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The brief & expansive history (and future) of the MOOC: Why two divergent models share the same name

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THE BRIEF & EXPANSIVE HISTORY (AND FUTURE) OF THE MOOC: WHY TWO DIVERGENT MODELS SHARE THE SAME NAME

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INTRODUCTION

This article will look at the two divergent histories of the massive open online course: the history of the MOOC based on 2008's Connectivism & Connected Knowledge (CCK08) course and its relationship to distance education scholarship, and the history of the MOOC based on 2011's Introduction to Artificial Intelligence (CS 271) course and its relationship to computer science and machine learning. After exploring both histories and noting the spaces where similarities exist, we will negotiate a structural definition of the MOOC and suggest how future research can utilize the dueling histories in their methodology.

One learning model is borne from an idea that network connectivity, and all of the connections humans and computers can make both with each other as well as themselves, is essential for learning in the modern digital age. Courses subscribing to this model relish the open Internet, a space for the free sharing of knowledge and creation among any person interested in participating. Content is dynamic, where instructor-provided texts work as a springboard to other artifacts brought forward by members of the learning environment, the group growing in knowledge and in some cases creating knowledge. Instruction is shaped not as didactic but as facilitated, with learners engaging various course members at various points in the novice-expert paradigm.

Another learning model uses artificial intelligence and machine learning algorithms to provide a space in which anyone can access coursework certified by some of the most elite colleges and universities in the world. This model was created with economics at the forefront; how to provide a space for high-quality learning at no cost or a cost much less than existing education opportunities. Courses subscribing to this model are conducted in a learning management system that provides all of the information a student will need to succeed in the work. Members of the learning environment have discussion boards as a space to share ideas, but the direction of the course does not alter based on this interaction.

Rather, the dominant interaction is between the learner and the expert-provided course content, assessed most often through automated means at the conclusion of each content package.

The first learning model mentioned here provides description of a massive open online course, a.k.a. MOOC, an education term so widely used in a short period of history that the New York Times referred to 2012 as the Year of the MOOC (Pappano, 2012). The MOOC heralded by the New York Times, however, looks and behaves little like the first learning model mentioned and more like the second learning model. The second learning model mentioned here, though, also provides description of a MOOC.

The nonsensical prose in the last paragraph is purposeful; how can these two learning models, both novel to education in the past decade and largely incongruent with one another, share the same signifier? Since Tamar Lewin's March 2012 article in the New York Times referred to both Sebastian Thrun's CS 271 and George Siemens' CCK08 as MOOCs, education researchers have struggled with how to marry the two disparate learning models together while mainstream discussion has largely foregone the CCK08 MOOC history in favor of that borne from CS 271. Understanding why classification of these learning systems has occurred in such a manner, as well as how the term has been appropriated in media coverage of higher education and what the role of learning model similarities played in appropriating the term, can help researchers and scholars to better place the MOOC in a sociohistorical context and develop subsequent research questions and instruments to study the model-cum-phenomenon.

THE HISTORY OF THE FIRST MOOCS

Tracing the history of the MOOC through a formal education lens leads back over 150 years to the birth of distance education through the establishment of correspondence courses in Great Britain (Harte, 1986). These courses were designed to provide training in specific skills or tasks to a clientele who could not avail themselves to University due to economics, class distinction or geography. The success of these ventures led to an interest from some higher education institutes in adopting their models and practices. These University-level initiatives in America, most notably at Cornell University, were unsuccessful (Gerrity, 1976). The lack of university-aligned success in America was not felt in England, however; the University of London established its International Programme in 1860, and distance initiatives have been a viable mode of higher education worldwide since (Lei & Zhao, 2005).

The development of distance education was conceptualized through an understanding of existing notions of educational structure and assessment;

however, distance education provided opportunities as well as unique obstacles (Katz, 2003). Therefore, a subset of education research formed to focus on educational means and pedagogies for students, faculty and staff working outside geographic proximity. Historians and scholars within this field traditionally view the growth of this field as generational, evolving with the technologies of the day that allow varied transmission of content (Nipper, 1989; Peters, 1983). For these scholars, distance education is a structure made possible and reimagined by the technological advances of their time, starting in the 1860s with the industrialization of the printing press for curricular materials, the advent of a penny postal system for transmission of information, and a societal lifestyle shift from rural homesteading to urban city centers.

