Neotown. […] But I think I also had a tremendous sense of guilt leaving the classroom and feeling like I wasn't upholding you know my commitment to education. And so for me it's like, this is a way to have a meaningful impact on the world of education. You know those sweet kids in the classroom who are just trying to go to school and learn something. And I can't directly impact that anymore because I'm not a teacher. So this is the way for me, to like you know, make their teacher...like not make...but give their teacher an opportunity to learn something. Find a new tool. Find a new educational model. Find something that will inspire them to go back into the classroom and just, like, really kick ass. Yeah I think at the end of the day, that's my hope.

In Peter's particular entrepreneurial narrative of the self, we see that he remains tethered to *teaching and learning* interests and his *teacher* identity even as his *commercial career* pulls him away.

Interpretive Synthesis

From an activity theory perspective, the shared object of this small community of practice is *the ed-tech network itself*, and the outcomes of its transformation include (1) an ed-tech service ecosystem capable of employing ed-techers and (2) marketable professional identities for ed-techers. For Peter and the other ed-techers, the network is a way of transforming a *teacher* identity into an *expert*, *entrepreneurial* or *commercial professional* identity that can secure a position outside of the disciplining context of schools. In developing and promoting the network, acting as facilitators, impresarios and coordinators of meetup spectacles, they trade on the market value of the spectacle, using it to connect and interact professionally with companies (prospective employers), for instance about sponsorship or panel representation. Focusing on the work of helping teachers transition from school into a freer but more precarious commercial educational market, the meetup functions as a community of ed-tech meetup practice. However, as peripheral members of this community move to the center, they are, by design, recruited away. The core *scene* of the ed-tech network is, in this sense, a *community of precarity*. As industrious entrepreneurs of themselves, co-organizers use the spectacle of the network to make themselves marketable in the very ed-tech network they help produce, and having done so, their trajectory in the core community of meetup practitioners is diverted from what would, in a more stable disciplinary or institutional context, be a centripetal and community-edifying movement to the center. The Ed-tech Neotown meetup community

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is *precarious*, because there is a risk that "the center does not hold" (Engeström et al., 1999). Communities of precarity are likely quite common in contemporary open networks, where so much collaborative work is done in the interstitial space between disciplines and organizations.

The practice of the core community of ed-techers is the creation of a meetup spectacle in which they and other ed-techers can participate. For ed-techers in Neotown, the people, tools and infrastructure of the ed-tech meetup, including space at TechAssembly, the Meetup.com platform, the beer and Korean-Mexican fusion, amount to a *black-boxed* service, an assemblage of people and materials that are spliced and settled in such a way that they function as a single actor on a network (Latour, 1999b; Spinuzzi, 2008). This black box connects, features, affiliates and co-brands diverse actors around discourses related to teaching, leaning, technology, school and social change.

The case of the breakdown in semi-automated network communications illustrates two important aspects of *knowledgeable sociomaterial practice*. First, it reveals this core area of the network as a community of practice and shows how Hannah's practice as an apprentice network storyteller is *disciplined* by Peter, who has experience and expertise with the technical work of configuring multiple media platforms and who is attuned to the social/professional implications of misconfiguration. By *discipline*, I mean both the sense of having a characteristic disciplinary style of communicating and interacting as well as disciplinary methods of conveying these styles to learners. "The word *discipline* (rather

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than teaching, training, or instruction) also marks an important moral quality (i.e., regarding 'proper conduct or action')" (R. Stevens & Hall, 1998, p. 109).

Second, the case of the breakdown shows how complex and highly mediated storytelling can become in social media environments. Knowledgeable performance in this scene involves learning to integrate multiple media platforms (Meetup, Twitter, face-to-face events) and understanding the cultural norms and professional populations that characterize different media environments, speaking across them in ways that grow and sustain membership and affiliation. Hannah, upon becoming a co-organizer, had to learn to communicate across Meetup.com, Facebook and Twitter in a coordinated fashion. These modal divisions are also sometimes exploited for splicing a heterogeneous network full of potential contradictions. For example, Peter tells a story about *privately* coaching a featured presenter at a meetup to present himself as an expert with "ideas" rather than as an entrepreneur with things to sell. In this way, Peter takes advantage of the multimodality of the network to tell two stories at the same time: one to the entrepreneur seeking a profitable market for their products, and another to classroom practitioners seeking to learn about technology-mediated practices from experts focused on the classroom use-value of ed-tech.

Scene 2: The Computer Science Education Scene
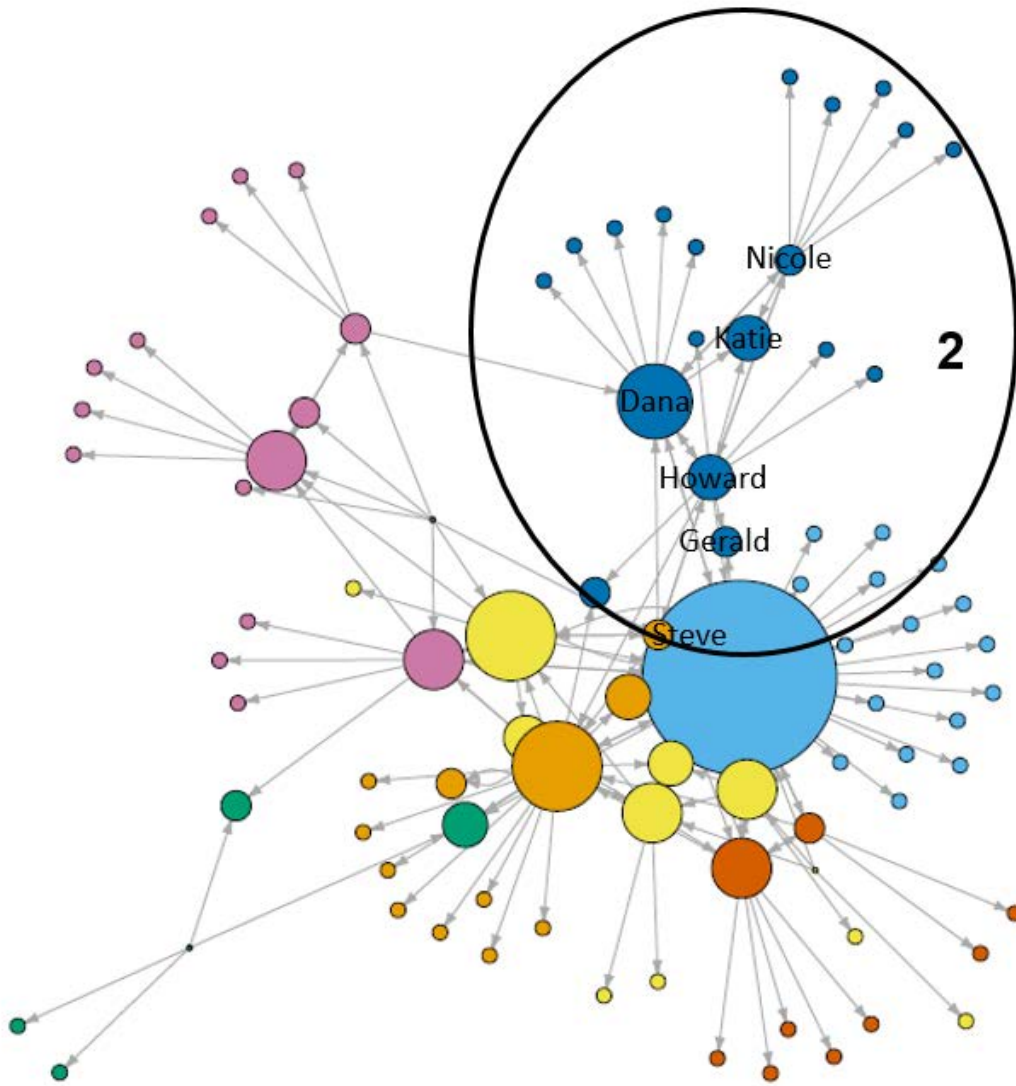
Figure 11: Actors in the computer science education scene.

I will now look at the scene assembled around Dana (Figure 11), another important (high in-degree) character in many network stories, though not situated within the central

ed-tech community of precarity. A former teacher, PhD-holder and center director at a university, Dana exists in an *institutional* world of grant-writing and educational research. Also a mother, Dana was struck by the fact that her children were not learning computer science or coding skills in school, skills she felt were critical to their futures in the contemporary economy. Her university position and affiliation with the STEM research community enabled her to study and articulate an evidence-based rationale for funding and scaling a program to train practicing teachers to be computer science (CS) teachers. She found that while STEM education interventions in schools were widespread, very few school curricula included computer science.

> So I wrote the white paper that basically kind of ended up catalyzing this conversation that no one was really having around computer science. And after I wrote the white paper was when I started getting some funding and met people. (Dana, interview transcript)

She used the ed-tech network first to present the whitepaper, problematizing the broadly compelling issue of *21ˢᵗ century STEM skills* as a *CS education access and equity problem*. However, departing conceptually from existing programs that brought professional programmers and computer engineers into schools to fill the perceived CS education gap, Dana rendered the issue technical as a teacher professional development intervention:

> One of my kind of, you know, axioms I live by is if we all believe that CS is truly for all students, then we have to believe that all teachers can learn CS as well. So you know there's a little bit of elitism around, you know, 'you need to have this degree', and actually, you really don't. (Dana, interview transcript)

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Via a variety of technology and professional networks, she gained a synoptic view of the funding and partnership landscape for her technical solution, and an opportunity to present a technical approach to funders and activists. Via the ed-tech network in particular, she recruited prospective CS teachers for the program. Dana felt that the type of teachers who are interested in ed-tech, she calls them "thoroughbreds" (interview transcript), would also be interested in becoming CS teachers:

> You know [these teachers] love the training. They love the fact that they improve their skills in the classroom. They love getting free stuff you know. But what they love the most is the professional relationships they build. That's what keeps them coming back to you …We honor them as professionals. We really approach this [as] 'we're all going to learn from each other.' You know a lot of our professors have a lot of content knowledge but they might not know a whole lot about K12 or even how to teach yet. (Dana, interview transcript)

The actors we see assembled around Dana are diverse: some, like Gerald, lead CS and coding non-profits, while others have *institutional* roles, like Katie, a district technology leader, and Nicole, a *former teacher* who now works at a state agency that promotes tech integration in school. Howard is a late career tech marketer who was similarly struck by the lack of CS education options for his children. Howard read Dana's whitepaper, and he has shared it on social media. He has become an "activist" for CS education, presenting at state legislatures and quitting his job as a tech marketer at a major tech company to work for an international CS education non-profit with a global scope. Howard has described shifting his focus from *commercial career* interests (in his own corporate advancement) to *global social change* interests through CS education. Notably,

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he retains his *commercial professional* identity as a marketer for a major tech company through this transition:

> I'm good at what I do, which is kind of stirring the pot and pushing people outside their comfort zone, because, I'm like this in the business world too. I'm very focused on the mission and yet I'm kind of apolitical. And if I put the kids interests first then that's the fuel that drives me forward. Right? Not a vendor, not a membership organization, and not an election. And I honestly believe—and I may be wrong—but I do have that personal conviction. I think it's best for kids. I'll go to the mat. Fight for the kids a little bit. You know like the Lorax, right? I speak for the trees because trees have no voice. Yeah, yeah, I speak for the kids that don't know the opportunity they're missing. (Howard, interview transcript)

In Howard's description of what makes him an effective CS education activist, he re-packages his commercial marketing professional identity as a kind of hardboiled activist identity. He is a tenacious, "mission"-focused, yet "apolitical" CS education activist who "speaks for the kids" who "have no voice."

Howard, Dana and Nicole all worked with Steve to develop the CS education scene as a grassroots network. A doctoral student in STEM education and relative newcomer to Neotown, Steve was a frequent Ed-tech Neotown meetup attendee and learned by watching Peter and the ed-tech co-organizers how to produce a spectacular meetup. Steve helped start a parallel meetup focused on bringing statewide stakeholders together around issues of CS education policy. The meetup is seen as a way of attracting the attention and participation of a variety of stakeholders in anticipation of forming a collective impact initiative in the near future.

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Interpretive Synthesis

Unlike the central scene of Ed-tech Neotown co-organizers, the linked actors in the CS scene do not collectively share a practice or community. Swarming around *21st century STEM literacies* as a runaway object, the connected actors in this scene work independently, via different but loosely coordinated institutions and practices, like lobbying, research, activism, grant writing, program design and implementation. The CS education scene is a network of shared, or at least discursively entangled, concerns about preparing children to be computationally literate. Dana, who is institutionally positioned at a university and has access to its "methods and instruments" (Latour, 2013), is able to develop a research-based whitepaper that constrains the compelling but largely intractable runaway object of *21st century STEM literacies*, "problematizing" it more narrowly as an issue of *CS education* and "rendering technical" (Sims, 2017, p. 13) a program of *teacher professional development*.

On this scene, there is no uniform practice or movement from periphery to center. Labor is divided and learning relationships are not clearly apprenticeship based. Expertise are distributed across individuals and emerge as a place-based and institutional *competence* (Callon, 1990), that is, a set of capacities concentrated among an assemblage of humans and material infrastructure. Dana, for instance, can write whitepapers, grants and procure funding by virtue of her position at a research university. Howard, for example, is embedded in and emerges from a marketing role with a major tech company, and while he

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is attracted to the object of CS education, he does not necessarily develop his skills or identity as CS education activist via Dana or Nicole, for instance.

As the labor undertaken by members of this community is divided across organizational and practice lines, it is not clear (via this study) how individuals do learn from each other. However, at the scene-level, expert network enactment looks like a competence that emerges from institutional and organizational contexts, and learning looks like a reconfiguration (Suchman, 2007) of these competencies around an object of CS education: Dana's university-based research and grant writing competence is configured with Howard's private sector communications skills and activism and Nicole's state-level advocacy work. Dana's whitepaper helped *transform* a compelling runaway into a technical program of teacher professional development around which an alliance of independent actors from institutions, business could configure loosely coordinated activities.

Scene 3: The Entrepreneurial Scene

An entrepreneurial scene (Figure 12) is visible on the left side of the network: Tim, Dean and Neil are entrepreneurs, and Trevor and Kevin consider themselves social entrepreneurs.
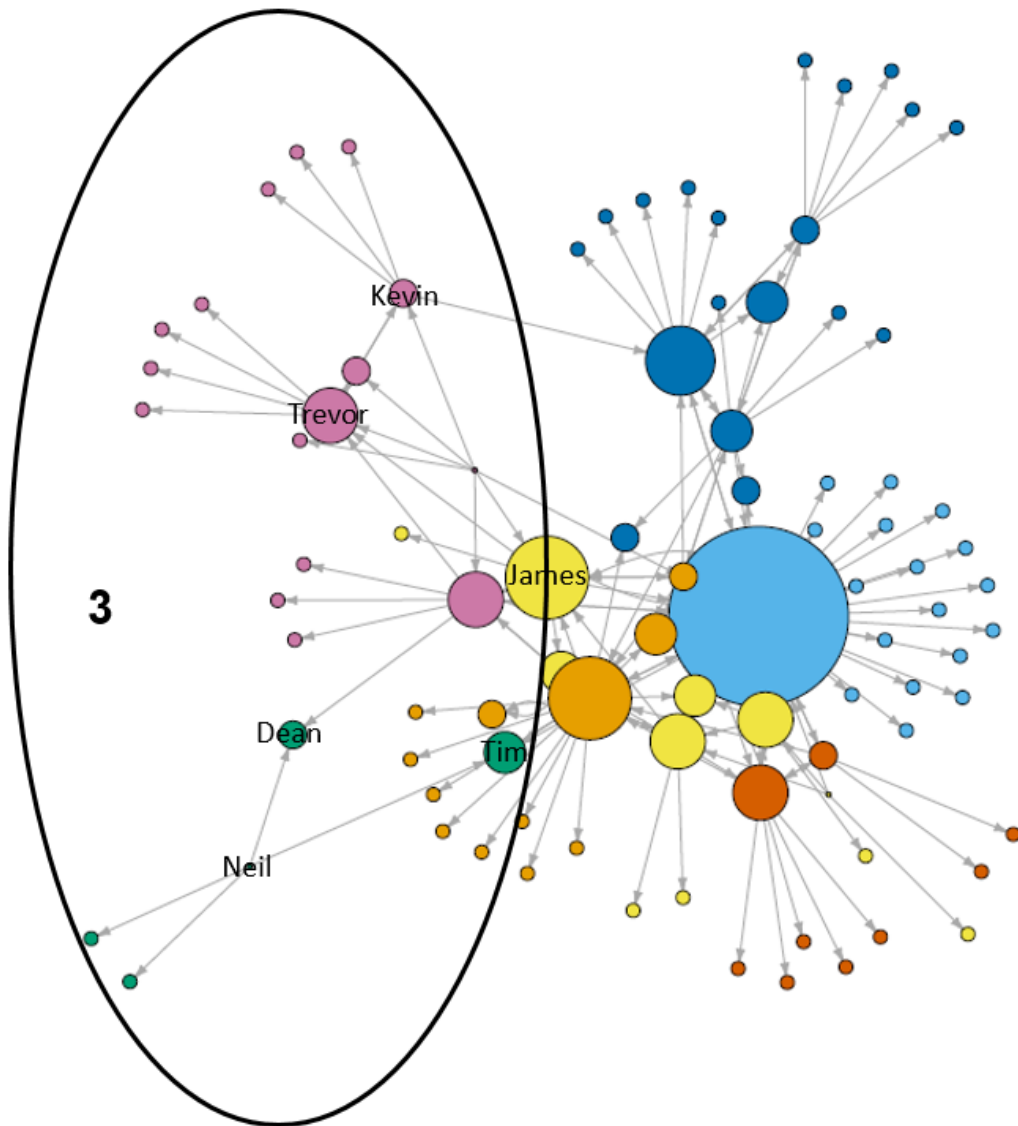
Figure 12: Actors in the entrepreneurial scene.

Commercial Entrepreneurs

Tim is the founder of TechAssembly, and on his blog and in numerous media interviews he describes himself as an "evangelist" for entrepreneurship and startup culture. The entrepreneur ed-techers with whom I spoke were all familiar or involved with the

startup accelerator and entrepreneurial mentorship programs running out of TechAssembly. Tim's public pitches for Neotown as a destination for entrepreneurs and TechAssembly as a hub play into *mobile* identity discourses, helping establish Neotown as an attractive, dynamic, culturally rich place to live, work and do business.

Neil is a recent graduate from a west coast product design program with a *mobile entrepreneurial* identity: he moved to Neotown because he read that it was one of the most supportive entrepreneurial environments in the country. Upon arriving, he cultivated mentorship relationships with more established entrepreneurs in the scene like Dean, a famous entrepreneur and professor at State U. Neotown, known as an enthusiastic mentor with deep knowledge of the technological landscape and market opportunities. Neil also immersed himself in the meetups and hackathons at TechAssembly, and became something of a hackathon shark, winning three out of the four he entered in a single year. The meetups are where Neil goes to meet people, though he finds them "superficial," preferring hackathons because he can form deeper relationships around real products, and really get to know how people work together. His teams won hackathons focused on health care, defense and human resources, and lost one focused on diversity. "I was pissed about that. I usually win those things" (Neil, interview transcript). While interested in designing for equity and education, Neil's hackathon work turned into a paying, if short term, contract to design and develop a product that scrambles sensors on autonomous vehicles. He is hoping that once he becomes established, he can use his current defense-oriented work as a "leg into the educational market." He has heard from Dean that State U. Neotown might

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be starting a new program focused on educating the public about self-driving vehicles, and he is anxious to find out more.