Viewing the evolution of distance education as generational based on transmission technologies is attributed to Soren Nipper (1989), who saw correspondence transmission of content as the first generation of distance education, and media-enriched transmission via radio and television as the second generation. The third generation, computer conferencing, was for Nipper a seismic shift in the notion of distance education. The first and second generations of distance education consisted of content transmitted from a sender to a receiver, with no opportunity for the receiver to do more than perform an assessment (Nipper, 1989; Bates, 1993). Computer conferencing, the structural change in the third generation, provided students the affordance for interaction in two-way communication with the instructor as well as students either in real-time or asynchronously, in a space accessible and editable by both student and instructor. Distance education, a subset of higher education heretofore considered authoritarian and isolating, now could be democratic and social:

> Accordingly, it has been said that distance education turns the learning process into something very individual. It could be argued that learning is always and of its very nature an individual matter. From my cultural perspective, I would say the contrary. Learning - although a very *personal* matter - must never be an *individual* matter - one learns best by and with others (Nipper, 1989 pg. 66).

More recent scholars have amended Nipper’s generational taxonomy to differentiate between various technological uses (Taylor, 1995), but the shift from one-way technologies to two-way technologies remains the focus of modern distance education scholarship. In this shift, computers provide the opportunity for quality interactions between members of the learning experience, providing a rich class experience and environment (Garrison, 2009).

The common elements of distance education and online education, most notably the opportunity for students to engage classes and coursework regardless of geographic distance, have led researchers to link the two together, often with online education as an extension of the distance education history (Annand, 2007). However, the structural literature review as noted earlier shows a schism in the creation and development of the disciplines. This difference is echoed in the work of Garrison (2009), who sees the history of distance education as supporting the passivity of the learner rather than activating the learner through the use of telecommunications:

> The theory and practice of distance education appears to continue to hold to the assumptions and challenges that defined the field in the 20th century; that is, independent study to cope with the structural constraints that restricted access to education [Annand, 2007]…the ideal of any educational experience was two-way communication, not independence. Separation of teacher and learner should not concede the necessity of sustained and purposeful communication.

For Garrison, online learning encompasses a potential for learners to communicate and collaborate no matter the geographical distance. It is this two-way communication between novices and an expert where researchers saw the potential in the early days of web-based personal computing (Nipper, 1989; Bates, 1993), as well as indicative of contemporary learning theory such as constructivism (Papert, 1993) and activity theory (Engstrom, 1993).

This is not to say that online learning by definition incorporates collaborative communication. Online learning provides the ability to utilize collaborative communication as part of pedagogical practice, but the technological advent becomes nothing more than a system of delivery if used to perpetuate prior practices:

> …There are two fundamental approaches to OLL [online learning]. The first is to provide the tools and techniques for individuals to access and organize information to sustain existing distance education practices that maximize learner independence. The second is to use the full capabilities of OLL to create purposeful communities of inquiry that is currently transforming higher education based on collaborative constructivist principles. In essence, the first approach is to sustain current practices, while the second is to transform teaching and learning at a distance by fundamentally rethinking the collaborative nature of higher education (Garrison, 2009).

Attacking the idealized autodidactic notion of learner as heralded by Peters (1983), Garrison notes the importance of establishing collaboration and transaction between student and teacher rather than expecting a student to embark on the journey from novice to expert through nothing but access to self-instructional materials (Garrison, 2009). Learning for Garrison in an online arena can be transformative through the use of collaboration tools of telecommunications, or it can be a space to continue status quo teaching but digitized, as seen in the ways most institutions employ learning management systems (LMS) to support rather than transform their pedagogy (Groom, 2014). This raises a question about the future of online learning: will its greatest success be as a contained Intranet or a free Internet?

If viewing online education endeavors such as the MOOC as an Intranet, we are led to question the meaning of both *open* and *online* (Wiley 2013). However, the first use of the term MOOC came in regards to an Internet, where various networks of information and individuals congregate and create. The term MOOC was developed in 2008, defined to describe a course experiment utilizing connectivism. Connectivism is a computer-mediated learning theory introduced by George Siemens (2005), developed specifically to address the issues of a world where the vast majority of learning and knowledge are impacted by technology. While connectivism draws upon prior learning theories of behaviorism, cognition and constructivism, it contends that such theories are concerned wholly with the process of learning, and in a technology-networked world, we must consider learning as it happens outside of people (such as machine learning and database aggregation) as well as the worthiness of information acquired. There is debate as to whether connectivism is a full-fledged learning theory or primarily a learning model (Kop & Hill, 2009), but recent and continuing experiments in distributed learning pinpoint connectivism, regardless of its classification, as an important mechanism in contemporary learning (Rodriguez, 2012).