Social Entrepreneurs

The *social entrepreneurs* in this scene, typified by Trevor and Kevin, have backgrounds as teachers. Trevor is a former teacher who speaks passionately about his career in the classroom, and about how he simply burned out due to a grueling workload. Having had an interest in tech as a teacher, he spun it into an early ed-tech product and started a company that he was able to sell. That left him with some time to think about what he wanted to do: "What's unique about me and what makes me feel good, and what can make money as well?" He realized:

> education is the lever that we have that's going to be most effective in making our society more equitable. And I'm not ideological about it… It's just, you have a kid that happens to be born in a really poor neighborhood and it's got nothing to do with his choice or her choice. Well, what's the lever that we can give that child or let that child use to maximize his or her chances to become a productive part of society and lead a good life? It's really that simple. That's [where] my values come in, based on where I come from and my family. That's a big part of my worldview. And on the other hand entrepreneurship is just in my blood. Not big scale billion dollar exits…It's more of a mindset. Of, 'I have an idea. Let me see it if it sticks, if that has value. OK, it does. Well, let me let me iterate through the whole process to move it forward and to be intentional about that and to create something good and something that's going to hopefully last, which doesn't always happen.' (Trevor, interview transcript)

As an educational changemaker with technology, Trevor is committed by family and history to "values" of equity and education, and but entrepreneurial approaches are in his "blood." Fascinated by the ethos and "mindset" of creative entrepreneurship, lean startup

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and design thinking, he was happy to be selected as a social entrepreneurship mentor at TechAssembly.

> You know that was a really nice thing … They viewed me as a...'Here's a social entrepreneur doing…arguably important work.' I don't know how they actually feel about it—you know it's a very for-profit oriented place—but I think that they want to have at least sort of a veneer of 'Hey! We also care about social entrepreneurship.' And then for me, honestly … in education in general there's a lot of fluff. There's a lot of big talk and there's a lot of inputs, and there's a lot of 'I think we should try this' and 'we should do that.' But, the outputs in education versus the outputs in the world of business…you know in the world of business if you don't succeed, you're screwed. Being part of the quote unquote 'real world' of entrepreneurship is critically important for a person like me who is trying to bridge the two. You know, rubbing elbows with guys that are out there raising 3 million dollars over the next two months and rubbing elbows with women who are developing amazing new mobile platforms to provide realtime telemedicine for people…[It is] real digital innovation where there's no net. (Trevor, interview transcript)

Via a fellowship with a national network of entrepreneurial educators, Trevor began to develop a concept, idea and pitch for a program that develops "entrepreneurial mindsets" among teachers in schools, teaching design thinking, lean startup and iterative, pilot-based approaches to change and learning. He hosted a design-thinking event with the Ed-tech Neotown meetup, in part to hone his idea and see how it played with teachers. When he finally piloted his program, Kevin was selected as a fellow.

Kevin is one of only a few black men that come to meetups with any regularity. A former teacher and a musician, he describes his approach to bringing technology into education as getting kids doing "dope stuff with tech." He wants them to use tech to be creative and land jobs in the creative economy. Good learning outcomes, in Kevin's view, include "cash in the pocket" (conversation with Kevin, meetup fieldnotes). Students in

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his programs learn marketable media skills by, for example, hacking VR kits to produce digital histories of local places that they know, constructing virtual tours with themselves as professional guides.

According to Kevin, if kids end up doing dope stuff with tech and eventually getting paid well in good jobs where they can be creative, then his program is successful. Kevin feels that he focuses on a section of the educational market that most of the ed-tech community doesn't care enough about, and it has taken him decades to pull together enough partnerships with tech, design and marketing firms to make it work.

> I purposely go after those kids that nobody wants to really fuck with, and I'm able to show that they're able to do high quality work that you could put against anybody's work. But that's hard. Not easy to do. You know that's sitting outside in the projects in 98-degree weather...These are things that I've done. Yeah this is going door to door in the projects and recruiting kids. (Kevin, interview transcript)

A big part of the curriculum his organization provides is focused on professionalism. In a conversation at a meetup, he relayed a story about one of his students of color who, playing into the informal dress code of the tech industry, wanted to wear his "fuck-off shirt" to his first day of an internship with a tech firm. The student felt that he could pull off the edgy, curse-word-emblazoned t-shirt, especially considering how the rest of the (white, male) office wore jeans and edgy word shirts. Kevin explained how this story highlighted a key challenge of teaching professionalism and employability to his students of color aspiring to work in a media and tech industry that excludes and misrepresents them:

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we give those kids an opportunity to say how they feel about how they're being portrayed [in the media]. OK. And then we say OK. That's how you feel about how you're being portrayed but you have these tools where you are able to tell your own story. So what story are you going to tell? Are you going to wear the "fuck off" shirt? If you are, okay, that's cool. But you better be a bad motherfucker if your gonna wear the fuck-off shirt. (Kevin, interview transcript)

As a critical professional *informant*, Kevin helps his students of color understand how their outsider status will "play" in privileged work contexts, while at the same time being careful not to de-legitimize their experience of oppression as they endeavor to move across cultural, social and economic boundaries. Kevin wants his students of color to be able to move into good, creative, powerful tech jobs, "fuck-off shirts" and all.

According to Kevin, a big problem with the way digital equity activities play out in ed-tech is that technologically "underserved" students are engaged in relatively empty educational performances with ed-tech. Real learning relationships are never really built through their creative activity.

We've all attended things for an organization that works with underserved kids, and the kids get up and do something and it's some bullshit cycle. 'Well bless their hearts, they really try.' We don't want that. It's not charity, what we're doing here…We're going to make a music video but it's not going to be some bullshit. We're going to make a damn fine music video, or whatever it is, we're not going to half ass it. OK. And that is hard, particularly if the kids don't already have the skill set. You have to cultivate the skill sets and that means you have to actually listen to them and interact with them before you can make a prescriptive move. Because you're there to facilitate for them. You actually have talk to them, you've got to have a relationship with them. And that's my issue with ed-tech. It is the relationship that really changes kids' lives. It makes them better learners. It's relationship-building. That's why the employability curriculum that we do, it's our secret sauce. Now, I'm sure there are folks that are out here that are doing those things. I'm not saying ed-tech is evil, or whatever. It's just a hard, heavy lift, to do it like that. (Kevin, interview transcript)

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He says that the only reason he is still doing his brand of digital equity work is that he has a few powerful white men on the board who have been able to shake loose funding to support his "hard, heavy lift," and that he only managed to get office space at TechAssembly after some white entrepreneurs were granted free space for doing some good, but smaller scale digital equity work. Now that he does have space at TechAssembly, he is beginning to grow his program and reach more kids.

Interpretive Synthesis

- In these stories of entrepreneurs, we see how they blend potentially conflicting *career commercial* and *social change* discourses with a "brutal pragmatism" (Law et al., 2014), often talking about their work in terms of "multiple bottom lines."

- We see how it is difficult for Kevin to use his digital equity techno-narrative to position himself productively within the downtown ed-tech infrastructure. He is only able to do so with the legitimizing power of the (white, wealthy) tech industry establishment.

- Learning among entrepreneurs is designerly (Cross, 1999, 2001). These ed-techers learn by making, and through iterative trial and error. They learn to hone and craft value propositions, and they use each other as mentors to identify "opportunities" and learn "the lay of the land" (meetup fieldnotes).

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Proximal, Ephemeral and Nascent Scenes
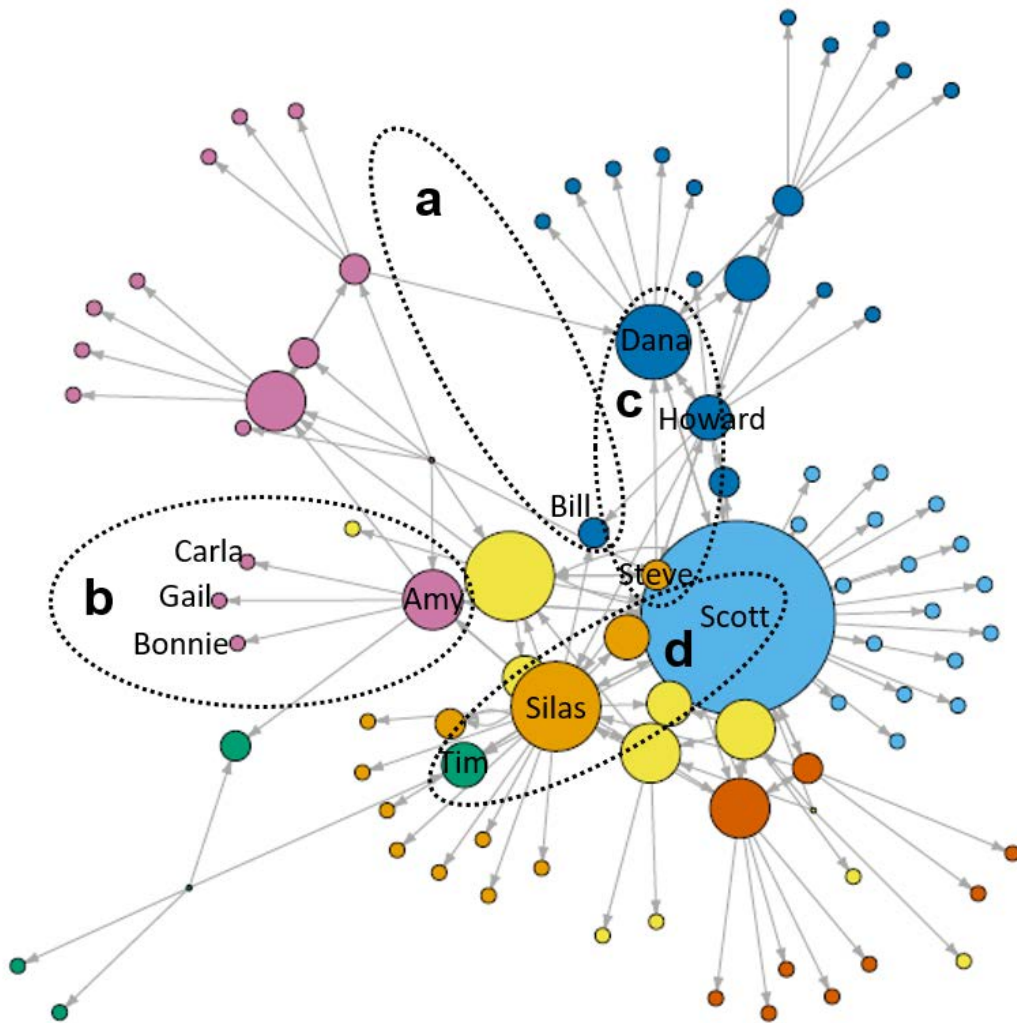
Figure 13: Actors in proximal, ephemeral and nascent scenes.

Analyzing the network as a narrative requires moving through its chronotope, understanding it as a dynamic, unfolding story in space and time. Figure 13 identifies actors that are linked to proximal, ephemeral and nascent scenes on the network. Bill, for instance, sits on a fuzzy, active boundary between the Neotown ed-tech network and a

much larger and much less open network assembled around a major media, technology and education conference that attracts a global audience to Neotown on an annual basis (Figure 13 scene a). This conference assembles around many of the same objects of education, technology and social change that attract ed-techers, and Peter and Silas regularly work with Bill, a key organizer of the event, to stage a local Ed-tech Neotown spectacle on a global stage. Dana attends the conference as well, using it as an opportunity to understand donor agendas and make connections with national foundations and corporate donors, for example.

The chronotope of the storytelling network can also be extended temporally, looking at past and possible future scenes. Amy (Figure 13 scene b), for example, tells a story of a national Ed-tech Women's Network that had, for some time, a chapter and meetup in Neotown. Actors like Carla, Gail, Bonnie and others would meet after work in a suburban office building. For Amy, it was a difficult and time-consuming drive, and what's more, she "didn't understand the woman part of it—it wasn't necessarily an advocacy group" (Amy, interview transcript). It was "about women in tech, you know, like someone who was so and so in so and so's company, and she talked about how she got where she was" (interview transcript). The meetup catered to *commercial career* interests, "kind of like business advancement kind of stuff," and for Amy, it did not seem to "fit a need" that would warrant the hard drive to the edge of Neotown (Amy, interview transcript).

Today, the scene appears to have disappeared, or been subsumed into the larger, more general ed-tech network that assembled in the city center. As an Ed-tech Neotown participant, I did observe a panel of women in ed-tech discuss issues of diversity in the tech workplace. One of these women argued that there should be more women-designing ed-tech products, as the teachers who use them are mostly women. This *critical gender literacies* discourse is different than the *commercial career* discourse Amy identified in the women's meetup. In any case, it is very difficult to tell what the women's network learned or created, because as a precarious volunteer-run endeavor positioned on the urban margin, *its center did not hold*. Digital artifacts are sparse and the discourse it may have generated is now dispersed. Scenes on the network are ephemeral, and once a visible spectacle—a meeting, website, symbol or brand—disappears, the knowledge, the learning, and the entrepreneurs of the self that assemble around them can become disentangled, unwoven, un-spliced and diffuse.

We can also examine the *agential antenarratives* (Boje, 2011), that is, the prospective stories, plans and "bets" that ed-techers make about future scenes on the network. Silas and Peter (Figure 13 scene d) describe an ed-tech "accelerator" at TechAssembly that would integrate funding processes and services required to produce ed-tech startups, anticipating a potential black-boxing of the network. In developing a spectacle in collaboration with EdWave that brought schools and startups together, Silas storied a vision of a more *organized* and *relevant* ed-tech scene. Dana, Howard and Steve (Figure 13 scene d) envision the current CS education scene becoming a more formal

"collective impact" initiative, and they are seeding this prospective network with a meetup to cultivate stakeholders and policy priorities. Amy envisions a type of program that engages entrepreneurs, teachers, school leaders and university-based researchers in the collaborative design of educational technologies. For Amy, "innovation is happening continuously" in the startup scene, but not the right kind of innovation.

> I see so many technologies that are created that are replicating what has been done before, and so I'm just like, you know, these people, developers or whoever are just creating things that have already been created, or creating things that are not creating learning opportunities that best match what research knows to be best practice. (interview transcript)

Recently, Amy has been researching and writing about ways of "helping these companies do the right thing" (interview transcript).

PART 4: EMERGENT ED-TECH INTERVENTIONS

In this section, I show how all this storytelling *matters* in terms of what I will call *interventions*—programs, approaches and products—that emerge from the network. The narratives and antenarratives of identity and interest, or the *lived fictions* (Sims, 2017) of ed-techers, pattern the way that runaway objects of education are problematized, made technical and transformed. I will focus on cases drawn from across the scenes: (1) the CS professional development program emerging from the CS scene, (2) the entrepreneurial teaching fellowship piloted by Trevor, (3) the digital professionalism and employability curriculum developed by Kevin, and (4) the Tech-Connect event co-organized by Ed-tech Neotown and EdWave.

Building CS Literacies in Both Students and Teachers

According to the personal stories told by Dana and Howard, the CS education scene emerged out of a shared concern that children were not being adequately prepared in schools for the emerging economy. In the CS education scene comprised of STEM education researchers like Dana and tech professionals like Howard, this perceived difference between what schools *teach* and what students *need* in order to be successful was framed in terms of technological literacies, in particular, computer literacy. The whitepaper produced by Dana made an evidence-based case that students should be learning to code and create with computers, an argument that resonated with Howard who assumed an activist role, speaking for kids without access to what were perceived as critical professional and creative skills for social mobility. The teacher professional development program that was developed as a technical intervention reflected similar, equity-conscious concerns about computer literacy, organized as it was around the "axiom" articulated by Dana that "if we all believe that CS is truly for all students, then we have to believe that all teachers can learn CS as well" (interview transcript). The equity discourse patterns an interventionist approach that celebrates teachers as creative, professional members of a cohort and network who are excited to change themselves and their practice.

Propagating Designerly Ways in School

Moving to the entrepreneurial scene, a similar equity discourse, or at least an attention to inequity, is visible in the general approach to teacher professional development

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piloted by Trevor. Trevor, a former teacher-turned tech entrepreneur, picks up on pervasive industry and commercial discourses about lean startup approaches to change, design thinking and iterative piloting to develop a program to introduce these things as an entrepreneurial "mindset" to teachers in schools. The ed-tech intervention that was pitched, piloted and tested into existence at TechAssembly and in Ed-tech Neotown meetups propagates "designerly ways" (Cross, 1999, 2001) of thinking, learning and innovating in school contexts. In this study, it is not clear how these abductive, risky, rhetorical approaches to change play out when adopted by teachers in restrictive, disciplining school contexts, but Trevor makes the case for this approach based on his own story that weaves together an equity-minded *teacher* identity tied to his "family" and where he comes from, and an *entrepreneurial* identity that "is just in my blood" (interview transcript).

Cultivating Critical Digital and Professional Literacies

Kevin positions himself and his equity narrative in the context of what many equity- and justice-oriented actors would consider the neoliberal heart of the beast, in downtown Neotown at TechAssembly. Differentiating himself from digital equity and access programs that "we have all seen" that engage students in trivial technological performances, he emphasizes digital equity as a "heavy lift" that requires sitting outside apartments in the projects, recruiting kids that don't already have exposure or access to quality creative career pathways, and creating real relationships with them. It is through

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these real relationships that Kevin is able to teach novel media and tech skills as well as enable the production of "damn fine music videos" and digital stories that reflect student experience more substantively (interview transcript). The curriculum that emerges from this polyphonic story of equity, employability and digital creativity simultaneously prepares students to work at TechAssembly and get some "cash in the pocket" while also acknowledging that in the context of history and racialized society, their place in the industry will be different and challenged (meetup fieldnotes). Kevin teaches with respect to neoliberal market norms rather than channeling institutional or disciplinary power to restrict the professional identities of his students. He respects their freedom as independent *entrepreneurs of themselves*, acknowledging, for example, that an edgy "Fuck Off" t-shirt can be both a professional liability as well as a *legitimate* and *potentially powerful* political statement, depending upon who wears it and how it is worn: "you better be a bad motherfucker if you're gonna wear the Fuck Off shirt" (interview transcript). This kind of curriculum and pedagogy reflects a very sophisticated notion of critical media literacy and professionalism that is situated specifically in the experience of young people of color in the creative tech and media industry.

Leveraging Openness and Connectedness for "Heavy Lifting"

Finally, it is important to highlight Tech-Connect, the event co-organized by Ed-tech Neotown and EdWave. From Silas's perspective, it was an instructive failure, and it reflects a very important lesson about how designed openness and connectedness support

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technological futures of education. Citing his own professional pathway narrative that positioned him in classroom, school leadership, commercial and donor contexts, Silas makes sense of educational innovation as a complex set of often discontinuous priorities, problems, solutions, development processes and procurement cycles. Tech-Connect was designed to address a chronic problem of ed-tech innovation, that is, that most innovations that emerge commercially are not particularly innovative. Merging his educational and service ecosystem perspectives, Silas framed this issue as a problem of coordination between schools and ed-tech providers, and presented a technical way forward that involved carefully working with schools to identify and prioritize educational problems and hosting the Tech-Connect event, a spectacle that would draw together schools and providers of ed-tech solutions around those problems. However, much to his dismay, the spectacle did not attract providers of relevant solutions, and instead "there were just these random, whatever, random companies would pay [EdWave] to come and do [the Tech-Connect event]" (Silas, interview transcript). The exciting and urgent spectacles around which innovators swarm on the open network are vulnerable to being co-opted by corporate interests, and the market values of ed-tech may become disjointed from use values. In the case of Tech-Connect, the problems brought to the market and the solutions presented for sale "just did not match up" (Silas, interview transcript). In Kevin's words, this is not because ed-tech is "evil," but getting these things to match up is just a really "heavy lift" (interview transcript). Tech-Connect might have worked out differently if the organizers

had been as careful about the way that solutions were assembled as they were about articulating and prioritizing the problems of schools.