Since connectivism depends not only on networks of information but networks of users both for individual gain as well as network growth (Siemens, 2005), its adoption in modern distance education provides an opportunity for individuals to create meaning, share knowledge and utilize an extensive web of networks to discern and utilize information as necessary. Siemens' most notable exploration of connectivism as a practical learning model was in 2008 through a course entitled CCK08: Connectivism and Connective Knowledge. Housed through the University of Manitoba, the course implemented the idea of open networks of information and users by opening enrollment to students outside the University's system, free of charge. While not the first online course to open its enrollment outside institutional walls (Fini et al., 2008), CCK08's student enrollment numbered in the thousands led to a greater awareness of the potential of both connectivism and open online education. This resulted in educational technology researchers Dave Cormier (2008) and Bryan Alexander (2008) to each label the experiment as a massive open online course, also giving it the acronym MOOC. For Alexander (personal communication, March 6, 2014), this acronym was a nod to various multi-user Internet platforms such as Multi-User Dimensions (MUDs), MUD Object-Oriented (MOOs) and Massively Multiplayer Online Role-Playing Games (MMORPGs).

Open online offerings similar to CCK08 grew after the open success. These offerings were not all unique to connectivism or, in some cases, not even built upon connectivism as a learning theory, but had elements in common with CCK08 in terms of pedagogy, affiliation and assessment. In line with an approach reliant on networked users learning from each other, these courses, referred to by some researchers as cMOOCs (Rodriguez, 2012), resist the notion of a student/teacher or novice/expert paradigm, choosing the term facilitator for the people organizing the environment (Couros, 2010). While early versions of cMOOCs were credit-based institutional courses offered for credit-less participation to the greater population, the majority of work within the course happened outside of the University's web presence or learning management system, instead occurring across various information and user networks the courses identified, encouraged, adopted and subsequently grew (Siemens, 2012). Out of these networks developed instruments by which students showed their learning: blogs and webpages to create digital artifacts denoting the learner's understanding of the content as part of the network as well as their individual practice. Such assessment strategy is congruent to the self-directed, lifelong learning history of distance education (Garrison, 2009), as well as the adult learning theory heutagogy, which views learner-generated content as a touchstone for high-quality adult education (Blaschke, 2012). MOOCs thus were envisioned as opportunities for motivated individuals to engage a unique geospatial environment of content and connections, a marked departure from the formalized and accredited nature of traditional higher education.

THE HISTORY OF THE LATER MOOCS

Prior to 2011, MOOCs similar in structure and concept to CCK08 were not labeled as cMOOCs; yet by 2012, the acronym had become seemingly necessary to differentiate within the MOOC marketplace (Rodriguez, 2012). MOOCs between 2008 and 2012 had not received mainstream media coverage, and coverage in education circles remained limited (Daniel, 2012). That would change starting in August of 2011 and culminating in March of 2012.

The course credited with catalyzing the buzz around MOOCs was Stanford University's Fall 2011 "CS 271: Introduction to Artificial Intelligence." Taught by Sebastian Thrun, a professor at Stanford, and Peter Norvig, the Director of Research at Google, CS 271 was a for-credit course at Stanford University which Thrun and Norvig mirrored as a no-credit course through Stanford's website, one of three such courses offered that semester by the University. Thrun and Norvig utilized a learning management system to host short videos, quizzes, tests and discussion boards for individuals who wanted access to the same material as Stanford students. Students at the University and online thus had the same content and assessment materials, regardless of prior knowledge, collegiate experience or socioeconomic status (Cheal, 2013). The course resembled a traditional face-to-face lecture hall course (Vanderbilt, 2012), with content delivered through online videos, the videos divided into eight-to-ten minute sections. There were no required purchases for online students, as all information necessary to take and succeed in the course was available within the course site system, with lectures and linked supplemental materials providing all reference the course would require. Assessment was achieved through lecture quizzes embedded within the Stanford course site, as well as traditional examinations, also delivered through Stanford's LMS. Most notably, it was not a requirement for students to engage in interpersonal connection and communication, whether with the professor or with their peers.

The course was not described as a MOOC by the professors, but rather a bold experiment in distributed learning (Rodriguez, 2012). For students taking the course in-person at Stanford, the experiment and its opportunity to procure content and complete tasks through the Internet led to a campus migration to the MOOC site, with only 30 students attending face-to-face lectures by the end of the term (Watters, 2012). The experiment resulted in an online enrollment of over 160,000 individuals (Friedman, 2012), and a substantial amount of press, including an American Ingenuity Award from the Smithsonian Institute for Thrun (Vanderbilt, 2012). Thrun, who prior to CS 271 had vacated his tenured position at Stanford in order to focus energy on developing a driver-less car (Leckart, 2012), utilized the energy behind his experiment to create MOOC provider Udacity, a for-profit organization independent from colleges and universities.