Openness and connectedness brings many efficiencies and possibilities to the work of innovation, but we must remain *aware, critical* and *intentional* about who is swarming around what runaway objects of education. We must design open innovation activities in ways that resist their devolution into mere corporate spectacle. If we don't, we can expect to see solutions emerging from ed-tech that do not solve clear or important problems.

PART 5: SUMMARY OF FINDINGS

Having examined the ed-tech network as a *revelatory case* (Yin, 2014) of an open, urban innovation network, what has been revealed? What, in summary, have we found out about the network? In this final part of the chapter, I will revisit the research questions around which this case study was designed, looking at (1) network enactment and composition; (2) boundary crossing; (3) knowing, learning and innovation; (4) transformational potential and (5) issues of method in the study of open networks.

Network Enactment

Research question 1: How is the open, urban ed-tech innovation network enacted? How are stories circulated and how do they influence network activity and participant identities?

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As we have seen by tracing the narratives of various ed-techers, the network is enacted discursively as stories of identity are crafted around different interests, goals and objects. The stories that ed-techers tell make at least three *scenes* of enactment visible, and also reveal how the overall the network is enacted as a market focused on the production of ed-tech products and services (interventions) as well as marketable ed-techer identities.

Scenes on a storytelling network are characterized by plot entanglement and the utilization of common characters. Like communities of practice and activity systems, scenes may have particular ways of talking (e.g. market vernacular or academic jargon), particular forms and genres (whitepapers, pitches, value propositions, panel discussions), objects (CS education, network expansion, digital equity) and characters that tend to be used in the crafting of stories that orient work. However, scenes do *not* necessarily have a community, domain or common cyclical practice (like a community of practice), nor are they necessarily organized by a coherent, focused or even persistent narrative (like an organization might be). Scenes may evolve into or become organized as communities or activity systems, but they are ontologically distinct; they are, empirically speaking, centers of discursive activity in a connected sociotechnical mesh.

The core Ed-tech Neotown scene, for example, is storied and enacted as a community of precarity; former teachers seeking the freedom and agency they are unable to find in *disciplining* (Foucault, 1978) school contexts engage in the cyclical activity of manufacturing meetups, hackathons and other *spectacles* (Debord, 1995) around which the ed-tech network can assemble. In a neoliberal society where identity itself is commodified as brand (McNay, 2009), ed-techers can use the spectacle to develop marketable professional identities as well as educational products and services. The community is

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precarious, because as core practitioners become proficient in their work, they transform themselves and are recruited away, mostly into commercial ed-tech firms. This kind of community of practice, sustained as a tenuous succession of volunteer entrepreneurs of the self, may not reliably retain knowledge and history at its center. *Its center may not hold* (Engeström et al., 1999).

The CS education scene, meanwhile, bears little resemblance to a community of practice. It is enacted as a loosely coordinated set of competencies residing in institutions and individuals configured around a specific object: 21st century skills and literacies. The scene, based on narratives collected from Dana and Howard, took shape as a very general and intractable runaway object (Engeström, 2007) was *problematized* as an issue of CS education availability and access, and *rendered technical* as a program of teacher professional development. A whitepaper was instrumental in constraining the runaway object of CS education.

Finally, the network is enacted as an entrepreneurial scene. This scene is comprised of ed-techers who story themselves as independent creators of value and impact. Social entrepreneurs in this scene pragmatically intertwine use value and market value in describing the objects of their activity. For instance, Kevin wants his students of color to engage with technology and new media to create stories and products that legitimize their experience of marginalization while also instilling in them the technical skillset required to become well-paid creatives in the cultural economy. This scene is enacted through designerly and entrepreneurial modes of creation. Trevor and Neil situate themselves at meetups, hackathons at TechAssembly, for instance, where they employ systematic empathy, iteration, abductive piloting and feedback to evolve educational interventions around social and market value propositions.

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Boundary Crossing

Research question 2: How, why, and to what extent do individual people, concepts and technologies move across boundaries in such a network? How do boundaries pattern network composition and activity?

Ed-techers say they are moving across boundaries, and many of the narratives I have collected attest to the fact that former teachers in particular use the network to find jobs in the commercial ed-tech industry. As a participant observer at meetups I have seen that university students who study education, for example, mix with teachers, former teachers, engineers and businesspeople at face-to-face networking events. The ed-tech network is indeed diverse in this way, and it does bring people across boundaries, if not all boundaries equally.

In my own narrative of network engagement, I show how the network is enacted sociomaterially, that is, as a performance that is patterned by place and medium. Ed-tech Neotown is a multimodal social technology that integrates a website, a social media platform and the physical infrastructure of a downtown co-working space. On the open internet, the network presents an attention-focusing spectacle that appeals to ed-techers as entrepreneurs of the self, that is, as contemporary knowledge workers who must craft and re-craft themselves—brand and re-brand themselves—in recognizable ways in a dynamic, hectic and confusing urban ecosystem. The Meetup.com platform, meanwhile, provides an efficient, technical interface for this complex social task; entrepreneurs of the self can use the platform to identify and affiliate with groups and brands as they develop their

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personal and professional identities. Ed-techers present themselves to the ed-tech meetup using latent discourses about identity and interests, often positioning themselves as mobile and in-transition between work contexts. The network is enacted physically at TechAssembly, a material infrastructure that by design promotes openness and mixing, but that also subtly patterns the composition of the network: ed-techers tend to be the sort of folks who want to and are able to make it downtown at rush hour to drink local craft beer.

Knowing, Learning and Innovation

Research question 3: What does it look like to know, learn and innovate in the network? What are the implications for our understanding of 21st century skills and connected pedagogies?

In the ed-techer stories assembled here, we see a wide variety of learning relationships, and we see expertise, or knowledgeable network performances, developed in different ways. Hannah and Peter have an apprenticeship relationship within the context of the ed-tech community of practice, the scene at the core of the connected network. Dana, on the other hand, uses the network to learn synoptically, to identify funding and resources for the implementation of a teacher professional development program. Ed-techers in the entrepreneurial scene describe learning through mentorship, through trial and error "lean implementation" approaches, and via systematic design interactions, for instance, in hackathons. They appear to learn in designerly ways (Cross, 2001).

On an ed-tech network where knowledge, identity, power and learning is ephemeral and shifting, ed-techers use symbols, brands, signposts and signifiers to hold knowledge together. The co-organizers of the meetup develop spectacles to assemble and hold attention. Ed-techers must not only assemble knowledge from many networked sources (Siemens, 2005), but also *sustain* knowledge as power, making it persistent and consequential. This is especially important for knowledgeable network actors positioned outside normative network discourse (like Kevin's digital equity work), for communities of precarity with vulnerable centers (like the volunteer-run Ed-tech Neotown meetup), and for ephemeral scenes at risk of being co-opted (like the women's meetup). In using network spectacle to hold knowledge together as a recognizable brand on a frenetic network, knowledge can become visible, durable, consequential and valuable to networked entrepreneurs of the self who, by their own accounts, want to change the world as they change themselves.

Transformational Potential

Research question 4: How does the network articulate and approach issues of equity and social justice in education? How do these issues figure into the stories that mobilize the network? Can we identify "conditions of emergence" (Fenwick et al., 2015) of substantive equity and justice-centered innovations from such an ideologically diverse, multiperspectival network?

The media spaces, like Meetup.com, and physical infrastructures, like TechAssembly, through which the network assembles are designed for openness and connectivity. As social technologies, they bring efficiencies to the work of finding, interpreting and affiliating with ideas, people and objects of value. These technologies not only help configure network actors (people, technologies, resources) around emergent goals and runaway objects, but in a contemporary neoliberal context their openness and connectedness tend to be patterned by the pervasive market form. While open, participatory infrastructure enables the convergence of consumer and producer identities (e.g. as co-production; Table 1), it does not necessarily resist the logic of the market. Despite being empowered as creators and changemakers, the use value of ed-techer skills, products and interventionist activities can always be recapitulated in terms of market value.

The ed-tech meetups, in the way they celebrate *novel* technology (e.g. AI, drones, VR), dramatically pursue big and compelling runaway objects of education, and circulate stories of disruption, change and impact, amount to a social *spectacle*. In an economy where professional appearances and affiliations are commodified (Boje, 2001a; Debord, 1995) and branded, the meetups create an opportunity for the co-branding of projects, products and people alike. The ed-tech spectacle is hosted and sponsored not *just* to attract swarms of innovators for the creation of useful educational products and interventions, but also for other purposes, like selling urban space (i.e. co-working space at TechAssembly), marketing educational products (e.g. for-profit coding schools or teacher professional

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development), and enrolling the (largely voluntary) labor of teachers in the design and testing of products.

Sometimes the network activities take on a more *carnivalesque* form, atmosphere and vernacular (Bakhtin, 2004). When this happens, for instance during meetup Lightning Rounds, the dialogic mixing, connecting, leveling dynamics of carnival—the churning from bottom to top—hold at least the potential for resistance and critical innovation. Trevor, a former teacher and social entrepreneur can be found "rubbing elbows with guys that are out there raising 3 million dollars" in funds at TechAssembly. Kevin, for instance, in his effort to seek out marginalized youth and bring them, profane t-shirts and all, into the tech and media workplace represents an effort at designing the concerted, equity-minded churning, mixing and flattening that is required for a more just market. These carnivalesque aspects of the open innovation network might be seen as conditions for the emergence (Fenwick et al., 2015) of educational innovations that resist the normalizing power of status quo corporate ed-tech spectacle, and promote retail-level change from the bottom up.

Multimodal Narrative Case Study Methods

Research question 5: How can we frame and analyze cases of open, dynamic, multimodal networks for the study of learning and innovation?

The mix of methods presented here present a blurry snapshot of the ed-tech network as it emerges from a frenetic urban ecosystem. The network as a case was framed and

modeled *multimodally*, representing it as a dialogic manifestation of latent discourses and pathways using LDA, a collection of designed digital and physical artifacts around which ed-techers efficiently assemble (a social technology), a systematic arrangement of characters linked by stories of work (a network map) and, finally, as a tangle of actor narratives about the past, present and future of their work on the network. By integrating these modal representations of the network, a more *particularized* picture of the history and dynamics of the network is revealed than would have been afforded by social network analysis alone, for instance. The network becomes a composite of nascent, ephemeral, overlapping and changing scenes that are useful in understanding what it does (e.g. create ed-tech products and ed-techers via meetups), what it did (engage classroom practitioners in practice-oriented discourse, as Peter initially preferred to do), and what it could do (recruit and feature marginalized problems and visions of ed-tech like digital equity or critical gender techno-literacies).

Chapter 5: Discussion

Taking the Ed-tech Network as a case study of an open, urban education innovation network, what kind of *analytic generalizations* (Yin, 2014) can we make about the nature and importance of these networks? If the Ed-tech Network represents a new kind of public sphere, how can it be understood and used to surface possible educational and social futures, and convene the kind of broad and inclusive public discourses about education and *the common good* that are essential in changing the entrenched *grammar of schools* (Tyack & Tobin, 1994). What does this case of the ed-tech network say about nature of networked work and critical 21st century literacies more generally? What does knowledgeable network performance look like, and how do we help students enact the network knowledgeably?

In this final chapter, I pull five thematic threads from the preceding analysis, highlighting salient research and design implications of each. I first unpack key issues of power and precarity with which ed-techers must grapple in and out of school as innovators. I then consider some pedagogical implications of the network study, proposing that Engle and Conant's (2002) notion of *productive disciplinary engagement* could be updated to reflect learning and work environments that are not strongly patterned by disciplinary norms or powers. A general form for the design of "carnivalesque" open, connected learning and innovation environments is presented as a way of more concertedly pursuing equity and justice in a market context. Finally, I move on to examine the utility of the

notion of a *scene* and present a narrative perspective on the *runaway object* (e.g. Engeström, 2007) in late generation activity theory. I end the chapter by making the case for working at the edge or outside of object-oriented activity theory frameworks to understand innovation and learning in open networks and scenes, and by pointing to theory and empirical work in the learning sciences that may be helpful in carrying out future research.

DISCIPLINE, PRECARITY AND THE NETWORK AS AN OPEN MARKET

The open ed-tech network as a whole is enacted as a market. Some ed-techers position themselves as *teachers* or school-oriented actors with *teaching and learning* interests who want to learn more about technology and how it can be leveraged to improve their own practices and benefit their students. Other ed-techers use discourses about *commercial professional*, *expert* and *entrepreneurial* identity in combination with *career commercial* and *school support* interest discourses that are generally critical of schools as overly bureaucratic and oppressive. These discourses are woven into narratives of "escape" from the classroom to a more "professional" identity and "impact" at scale in an expansive (potentially global) market. These escape stories represent ed-techers as leaving the *disciplining* (Foucault, 1978) context of school, where their subjectivity and creative agency is restricted and controlled, to become entrepreneurs of the self (Foucault, 2008; McNay, 2009). In fleeing the disciplining power of school, they leverage the social technologies of Meetup.com and TechAssembly to identify and differentiate themselves as

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professionals and free agents in a biopolitical mesh in which values are inevitably marketized.

Ed-techers who position themselves as outside-of-school actors (e.g. *entrepreneurs* and *experts*) tend to present themselves as having knowledge and services to offer, while those who present themselves as avid learners of technology tend to story themselves with in-school *teacher* identities and interests in *classroom teaching and learning practice*. While not at all surprising that teachers, for instance, care about getting better at teaching, or that entrepreneurs are interested in developing useful intellectual properties to sell to schools, the important thing is that this overarching market dynamic tends to direct the formal flow of knowledge on the open ed-tech network from the outside of school in. While the value of school-based teacher knowledge and day-to-day classroom work is *acknowledged* by ed-techers, even *celebrated*, it is rarely valued or engaged as *innovative*. Peter's early meetups did embrace the idea that teacher knowledge and classroom practice was both interesting and important, and that teachers and teacher knowledge were an important part of an ed-tech innovation process, but in order to sustain and grow the network, the focus of the ed-tech spectacle shifted to panels of outside actors who could sponsor events and draw a large crowd, and the location of the network settled at TechAssembly, a commercial center that is practically inaccessible to many teachers. In the end, *what counts* as ed-tech and ed-tech knowledge in the open ed-tech network—indeed, what counts as "innovative"—are products, apps and services that emerge outside of school in the hackathons and startups assembled at TechAssembly. Teacher knowledge

about how these products and services operate in the classroom is valued as "feedback" on products that have already been designed, or for its utility in marketing products to schools. While the ed-tech network in its physical and digital infrastructure is designed very specifically for open knowledge exchange, it is not necessarily designed for equal knowledge exchange.

Why should it be the case that teacher knowledge is not valued on the open ed-tech network in the same way that out-of-school expert or entrepreneurial knowledge is valued? Shouldn't a teacher's useful contextual knowledge also have market value? It may be that the *disciplining, panoptic* nature of school (Foucault, 1978) does not accommodate teacher expertise when it comes to technology. Schools may develop and control teachers as disciplinary specialists and confine their productive or creative attention to the narrow confines of their classroom. Peter's story of disappointment with PD lends support to this interpretation. It may be that teaching is perceived as women's work, and that women do not, as Essers et al. (2017) point out, conform to the traditional model of white, male tech entrepreneur, even in education, and *especially* within ed-tech. Another paternalistic explanation is that in-school actors like teachers don't feel the *need* to assume expert identities, and that teachers, for example, being positioned with relative occupational security in a school context are simply *free* to identify as learners of ed-tech rather than assume an expert identity.

In any case, due to their relative precarity on the open market, out-of-school actors like those in the entrepreneurial scene *must* position themselves as "experts" and "helpers"

with "solutions." Out-of-school ed-techers, as entrepreneurs of both educational technology and themselves, cannot afford to be without a clear solution to difficult, contentious, intractable problems of education. In the open network patterned as a market, ed-tech emerges as an array of technological solutions designed by outsiders to problems that teachers, as school insiders, are quite well positioned to understand.

NONCOHERENCE AND SYNCRETISM

On this heterogeneous network, ed-techers must negotiate ideological and epistemic noncoherence (Law et al., 2014). However, there is much room for *translation* (Callon, 1984) due to the fractured, multimodal nature of the network. Situated tactics for dealing with noncoherence, or "modes of syncretism" (Law et al., 2014), abound. For example, Peter can "separate" (Law et al., 2014, p. 180) entrepreneurial discussions he has with sponsors and ed-tech marketers from the stories of participatory innovation he tells on the web, social media and in face-to-face meetups, and coach entrepreneurs with products to sell to present themselves as experts with ideas to give. Trevor can emphasize the use value of his programs to teachers in meetups on design thinking, and the market value to the network of commercial entrepreneurs with whom he interacts at TechAssembly. Practices of human-centered design, like those espoused by Trevor and Neil, can be read as a kind of provisional "caring" (Law et al., 2014, p. 182) approach to dealing with network noncoherence, where the pain and disruption of changing teaching and learning innovation is taken on as an iterative, empathetic, ongoing project of helping or improvement. Kevin, exercising what many would consider a ruthlessly pragmatic

accommodation of noncoherence, "collapses" (Law et al., 2014, p. 184) the historical division of use and exchange value of education with statements that equate learning outcomes with "cash in the pocket" (Kevin, meetup fieldnotes). Kevin's critical perspective on professional literacies and his emphasis on material cash transfer reflect, in a marketized neoliberal context, the goals of racial literacy and material redistribution that Guinier (2004) sees as fundamental to substantive equity and social justice.

Learning scientists have taken up the pedagogical goal of *productive disciplinary engagement* (Engle & Conant, 2002) in a modern era that framed learning practices with reference to disciplines, canons and institutional contexts. If we want to prepare connected learners to act in a postmodern, neoliberal, 21st century workplace that is organized less by disciplinary power and more by dialogic settlements, biopolitical "norms," and "responsible self-management" (McNay, 2009), a profitable future research direction may be to elaborate a pedagogy of *productive syncretic engagement*. How do we teach students to operate as learners and actors in ideologically, epistemologically, culturally and technologically heterogeneous networks where they may never settle into a coherent discipline or a career-defining practitioner role? Knowledgeable network performance would seem to involve the *syncretic* negotiation of *noncoherence* (Law et al., 2014).

DESIGNING CARNIVAL

A productive program of design-based or ethnographic research on learning and innovation in open networks may focus on characteristics of Bakhtinain carnival:

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1. *Spectacular:* Novelty, eccentricity, possibility, disequilibrium and discontinuity are featured as attention-capturing spectacle.

2. *Familiar:* Relations become familiar. Learners and innovators become comfortable in collaboration and critique.

3. *Interactive:* Carnival connects people, brings them into interaction, new modes of relation and dialogue.

4. *Integrating:* The high is positioned with the low, the marginal with the central, the elite brought down to earth, and the spectators become the spectacle.