CS 271 was not the only MOOC offered by Stanford in the fall of 2011. Computer Science professor Andrew Ng led the course CS 229: Machine Learning, and Computer Science professor Jennifer Widom taught the course CS 145: Introduction to Databases. Over 104,000 enrolled in CS 229 (Kolowich, 2012), and over 65,000 enrolled in CS 145 (Ng, 2013). This success in part led Stanford to devote research hours to developing MOOC platforms and providing courses for other MOOC organizers. The success also led Ng and fellow Computer Science professor Daphne Koller to organize a MOOC provider external to Stanford, Coursera (Watters, 2013a).

The number of MOOC platforms, MOOC organizations, MOOC-affiliated institutions and courses advertised as MOOCs increased substantially over the next 12 months, to the point that many in media and education identified 2012 as the "Year of the MOOC" (Watters, 2012; Pappano, 2012). The frenzy with which MOOCs and the MOOC discussion moved through the oft-inert institution of higher education (Waks, 2007) was unprecedented (Waldrop, 2013). Pundits and educational technology professionals linked this energy to the MOOC as evidence of the platform as a disruptive technology (Shirky, 2012). Linking both the current state of higher education and the fast development of the MOOC to previous innovations and disruptions in technological sectors, Internet scholar

Clay Shirky saw the MOOC as a solution for a world of individuals who either cannot afford higher education in its traditional state or will not receive a proper value for the cost of their college experience. For Shirky, not only could MOOCs shorten the gap between cost of college and monetary benefit of degree, but MOOCs also had a greater potential than the existing system to better their offerings:

> And once you imagine educating a thousand people in a single class, it becomes clear that open courses, even in their nascent state, will be able to raise quality and improve certification faster than traditional institutions can lower cost or increase enrollment…Things That Can't Last Don't. The cost of attending college is rising above inflation every year, while the premium for doing so shrinks. This obviously can't last, but no one on the inside has any clear idea about how to change the way our institutions work while leaving our benefits and privileges intact (Shirky, 2012).

Christensen himself has echoed similar sentiments, going so far as to label the MOOC a disruptive technology, acknowledging its similarities to existing case studies of disruption, and arguing that the MOOC will likely play an integral part in the reorganization of higher education as we know it (Horn & Christensen, 2013).

The most noteworthy argument for the MOOC as a disruptive technology may be its economic partnerships with private, non-profit and public funds. As defined by Christensen (Christensen & Bowers, 1995), a disruptive technology initially establishes its market by serving consumers ill-affected by or unable to enter the existing market. Education has historically been funded through government subsidy and personal payment, though the ratio of government to individual has changed over the past several generations (Oliff, Palacios, Johnson & Leachman, 2013). The addition of venture capital and grants from foundational philanthropies (Watters, 2012) into the development of MOOCs disrupts the traditional alignment of who pays for the service of education, in a way creating a new market. The growth of MOOC financing has led an existing marketplace player, state and the federal government, to reposition its finances. While these governments have funded online and distance education ventures throughout their histories, the mechanisms to procure and distribute such monies existed within traditional higher education, such as the University of Nebraska's federal grant to establish Nebraska Educational Telecommunications (Schramm, 1971). Repositioning the ability for educational innovations such as MOOCS to receive federal student aid money would provide greater revenue streams for MOOC development while cutting away at the "rotting tree" of traditional higher education (Shirky, 2013).

Despite the expansion of MOOC providers and MOOC-related media, MOOC developers have proven reticent to link the learning model to prior education history, theory or research (Bady, 2013b). Much of the developer-led conversation pinpoints the MOOCs as inspired exceptionalism, a self-described "bold experiment" (Rodriguez, 2012) that fails to reference prior distance or online learning experiments and initiatives. Sebastian Thrun and Andrew Ng have both described their paths to MOOCs not from theoretical perspectives but as built largely from their own designs and ideas, with a nod to Salman Khan, the CEO of Khan Academy, whose company operates a website that builds and hosts educational videos designed to provide content and practice in academic subjects. Thrun noted the inspiration happened while he was listening to Khan's TED talk on the future of education. For his part, Khan also does not link his influences in the development of Khan Academy to historical precedents or educational theories, rather noting that much of his inspiration was based on practice and intuition rather than academic research:

> Every time I put a YouTube video up, I look at the comments — at least the first 20, 30, 40 comments that go up — and I can normally see a theme… I think it's nice to look at some of the research, but I don't think we would… and I think in general, people would be doing a disservice if they trump what one research study does and there's a million variables there (Weber, 2011).