Many of these carnivalesque aspects are visible in the ed-tech network. Peter, in assembling the Lightning Round parade at the end of each meetup creates a *spectacle* that integrates the idiosyncratic visions of the broader ed-tech crowd. A relative diversity of ed-techers *integrate*, *interact*, "rub shoulders" and become *familiar* via meetups at TechAssembly (even if many would-be ed-techers are excluded by its location). Silas designs Tech-Connect as a spectacle that attempts to *integrate* schools and companies and put them into *interaction* for more substantive innovation. Brushing aside the "elitist" (interview transcript) and credentialist notions that CS can only be taught by those with a CS-related university degree or position, Dana designs a professional development program that *integrates* teachers in the work of cultivating CS expertise. Kevin's digital equity programming seeks out and *integrates* students of color into creative economy work environments and promotes *critical familiarity* and substantive *interaction*.

This study has made the case that open learning and innovation are fundamentally patterned by a market dynamic. By emphasizing the more *carnivalesque* aspects of the marketplace (Bakhtin, 2004), designers of learning environments and innovation ecosystems might more effectively pursue equitable and just educational outcomes. I have included a set of user profiles and issue profiles to help organizers of and actors on the ed-tech network design for a carnival rather than spectacle (Appendix I).

SCENES AND DISCOURSE

I have introduced and made use of the concept of a network *scene*. But in the interest of ontological parsimony, do we really need scenes? Why bother? What do scenes give us analytically that other units of sociocultural or sociomaterial analysis do not?

As a *linked set of characters and plots on a storytelling network*, a scene is related to what Gee describes as a "Discourse," a "saying-doing-being-valuing-believing" community (1989, p. 6). For Gee, Discourses function as "identity kits" that assemble "appropriate costume and instructions on how to act and talk so as to take on a particular role that others will recognize" (p. 7). A scene in this dissertation, however, does not necessarily enforce saying-doing-being-valuing-believing in any strongly disciplinary way, nor do actors story themselves exclusively or persistently within the context of a single scenes. A scene might be enacted as a precarious community of practice, like the co-organizers of the Ed-tech Neotown meetup, or an ephemeral community like that of the women's meetup where the center does not hold. A scene may be enacted as a loosely

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coordinated collective initiative, like the CS education scene assembled across institutions around a funded solution to a problem made technical in a whitepaper. Or, a scene could emerge around a worldview, values or way of thinking, like the "entrepreneurial mindset" (Trevor, interview transcript) and "designerly ways" (Cross, 2001) embraced in the entrepreneurial scene.

Scenes, I think, are useful in studying the learning of free agents in the open, connected, biopolitical mesh (McNay, 2009) of contemporary society, as they do not presume an attraction to or the clear influence of disciplinary power. Studying scenes might help us say something about learning in pursuit of objects that are not officially formed or settled, but *recognizable, relatable*, *lovable*, or *desirable* all the same. Scenes can give us a way of understanding how individuals learn per storytelling "kits" (Gee, 1989, p. 7) of people, values, beliefs, ways of doing things and ways saying things, but without committing to or subjecting themselves to any kit in a long-term or strongly disciplinary way. The may help us understand discursive "swarming" around "runaway objects" (Engeström, 2007) and the subsequent emergence of more concrete, material-discursive objects around which communities and activity systems form. Scenes are a way of understanding how our *lived fictions* influence how educational issues are *problematized* and *rendered technical* for technological intervention (Sims, 2017). They can help us understand the narratives that operate in the public spheres in which we publicly articulate a "new sense of the common good" (Tyack & Tobin, 1994).

A NARRATIVE PERSPECTIVE ON THE RUNAWAY OBJECT

One way to approach the problem of runaway objects is to theorize them, as we have done here, as material-discursive aggregations around which individuals story themselves in networked scenes. A scene, as a unit of analysis, is not defined by a shared technical practice or logically coherent worldview, but it does require plot elements, including characters and some kind of "disequilibrium" to drive a story forward (Czarniawska, 1998, 2004). Runaway objects might be theorized as primordial, plot-driving, *disequilibria* that characters in scenes use to dramatize, differentiate and power their individual and collective narratives. From a narrative perspective, the runaway objects around which actors swarm on a storytelling network might be conceptualized as spectacular *MacGuffins*. Hitchcock describes the screenwriting device:

> Well, it's the device, the gimmick, if you will, or the papers the spies are after… So the "MacGuffin" is the term we use to cover all that sort of thing: to steal plans or documents, or discover a secret, it doesn't matter what it is. And the logicians are wrong in trying to figure out the truth of a MacGuffin, since it's beside the point. The only thing that really matters is that in the picture the plans, documents, or secrets must seem to be of vital importance to the characters. To me, the narrator, they're of no importance whatever. (Truffaut, 2015, pp. 157–158)

A MacGuffin in a storytelling network is an object that assembles and drives narrative activity. It might be thought of as an elemental disequilibrium that must be resolved and to which we tether ourselves as actors in scenes. MacGuffins in films include the "government secrets" that must be learned (*North by Northwest*), the briefcase that must be retrieved (*Pulp Fiction*), the inner peace and true identity that must be found (*Kung Fu*

Panda). It is urgent, for some, that El Capitan be climbed without a rope (*Free Solo*). In ed-tech, MacGuffins abound, including laptops that must be procured, coding skills that must be acquired, global connectedness that must be achieved and participation gaps that must be closed. Unlike Hitchcock, however, most of us narrate our *lives* rather than *films*, and the nature of our MacGuffins matters a great deal.

ANALYTICAL LIMITS AND DIRECTIONS

In conducting this study, activity theory has been particularly helpful in guiding the formation of the network sample, for interpreting the mediational role of digital platforms and for differentiating *scenes*, for instance, as clearly object-oriented or not. However, the analysis presented in the preceding chapter suggests that the ed-tech network as a whole is probably *not* understood by its actors as oriented by a single shared object. Individual scenes of network enactment seem to have different objects, and in the case of the entrepreneurial scene, it is difficult to identify a clear object that orients activity. Neither do we see that activity within scenes or across the network is always coordinated or "woven" (Spinuzzi, 2008) in developmental cycles (though Silas would *like* better alignment between school procurement and entrepreneurial product development cycles). In the absence of clear objects that orient activity, and without a persistent focus on developmental coordination, we must think about where activity theory works as an analytical framework on this network, and where it does not.

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For example, to understand how the scene of independent and polymotivated entrepreneurs on the ed-tech network produces educational interventions, the *teleological presumption* that their activity is oriented around some implicitly or explicitly shared object seems unwarranted. Neither does it seem helpful to look for some specific object—runaway or otherwise—that can be used as a "sense-maker" (Kaptelinin, 2005) in guiding an analysis of learning or activity; indeed, from a narrative perspective, imputing or highlighting specific sensemaking objects in the polyphonic network is itself an interpretive act, and may distort or contradict diverse interests, motivations and identities described in actor stories. This is not to say that the scene of entrepreneurs we have examined does not engage in some kind of collective sensemaking or collaborative activity; the scene does work—sometimes together—in certain entrepreneurial and designerly ways to produce ed-tech. However, framing the analysis of the scene per one or several shared objects may simply presume too much. In analyzing activity in open networks and scenes, it may be more appropriate to scale back the heavy conceptual and sensemaking load that *runaway objects* must bear—perhaps letting them go altogether—and instead emphasize the mediational and narrative role that material-discursive *runaway things* play among networked actors. Rather than undergoing transformation or orienting activity in any strong way, runaways may simply operate as influential or accessible material-discursive resources on a storytelling network that is constantly crafting and re-crafting histories and possible futures of education. Like Hitchcock's *MacGuffins,* runaways may be better understood in terms of their narrative function than their substance.

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Knowing, learning and change in networks and scenes would indeed seem to involve narrative modes of sensemaking (Bruner, 2009): we see a narrative mode of sensemaking in the way that Trevor collapses potentially noncoherent equity goals and market-based change strategies via a story of "family" and "blood." Learning from Boje's work on antenarrative assembly (Boje, 2011) but working from a learning sciences perspective, we might build upon *knowledge-in-pieces* (diSessa, 1994) and *ideology-in-pieces* (Philip, 2011) approaches to study collective cognition and change in scenes. A *narrative-in-pieces* approach could employ knowledge and interaction analysis (diSessa, Levin, & Brown, 2015), for example, to examine how *stories are assembled* and *scenes enacted* on the fly from elements in the social and material ecology (e.g. elements like characters, tropes, tools, emotional or intuitive *disequilibria*), and how they are coordinated in more persistent sensemaking narratives.

CONCLUSION

"The cultural construction of schooling" must involve a "continual public dialogue" and a "searching inquiry resulting in commitment to a new sense of the common good" (Tyack and Tobin, 1994, p. 478). Open, urban ed-tech innovation networks can leverage spectacle to catalyze dialogue in a large and diverse public sphere. To the extent that we embrace these spectacles in ways that continuously surface, critique and challenge the norms by which they are inevitably patterned, they can be exciting places for rethinking how technology and education figure into the common good. The ed-tech network, as a social technology, presents us with a set of ambivalent possibilities, but we must *choose*

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and *act* persistently to make the network spectacle not just interesting and interactive, but also familiar and integrated. Ed-tech networks must mix participants and spectators from bottom to top, from margin to center, and foster familiarity, a *rubbing of elbows*, and understanding through critique. If we are to pattern school and learning after work and the market—like we so often have in the past—let us make it more than a spectacle of commodified experiences. Let's make it carnival.