If MOOC developers were influenced by prior efforts in online learning, distance education and/or educational theory, they believe this influence was tacit (Waldrop, 2013).

The research Khan does cite comes from cognitive science, a psychological field dedicated to interpreting how the brain interprets information via thought (Khan, 2012). This field of study at-large began in the 1960s, but early research in memory recall and information processing is initially credited to United States military exercises during World War II. At this time, cognitive science was not a field of psychological study as much as a mechanism to utilize human attributes of memory and prior knowledge in the development of machines, fields that would come to be known as cybernetics and artificial intelligence (Pylyshyn, 1984; Chamak, 1999). Within education, cognitive theory seeks to utilize the nature of the brain's ability to store memory and utilize prior knowledge in undertaking complex or multi-step problems (Bruning, Shaw & Norby, 2010). While important to the development of learning theory over the past 40 years, its current place in the canon of educational theory is as a stepping-stone to more modern theories, an important step in the development of learning theory but not the destination (Fosnot, 1996).

Cognitive research, however, is what has driven development of the MOOC learning model from the CS 271 perspective, with a learning theory focus on borne of memory recall and other 1960s theories (Siemens, 2013). At a 2013 conference on the future of higher education, Anant Agarwal, the director of

MOOC organization edX, heralded a 1972 paper on memory recall as a "must-read" (Rivard, 2013a) for anyone involved in tech-based higher education instruction. The paper Agarwal heralded was a review of existing memory-based research and a proposal for unique methods to consider information processing in context to memory (Craik & Lockhart, 1972). Similar to Khan's self-described haphazard entrance into education research, Agarwal noted the irony in how his scholarship and methodology toward MOOC pedagogical practices was similar in scope to the 1972 study, saying, "If we followed [this research], it was completely by accident" (Rivard, 2013a). More recently, Ng has used Twitter to promote the book "Why Students Don't Like School: A Cognitive Scientists Answers Questions About How the Mind Works and What It Means for the Classroom," in doing so advocating for the cognitive approach, saying, "[This is a] great book on applying cogsci principles to teach better. Loved this!" (Ng, 2014). These exchanges are some of the first recognized links between MOOC developers and educationally rigorous learning theory, signifying a change in the histories MOOC developers have heretofore shared with the world. Such statements provide a link between the artificial intelligence and machine learning backgrounds of the primary MOOC developers and the cognitive principles at the foundation of their academic disciplines.

Cognitive science and computer science find common ground in viewing analogies between the way the brain and a computer processes information: information enters the terminal, a decision is made as to how to organize it, followed by a decision on what retrieval cue must be assigned to this information in order to bring it to short-term memory for use and application (Norvig & Russell, 2009). Within computer science, methods on how to conceptualize and develop artificial intelligence are split: on one side is a true AI system, where the system could learn based the present interaction in conjunction with information retrieval and prior usage; and the other is the concept of expert systems, where Boolean logic allowed the system to reason its way down a taxonomy of knowledge, the system's growth based not on user interaction but rather developers who alter the database.

Within education, comparing the brain to a computer made of meat (Minsky, 1982) makes for an analogous summation but is factually incorrect. The desire to compare the brain to technological prowess of the day dates back to Aristotle describing the brain as a wax tablet, or *tabula rasa,* and analogies have adapted based on the technological innovation of the time: papyrus, books, television, holograms, and computers (Draaisma, 2004). Computer systems and programs can replicate the behavior of the brain in the same manner it can predict weather, but this is the manipulation of abstract symbols through highly defined rules-as-intelligence rather than the understanding of symbols as concrete constructions unique to environments (Searle, 2006). Replication is a core tenet of the AI philosophy, as noted in its groundbreaking stages during the 1955 Dartmouth Summer Research Project "The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it" (McCarthy, Minsky, Rochester & Shannon, 1955).

Whether an artificial intelligence system is utilizing expert system logic or is utilizing terminal interaction to grow a self-referential database, the end result is not learned material but the perception of learned material (Searle, 2006). As cognitive science and artificial intelligence are fields dedicated to studying how learning occurs, determining the precise definition of learning within these fields is vital in understanding how learning as a concept has transferred from AI developers to human education learning models. If replication or simulation of knowledge is the definition of learning within computer science and artificial intelligence, such a definition differs from how learning is defined in education circles.

Whether learning is defined through replication and simulation and if it can or cannot come happen through statistical overlay is a debate most recently contested between two highly respected scientists: Linguist Noam Chomsky on the side of learning as a transformative human endeavor, and computer scientist Peter Norvig representing the belief that the human brain functions in a manner similar to a computer processing unit. In response to computer science efforts to solve issues within the field of linguistics, Chomsky (2011) questioned the increased reliance on statistical data and modeling in human learning environments:

> It's true there's been a lot of work on trying to apply statistical models to various linguistic problems. I think there have been some successes, but a lot of failures. There is a notion of success...which I think is novel in the history of science. It interprets success as approximating unanalyzed data.

For Chomsky, the use of learning analytics and data mining to produce behaviors in human subjects is a science bereft of understanding the meaning of the behavior; the end results a notion of success that Chomsky sees as facsimile showing a perception of learning but in essence providing none. This is in contrast to Norvig, who pioneered CS 271 with Thrun, who believes there to be a link between probabilistic and statistical inference and the manner in which humans learn language, which according to Norvig means a direct correlation exists between how machines learn and how humans do (Norvig, 2011).

Further differentiations in how those MOOC developers trained in artificial intelligence see learning is evident in how Thrun & Norvig's described CS 271: a bold experiment in distributed learning. The use of such nomenclature identifies a verified educational model which rose to prominence at the dawn of telecommunications-based education development, yet distributed learning as a concept is no longer used by the MOOC developers to refer to courses like CS 271 or platforms like Udacity. Distributed learning, as defined by educators, is a learning model borne of the rise in telecommunications technologies during the 1990s. Recently the term has been interchanged with *distance learning* (Petrides, 2002), though the academic history and general etymology of *distributed learning* do not provide a basis for substitution (Bates, 2000). Distributed learning, as defined by the Institute for Academic Technology (quoted in Bates, 2000):

> …Integrates a number of technologies to enable opportunities for activities and interaction in both asynchronous and real-time models. The model is based on blending a choice of appropriate technologies with aspects of campus-based delivery, open learning systems and distance education. The approach gives instructors the flexibility to customize learning environments to meet the needs of diverse student populations, while providing both high quality and cost-effective learning.

A lack of congruence between this definition and CS 271 is evident. Only students registered for credit at Stanford had a reasonable opportunity to interact with Thrun or Norvig. Students in both the Stanford course and the online mirror had a means to interact with one another, though those in person had a greater array of opportunities, while those online were provided message boards, a communication technology found to have little benefit in a student's learning (Michael Morris & Stommel, 2013). The flexibility in the system was only found for Stanford students, who could utilize the online mirror for lectures yet still access Thrun and/or Norvig for feedback, while online students received feedback through automated grading, and the hope of a teaching assistant replying to a post on the message board. Along these defined criteria, the methodology of CS 271 does not lend itself to the distributed learning model.

There is another etymological use of the phrase *distributed learning*, one from the machine learning and artificial intelligence field where Thrun, Norvig and other MOOC developers began their professional lives. Within computer science, distributed learning is an intersection of multi-agent artificial intelligence and machine learning (Friedrich, Kaiser, Rogalla & Dillmann, 1997). In a distributed learning algorithm, each agent, or AI, is dedicated to a specific aspect of the many tasks provided to the network, in an effort to increase the network's processing speed as well as the collective knowledge of the agent group (Dowell, Stephens & Bonnell, 1998). In order for a network of computers to learn a process, they must mine a great deal of information in order to make generalizations and inferences associated with human cognitive learning (Thrun, 1996). Distributed learning algorithms attempt to teach the network through a smaller quality of data points while gaining the information necessary to complete future complex tasks.

Utilizing the artificial intelligence definition of distributed learning rather than the educational one, the MOOC is not a composite of pedagogical tools, social networks and content-delivery systems, but rather a data-driven learning environment design based on scalability. Scale is one of the attributes often quoted by MOOC developers who discuss it as an opportunity to lessen a student's debt load (Thrun, 2012). The idea of scale in a distributed learning algorithm is different than in a distributed learning environment for human subjects. In an artificial intelligence learning model, the objective of the algorithm is to get more networked agents to learn from fewer data points. This link suggests MOOC developers believe the principles they employ for teaching machines are ideal principles for teaching humans.

ANALYSIS

Having looked at the MOOC as defined between 2008 and 2011 and the MOOC that burst into a sociocultural phenomenon in 2012, there are few places of coherence on learning theory and pedagogy, and no direct link from the 2008 version to the 2011, whether spoken from MOOC developers or found in qualitative analysis. There is no theoretical or pedagogical reason for the CCK08 model and the CS 271 model to both be called MOOCs.