Appendices

APPENDIX A: INTERVIEW LIST

n	Interviewee	Description
1	Amy	Former teacher, current university faculty and education researcher
2	Dana	Former teacher, university faculty researcher
3	Hannah	Former teacher, current Ed-tech Neotown co-organizer, current tech professional
4	Howard	Former tech marketing professional, current CS activist
5	Jeremy	Former teacher, current educational technology integration specialist
6	Kendra	Former teacher, current tech professional
7	Kevin	Former teacher, musician, current social entrepreneur
8	Kim	Former teacher, current Ed-tech Neotown meetup co-organizer
9	Mary	Former teacher, current ed-tech startup entrepreneur
10	Neil	Product designer and entrepreneur
11	Nicole	Former teacher, current state-level educational technology advocate
12	Peter	Former teacher, current Ed-tech Neotown co-founder, tech professional
13	Rachel	Ed-tech professional, current Ed-tech Neotown meetup co-organizer
14	Silas	Former teacher, former school leader, former education entrepreneur, Ed-tech Neotown co-founder
15	Steve	Former teacher, former ed-tech startup entrepreneur, current PhD, current CS meetup co-organizer
16	Tina	Former teacher, current innovation network organizer
17	Trevor	Former teacher, current social entrepreneur

Introductory script for telephone and face-to-face interview:

I'm going to ask you about your experience with the ed-tech network. We are very interested in learning about what the ed-tech network looks like from your own personal perspective, and how you have interacted with it over time.

It may seem a little odd, but I am really interested in both the human and nonhuman aspects of the network, that is how the ed-tech network looks and works a set of interconnected technologies, projects, products, groups, and, of course, people! I will therefore be asking you to provide the names of people, groups and even things with whom you have interacted via Ed-tech Neotown.

For people, please list first and last names if possible. If this is not possible (or you can't remember their full name), then try provide a last initial or identifying characteristics (e.g: "brown hair" or "IT coordinator for such and such school").

Note that **your response is completely confidential. People or organizations that you list will not be told that you listed them in this survey, and you will not be told if anyone listed you.** *There are no right or wrong answers for this. These data are incredibly valuable, so we truly appreciate your thoughtful input!*

1. **Individual Humans:** *Which relationships or interactions with people in the ed-tech network have been most important to you for the work that you do? (If no one fits this description, you can respond "None.")*

Name (and/or other identifying characteristics)	*Can you describe the relationship?*	*Why is it important?*	*What does/has this relationship allow(ed) you to do?*
1			
2			
3			
4			
5			

2. **Groups:** *Which groups, organizations or firms in the ed-tech network have been most important to you for the work that you do? (If nothing fits this description, you can respond "None.")*

Name (and/or other identifying characteristics)	*Can you describe your connection or involvement?*	*Why is it important?*	*What does/has this allow(ed) you to do?*
1			
2			
3			
4			
5			

3. **Objects:** *Which activates, projects, programs or goals in the ed-tech network have been most important to you for the work that you do? (If nothing fits this description, you can respond "None.")*

Name (and/or other identifying characteristics)	*Can you describe your relation or activity?*	*Why is it important?*	*What does/has this allow(ed) you to do?*
1			
2			
3			
4			
5			

4. **Non-humans**: *Which resources, services, tools, technologies, or systems has the ed-tech network used or connected you with that have been most important to you for the work that you do? (If nothing fits this description, you can respond "None.")*

Name (and/or other identifying characteristics)	Can you describe your use of or interaction with the tools or system?	Why is it important?	What does/has this allow(ed) you to do?
1			
2			
3			
4			
5			

Facet	Storytelling prompts	Targets
Present perspective	1) Tell me about yourself and your relationship to education and technology a) Demographic? b) Professional positioning? c) Preparation? 2) What have you been doing with the Ed-tech Neotown Meetup? a) How does it help you do your work or meet your goals? b) What kinds of things have you been able to do? With whom? c) What kinds of things do you want to do next? d) Do you have a hard time doing certain kinds of things? Why?	• Living Stories • Participant info (subject) • Big object(ives) • Smaller claim-objects of activity • Tools, community, rules, roles • Contradictions/discontinuities • Boundaries and mobility • Power (marginalization, legitimation)
Historical perspective	3) What's your perspective on the history of the Ed-tech Neotown network? a) Do you have a sense of how the network started and what the is does? b) How did your involvement begin, and how did it lead to what you are doing now? c) What are the major projects, activities, or products what have come out of network activity?	• Narratives • Big object(ives) • Smaller claim-objects of activity • Tools, community, rules, roles • Contradictions/discontinuities • Boundaries and mobility • Power (marginalization, legitimation)
Future perspective	4) What's your vision for the ed-tech network? What do you think Ed-tech Neotown (or constituent projects) *should* do next? Why? a) Will it happen? Why or why not? b) What do you see as your role? c) Do you think the Ed-tech Neotown network (or constituent projects) is going to have an impact? On what? How?	• Antenarratives • Big object(ives) • Smaller claim-objects of activity • Tools, community, rules, roles • Contradictions/discontinuities • Boundaries and mobility

		• Power (marginalization, legitimation)

Concepts and values	5) What does the Ed-tech Neotown do that is unique? What unique potential does it have for education?
	  a) What type of entrepreneur?
	  b) What types of educator?
	6) What are we talking about when we talk about education?
	  a) What should schools do? Teachers?
	7) Why are we focusing on or using technology in education?
	  a) What is technology?
		• Goals, e.g. equity, access, freedom, efficiency
		• Roles, e.g. teacher, entrepreneur, admin, leader, technology
		• Tools, e.g. technology, strateg

APPENDIX D: TOPIC MODEL TERMS

LDA Term Trace: Latent Interest Discourses (de-identified):

https://dataverse.tdl.org/dataset.xhtml?persistentId=doi:10.18738/T8/3DDN6Z

LDA Term Trace: Latent Identity Discourses (de-identified):

https://dataverse.tdl.org/dataset.xhtml?persistentId=doi:10.18738/T8/3DDN6Z

APPENDIX E: ED-TECH PATHWAY CODES

Nested codes used to visualize ed-techer pathway narratives based on their profile data (de-

identified):

https://dataverse.tdl.org/dataset.xhtml?persistentId=doi:10.18738/T8/HNHTOD

This is synthetic data comprising an example "sociomaterial index." Data in this format

was imported, analyzed and visualized using the 'igraph' package for social network analysis in R

(Csardi & Nepusz, 2006).

Network edge list (.csv):

Ego ID	Alter ID	Alter Source
101A	102C	name generator
101A	201C	name generator
101A	202E	narrative interview
101A	103P	narrative interview
102C	101A	name generator
102C	103P	narrative interview
102C	203B	name generator
102C	204C	name generator
102C	205M	name generator
103P	102C	name generator
103P	104B	narrative interview
103P	206M	name generator
103P	205M	narrative interview
103P	202E	name generator
…		

Attribute data (.csv):

Actor ID	Actor Name	Alter Type
101A	Adam Thoth	human
102C	Cheryl Lu	human
201C	Calendly App	nonhuman
202E	EdPal Product	nonhuman
103P	Phil Xanadu	human
203B	Bus	nonhuman
204C	TechAssembly	nonhuman
205M	Meetup.com	nonhuman
104B	Barb Mayo	human
206M	Maple Makerspace	nonhuman
…		

In the interest of conducting reproducible research and sharing novel methods, R syntax and de-identified data have been archived on with the Texas Digital Repository: https://dataverse.tdl.org/dataverse/edtechnet. Data and scripts include de-identified network data as well as R syntax for network analysis, network visualization, text processing, topic modeling and discourse visualization.

1. R scripts (.R)

    a. network analysis: centrality measures, communities detection

    b. network visualization: network maps

    c. text processing: generation of document term matrix from corpus

    d. topic modeling: LDA

    e. discourse visualization: alluvial diagrams and wordclouds

2. De-identified network data (.csv)

    a. edge list

    b. attribute tables

3. De-identified topics (.csv)

    a. LDA topics (k=2 to k=10)

APPENDIX H: PROTECTION OF ANONYMITY

Participant observation and name generator approaches can easily generate information about people who were never approached about participating in the study. This is the case in this study. Considering the public nature of the network, the high degree of visibility that it strives to achieve and its manifestation across many different media landscapes, it is quite possible that a motivated reader could plausibly speculate about the identity of the network or the individuals and organizations of which it is comprised. To make this more difficult, I have taken a variety of measures to transform the data presented, roughly following the approach described by Sims (2017).

Per ethnographic norms, I have given various manifestations of the network pseudonyms, including organizations, locations, events and hashtags. I have also changed the names of all study participants, the names of their places of work, and the names of network actors who figure prominently in their narratives but who may not have been enrolled in the study. In quoting study participants, I have been careful to not to reveal identifying information and have adjusted the characters in the stories per my own use of pseudonyms. I have limited my presentation of digital artifacts representing individual people to those that, to my knowledge, are not searchable, and I have re-written the texts to preserve sense and meaning but obscure any link to an individual. In presenting topics inferred through text analysis of public online discourse, I have changed any terms that locate or identify the case or individual.

Core to the work of the ed-tech network and the analytical work of this study are digital images and marketing artifacts indexed by major search engines. In presenting these things as

data, I have modified them to obscure the faces and names of individuals, company logos and information that could be directly linked.

I have chosen not to obscure platforms with global userbases like Facebook, Twitter and Meetup.com, the names of some large technology companies like Google and Apple or large, national organizations and professional networks, like Teach for America (TFA). My reasoning is that use of or affiliation with these entities is not generally an identifying characteristic, considering their size and broad distribution. In cases where it may indeed be identifying, I have obscured the affiliation.

Finally, I have often taken steps to generalize the way I refer to participants and characters in their stories. I may refer to an assistant principal, for example, as a school leader. I have also adjusted gender pronouns, roles and affiliations of some study participants, enabling plausible deniability in the event that identification becomes an issue or concern for any participant.

APPENDIX I: DESIGN PRODUCTS

User and issue profile resources for ed-tech network design:

https://dataverse.tdl.org/dataset.xhtml?persistentId=doi%3A10.18738%2FT8%2FCXWEHB

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