There is a link between the two models in regards to social and mass media. When Stanford announced CS 271 would be available online for free with no enrollment cap, it was Siemens (2011a) who labeled the initiative a MOOC:

> MOOCs are great opportunities to connect with colleagues from around the world and develop a broad understanding of topics from diverse perspectives. Our goal, since CCK08, has been to do for teaching and learning what MIT did for content…education is ripe for change and transformation and alternative models, that take advantage of global connectedness, are important to explore…(L)earning in a global cohort is an outstanding experience – networking on steroids!

Here, Siemens reinforces the pedagogical hallmarks of MOOCs as defined through his CCK08 experiment and beyond: networking among students as integral to the learning process, global diversity, and a focus on teaching and learning. MOOCs, at the time, were spaces where people coalesced around a topic, explored numerous forms and visions of content, created their own learning, and through the network grew in what they understood individually as well as could access later. Siemens' reference of the CS 271 course as a MOOC, several weeks' prior to the start of the course, was a link between the neologism used to describe CCK08 and the idea of Stanford University offering an open online course.

One month later, Siemens' (2011b) bthoughts on CS 271 as a MOOC relay a frustration at the course's methodology and a disconnect between the distributed learning of CS 271 and the distributed learning in courses such as CCK08:

> The dynamics of an open course are very different from what I imagine Sebastian Thrun and Peter Norvig are used to in their courses at Stanford. In a MOOC, you are not the sole provider of knowledge nor the determiner of space…The process of learning is iterative and the relationship is mutually beneficial. Participants do the course organizers as much of a favour in joining as the course organizers do in opening the course…I want to see the AI open course succeed because it helps to increase awareness about distributed online learning, participatory pedagogy, and alternative course formats. It would be a shame if AI organizers ignore the work that Couros, Cormier, Wiley, Downes, and I (among many others) have been involved in over the past few years (paragraph 4).

At the point of Siemens' critique, neither Thrun nor Norvig had labeled CS 271 as a MOOC, and the phrase they continued to use to describe the course was distributed learning, not open online course, a phrase they would continue to use until early 2012.

Tamar Lewin, the higher education reporter at the New York Times, had followed the work of George Siemens, Stephen Downes and others on the edge of online learning and open learning for some time (personal communication, January 2 2014). It would be her writing, quoting both Thrun and Siemens, that would introduce MOOC into the mainstream lexicon (Trovatten, 2013), presented in such a way that the MOOCs of Stanford, MIT and Udemy were see as logical extensions of the MOOC movement created by Siemens. However, future mass media authors who did not follow the work of Siemens or Downes would fail to reference the history of MOOCs in their writing (Brooks, 2012; Friedman, 2012). Within months, the MOOC was a media phenomenon, widely discussed in media as catalyzed by Thrun's CS 271 and grounded in a history, but rarely discussing the Siemens-forged MOOC movement and never questioning the validity of the link between the two.

Education researchers have struggled to adequately discuss the MOOC due to the contradictions inherent to both models. In an effort to differentiate between the two MOOC types, researchers have labeled the connectivist-driven model as cMOOC and the Stanford-based model xMOOCs (Rodriguez, 2012) because developers view the methods and implementation of their models in different lights: cMOOC developers see a participative pedagogical nature to their model where the technology amounts to a transformative application of computer-based learning (Siemens, 2012); while xMOOC developers link their model to behaviorist-cognitive ideals of the early 1970s (Siemens, 2013a; Rivard, 2013a) and didactic assessment practices and pedagogies, resulting in a model based on knowledge transfer. The use of cMOOC and xMOOC is problematic, however, as these labels are only used in education research and have not had any effect on mainstream MOOC discussion. Also, xMOOC as a label has become largely pejorative in academic parlance, rendering the term biased (Porter, 2013). Dominant discussion of the MOOC, both inside and outside of education circles, uses the term MOOC to refer to courses similar to CS 271, and cMOOC to refer to courses similar to CCK08.

It is the confusion of what constitutes a MOOC that has made defining the massive open online course difficult for scholars and the general public (Daniel, 2012). There remains no standard definition of a MOOC, and the noted ambiguity within the field of study has allowed the term to be used for a number of educational platforms, models and styles with seemingly little in common (Watters, 2012). As noted in previous discussion, several common elements have emerged between the CCK08 model and the CS 271 model: an association with existing higher education structures (either through development or implementation), a need for technology to provide connection to professors and materials, a tacit requirement of some level of prior content knowledge, and a space for two-way communication between students or a student and a instructional figure such as a teaching assistant. However, such elements are emblematic of casting a wide net that promotes inclusion, as the above signifiers could be used to classify a number of learning environments that have existed since the advent of computer teleconferencing. A definition of the structural aspects of the MOOC must acknowledge the history of distance education and its generational parlance, while also recognizing the dominant narrative surrounding MOOC models and MOOC discourse.

<u>Massive</u>: Massive relates both to the student experience as well as the structure of the system. For a course to be massive, it must not only be open to a significant number of students, but in so doing it must scale learning materials, projects, assessments and outcomes in a manner so that all students receive a similar course experience. The use of the word *significant* to describe class size is purposeful; what several hundred or several thousand students may be significant in one learning environment, another learning environment may require tens of thousands of students to be significant. It is the issue of scalability that makes Massive a contentious term, as MOOCs associated with the connectivist theory of learning promote a hybrid of standardized elements with unique artifacts brought forward by class participants, creating expansive differences in projects, assessments and outcomes. Moreover, the catalyst behind the CCK08 MOOCs was personalization through content exploration and network recognition rather than personalization as a standardized algorithm.

Open: Open refers to the opportunity for students to enroll in the course at no monetary cost. Such a definition of *open* is also disputed in scholarly debate; pioneering work in MOOCs came from the Open Educational Resources (OER) movement, where not only was monetary cost neutralized but the course content and learning materials were removed from existing structures of ownership and authority and promoted as free, ubiquitous and remixable in the creative commons (Downes, 2013). To the pioneers who have defined and spearheaded the open movement, *open* stands for more than a monetary price; however, within the mainstream understanding of the MOOC, *open* focuses primarily on the lack of cost for course and institution enrollment.

Online: Online deals with the mode and method of course access and activity. In the instance of MOOCs, every element of the course a student is believed to need for successful completion is housed online: lecture, assignments, supplemental materials, assessment, communication. This is not to say that there are not opportunities for students to engage the material off-line: most MOOCs encourage students to form study groups either through the use of social media or in developing face-to-face groups around geographical locations, and recent MOOC initiatives have partnered to offer courses at existing higher education institutions where students have face-to-face access to teachers and students; however, these elements are not considered mandatory to a student's success. There are also incidences of MOOCs requiring students to purchase textbooks. Such instances are infrequent, and would be at odds with both the *online* aspect of the MOOC as well as the *open*.

Course: Course is a term used to denote the registration and association with an affiliated instructional group, as well as the course's existence in space and time. A course therefore requires a registration with the instructional group and a designated time period over which the course progresses. Such a definition removes self-paced courses from the MOOC definition, despite their association with existing MOOC developers and providers.

CONCLUSION

From an instrumental perspective, utilizing an historical outlook to define the MOOC conjures up more questions than answers and supports the confusion held by may scholars when attempting to define the learning model (Daniel, 2012; Watters, 2012). A definition inclusive of both CCK08 and CS 271 models becomes vague to the point of including many recent educational technologies, and a definition attempting to clearly define each letter in the acronym creates more debate than it solves. From this perspective, the term is a conundrum that cannot establish a base definition and instead builds confusion to the point that the term lacks meaning and is lost to educational research (Moe, 2013).

While the lack of a clear instrumental definition for the MOOC creates linguistic issues when discussing MOOCs, perhaps the struggle to define the MOOC in systematic terms is indicative not of the MOOC acronym lacking meaning, but of its meaning existing outside of systems and rather as a sociocultural phenomenon. Discussion of online learning has increased significantly since the term MOOC entered the public lexicon (Daniel, 2012), and while the mainstream conflation of the term MOOC as interchangeable with online learning has created problems for educational researchers (Moe, 2014), the increased discussion of education and educational technology in mainstream media sectors has placed the MOOC learning model, as well as the notion of online educational technologies, at the forefront of higher education discussion. From this lens, the term MOOC more adequately represents public perceptions of educational crisis, technological solutionism and disruptive innovation than it does an instrumental learning model.

The MOOC movement may have started in 2008 but it became a phenomenon in 2012 when media attention latched onto its acronym rather than the research keywords such as distributed learning. Research on the MOOC as a learning model remains important to provide results of platform efficacy and evidence of learning to the general education community as well as institutional education administrators. However, future research would be served to recognize the MOOC as more than an instrument for learning management, but a signifier representing a desire for change in the organization and dispersal of higher education. Recognizing the dual meaning of MOOC in terms of instrument and social phenomenon is of a greater importance than weighing the validity of the instrument's utility of the acronym.

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